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ICELANDIC ZOOARCHAEOLOGY:

NEW DATA APPLIED TO ISSUES OF HISTORICAL ECOLOGY,

PALEOECONOMY AND GLOBAL CHANGE

by

THOMAS AMOROSI

VOLUME I

A dissertation submitted to the Graduate Faculty in Anthropology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

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THE CITY UNIVERSITY OF NEW YORK

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ABSTRACT

ICELANDIC ZOOARCHAEOLOGY:

NEW DATA APPLIED TO ISSUES OF HISTORICAL ECOLOGY,

PALEOECONOMY AND GLOBAL CHANGE

by

Thomas Amorosi

Advisor: Thomas H. McGovern

Recent international initiatives concerned with global environmental change have recognized the need for a long-term perspective on human interactions with natural resources. New integrative theory emerging in Anthropology, Cultural Geography and History again focus upon the complex interplay of human decision making and the dynamics of natural systems in the creation of landscapes through time. Zooarchaeology would thus appear to be well positioned to play an enhanced role in research both within archaeology and in cross-disciplinary settings in the coming decades. However, zooarchaeologists face apparently daunting challenges in effectively incorporating individual site

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collections into regional and temporal syntheses required for such integrative projects.

This work presents and synthesizes the current zooarchaeological evidence for the economy of Iceland from the first Scandinavian settlement in the 9th century to the mid-19th century. This investigation has focused upon the processes of Viking/Norse cultural expansion, stabilization and Early Modern contraction in Iceland with the interaction of climate change, maritime and terrestrial resources availability and human land use strategies. Using zooarchaeological data, an integrated view of the interaction between human response and a changing climate, the development of cultural landscapes and the Icelandic commercial stock fish trade is addressed in relation to the wider North Atlantic region of the Circumpolar zone.

KEY WORDS: Zooarchaeology, Paleoeconomy, Iceland, North Atlantic

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AN ORITHOGRPAHIC APOLOGY FOR THE ICELANDIC READER...

Had the other Harold won the battle of Stanford bridge in 1066, this note might not be necessary. If indeed Harold of Norway came to the throne then the Anglo tongue might contain a much stronger Scandinavian component and hence old word processing programs like this one would contain the missing orthography that this text sadly lacks. Why use such an old word processor? I have to claim the need of expediency and the shortage of funds in order to complete this text before the University deadline of September 24, 1996. In the near future a more polished text with the correct orthography will be made available and deposited in the libraries of the National Archives of Iceland, the National Museum of Iceland and the Icelandic Museum of Natural History.

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Chapter 1

INTRODUCTION

1.1 INTRODUCTION

This dissertation presents and synthesizes the current zooarchaeological evidence for the economy of Iceland from the first Scandinavian settlement in the 9th century AD. to the mid-19th century. Located on the mid-Atlantic rift, Iceland is geographically central in the North Atlantic, and, due to both volcanic and glacial activity, is one of the most dynamic natural landscapes in the world (Carwardine 1986, Malmstrom 1958, Perkins 1983). The many volcanic tephras that have historically troubled Icelandic farmers provide a set of high-resolution dating horizons that allow for an exceptional possibility for precise dating of both sites and landscapes (Dugmore and Buckland 1991, Thorarinsson 1981a). The island has been biologically isolated from continental land masses and most of its terrestrial mammals have been imported by Medieval human

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settlers. Thus Icelandic soils and vegetation have developed since the last island wide glaciation (the early Holocene period) without the influence of either humans or grazing mammals, a rare situation in the circumpolar north.

Iceland is situated in two major North Atlantic maritime environments. These biomes have been described as the Low Arctic and Boreal zones by both geographers and biologists (Ashmole 1971; Dunbar 1968; Hallsdottir 1987) and are based on such variables as temperature and salinity. Iceland's Low Arctic zones experience a mixture of high-Arctic and boreal water, where August temperatures range from 4-10 C and the salinity varies from 3.1-3.4%. The Boreal zone areas are formed by broad bands of the North Atlantic Current with warmer August temperatures ranging from 10-19 C and salinity varying from 3.1-3.5%. Obviously there is some degree of overlap between these two biomes (Nettleship and Evans 1985).

Iceland's oceanographic zonation can also be traced in the circulation of the warmer North Atlantic, the colder East Greenlandic currents and the extent of the permanent sea drift ice. These shifting currents have produced the nutrient rich waters around Iceland, causing a rich yield of substantial populations in fish (especially the North Atlantic cod), sea birds, and marine mammals. Such wild

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marine species have regularly provided a critical supplement to the Icelandic economy where wild foods are traditionally known as the "gifts of God" in Iceland. These same shifting sea currents have also had great impact on both marine and terrestrial ecology in Iceland, making Iceland profoundly vulnerable to small scale changes in northern hemispheric climate.

1.1.1 Iceland and Human Settlement

Iceland has also been central to the spread of human settlement in the western North Atlantic since the Viking Period. During the 200 year long expansion of Scandinavian peoples and economies from Norway to Newfoundland (ca. AD. 800-1000), Iceland provided both a centrally located base and a population reservoir for settlement attempts further west in Greenland and Vinland (in Newfoundland). Iceland was traditionally settled ca. AD. 870 by Ingolfur Arnarson and his contemporaries (Hjalmarsson 1993, Jones 1986). Celtic monks (also known as the papar) were supposed to have reached Iceland before the Norse and archaeological investigations in the Vestmann Islands off the south coast have suggested the presence of an unrecorded 7th century Scandinavian occupation (Hermans-Audardottir 1986, 1989,

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1991, 1992). However, intensive archaeological and paleoecological research in areas with papar-element placenames have demonstrated no pre-9th century human occupation in these areas (Einarsson 1994a; Sveinbjanardottir 1988). If the Celtic monks were not simply a pious invention by later Christian authors, they must have been few and had little impact on Icelandic landscape or history. The Hermanns-Audardottir hypothesis of pre-9th century Nordic settlement remains interesting, but most North Atlantic scholars have been unwilling to accept it without additional evidence (Crawford 1991; Kaland 1991; Mahler 1991; Morris 1991; Sigurdsson 1991; Vilhjalmsson 1990, 1991). This thesis will use the conventional Icelandic historical phases to provide broad temporal organization: Settlement Period (ca. AD. 874-930), Commonwealth Period (ca. AD. 930-1264), Later Medieval (ca. AD. 1264-1500), and Early Modern (ca. AD. 1500-1850).

It is certainly fair to say that had Iceland not proved so congenial a home to Northwestern European mixed agriculture in the Viking period of settlement, the rest of the "Norse Atlantic Saga" would have had a very different ending. After the Viking Period Iceland continued to play a special role in Scandinavian society, creating a somewhat anachronistic chiefly Commonwealth that resisted the general

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trend towards state-building in the Nordic countries for over 300 years (elsewhere states dominated the former Viking chiefdoms by ca. AD. 1100, cf. Kristiansen 1991). The Icelandic Commonwealth period, traditionally dated between 930-1264, also saw the fluorescence of Icelandic literature, with sagas written about both contemporary events and about the older period of Settlement (cf. Kristjansson 1992). Icelandic Medieval authors also produced a wide ranging set of royal histories, hagiographical "bishop's sagas", lawcodes (notably the 12th century Gragas compilation), speculative reconstructions of pre-Christian religion and, in later periods, monastic landuse registers and annals (see Ogilvie 1981 for a useful and critical review). After the 15th century written records become even more numerous while Iceland was a colony of the Danish Crown. This Early Modern period is well documented with remarkably comprehensive land registers containing human and animal demographic census data. The years from 1702-1712 marked one of the most detailed land registers known as the Jardabok compiled by Arni Magnusson and Pall Vidalin (Larusson 1967; Ogilvie 1981). All of these "thickly" written records have been extensively employed by Icelandic and foreign historians (Gelsinger 1981; Miller 1990), by social anthropologists (Byock 1982, 1988; Durrenberger 1992; Ingimundarson 1989,

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1995; Palsson 1992; Vasey 1991, nd.) and more recently by historical climatology as part of the growing Global Change research effort (Gunnarsson 1980a & b; Ogilvie 1981, 1991, 1992).

1.1.2 Texts and Trowels in Iceland

Iceland's rich literary heritage has also had a major impact upon its archaeology (see Fridriksson 1994a and the following section, History of Icelandic Zooarchaeology), particularly in its early phases. Most historical syntheses, until recently, have been dominated by literary evidence, with archaeology supplying only a few illustrative artifacts or house floor plans. Zooarchaeology has had virtually no impact on these traditional accounts. What is still an important work in English dealing with pre-modern Icelandic economy (Gelsinger 1981) made no use whatever of any paleoeconomic data, relying entirely on documentary sources. Without zooarchaeology, settlement analysis, and other tools of modern paleoeconomic reconstruction, the Icelandic economy prior to the comprehensive surveys of the early 18th century was effectively a "black box" whose broad outputs could be perceived but whose inner workings remained a mystery.

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In the absence of data to the contrary, most scholars working on Iceland assumed that the Medieval Icelandic economy was much the same as that of the 18th century and any temporal or spatial variability in the Medieval economy remained largely invisible. Without basic paleoeconomic data from the Medieval period, anthropological arguments about the nature of society and changing political relationships likewise remained somewhat sterile, divorced from critical information on the range of variability in the fundamental means of production. Without such basic paleoeconomic evidence, any cultural ecology of pre-modern Iceland would remain highly speculative, and any multi-disciplinary system-science approach to the interaction of humans, climate, and landscape would be permanently crippled. The research for this thesis was intended to fill this major gap in our understanding and proceeded in close coordination with developments in Icelandic and North Atlantic research.

At present, many younger Icelandic archaeologists are expressing a healthy skepticism about the dominance of literary evidence over archaeological and paleoecological evidence in the description and explanation of Iceland's past (Fridriksson 1994a; Einarsson 1994a; Vilhjalmsson 1988, 1991). Many modern workers are advocating a return to the basic archaeological record as the primary source of

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evidence and the wider application of methods developed in prehistoric archaeology. This re-emphasis of archaeological data parallels processes in the British Isles, where Chris Morris has memorably described 8th-10th century archaeology as "text hindered" (personal communication, Morris 1994) and likewise called for more effective scientific archaeology in nominally historic periods. One critical tool in this new agenda is certainly zooarchaeology. Zooarchaeology has roots in prehistory, but in the past 30 years has come to make major contributions in historic periods as well (Amorosi, Woollett, Perdikaris and McGovern 1996; Bogan and Robinson 1987; Crabtree 1990). As described more fully below, Icelandic zooarchaeology has made great strides since 1985 and is now in a position to contribute significantly to Icelandic archaeology and to the Historical Ecology of the North Atlantic as a whole. The creation of this record is a major result the Icelandic Paleoeconomy Project and of the cooperative work of the North Atlantic Biocultural Organization (NABO, see NABO Newsletter 1992, 1993, 1994, 1995). This thesis research occurred over the same period that saw the development and formal organization of the NABO research cooperative. The creation of the modern Icelandic zooarchaeological record has thus been coordinated with ongoing research in Icelandic archaeology and paleoecology

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and has benefited from connections to similar research efforts in Greenland, Norway, and the British Isles. This thesis provides primary documentation for the current zooarchaeological record of Iceland, describing the data collection and interpretation methods, key sites, and major patterns in the existing zooarchaeological evidence.

1.1.3 Major Research Questions

This thesis also addresses a series of interlocking research questions that are central to understanding the complex interactions of humans and the Icelandic landscapes over the past 1200 years. These research questions can be organized under the general headings (also common to the overall NABO research agenda) of Human Impact on Landscape, Climate Impact, and Human Interactions. While these questions are not organized as a strictly processualist set of hypotheses and test implications, they did serve to identify major research topics and probable zooarchaeological correlates. As elsewhere, this zooarchaeological research in Iceland was driven by chance and opportunity as much as by any deductive research strategy, but the following research questions have played a

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central role in the cooperative investigations and may serve as initial primary objectives for this thesis.

Human Impacts on the Landscape: Since the 1950's, Icelandic paleoecologists and geologists have noted rapid environmental changes associated with human settlement (cf. Thorarinsson 1956, 1958, 1961, 1968, 1970a & b, 1974, 1975, 1976, 1979, 1981a-c). Margret Hallsdottir's palynological work (1983, 1987) has confirmed the major impact of settlement on Icelandic vegetation. Buckland and Sadler (1989) coined the term "ovigenic landscape" to describe the largely treeless landscapes of the modern northern isles and Iceland. The impact of humans and their imported domestic stock is clearly one of the central research topics for any historical work in Iceland and zooarchaeology appeared to be particularly well suited to aid in its multi-disciplinary investigation.

Landnam Impacts: The early years of settlement should have seen radically different social and environmental conditions than any subsequent period. Extensive birch-willow forests, relatively thick soils, undisturbed bird and sea mammal colonies and a shortage of human competition provided early settlers great opportunities. Labor shortage, unknown climatic variability, and (perhaps especially) an absolute shortage of imported domestic

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mammals would simultaneously provide special challenges to first settlers. If so, there are a number of implications to be examined. For example, in the Landnam (or settlement) period sites should produce archaeofauna noticeably different from later period collections. Domestic mammals should be extremely valuable and there should be evidence for extensive use of alternate wild resources (the "gifts of God") for household provisioning. Age/sex structure and species composition may well differ from later patterns.

Commonwealth Expansion and Overshoot: Thorarinsson hypothesized that the Settlement and early Commonwealth periods should have seen a "high tide" of settlement as the numbers of farmers increased and they penetrated into interior valleys and attempted to upgrade higher altitude sheilings (Icelandic sel) to year round farms. Thorarinsson postulated an "overshoot" prior to AD. 1100, as farms over-extended into zones (or micro-habitats) that could not long support grazing animals, and individual farms and whole regions became abandoned due to soil erosion. The implications might be that some early Commonwealth (later 10th-11th century) sites may be found in areas without modern (or recent) settlement. The archaeofauna from these sites may show some indications of stress, unusual mortality

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patterns or atypical species mix. Use of wild species as supplements may be expected.

Maritime-Terrestrial (or the "Green foot/ Blue Foot") Interactions: The rest of the Scandinavian North Atlantic reveals the range of adaptations possible in this maritime farming culture. In Northern Norway, Reidar Bertelsen has described Medieval farms as "standing on one green foot while the other is said to be the blue foot of the sea" (personal communication, R. Bertelsen 1994). The mix of marine and terrestrial taxa exploited on a particular farm appear to reflect both local ecology and the requirements and output of the domestic components of the household and district economy. Documents indicate that not all farms had equal access to wild resources and that higher status farms seem to have controlled a broader range of resource zones in most cases. However, many wild taxa (such as shellfish) appear to have been regarded as second-class, essentially emergency food. The changing mix of agriculture and fishing/hunting should thus reflect changing human environmental impact as well as local resource competition and allocation. Again the implications might reflect the mix of marine and terrestrial resources. There should be an important indicator both of individual farm provisioning options and of local environmental impact. Similar mixes of

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species may have different social and economic correlates in different periods and areas and simple linear explanations (more fish=lower status, more cows=higher status) are probably suspect. This balance between the "green foot and blue foot" is a core feature of Icelandic subsistence in all periods and should be a central issue for zooarchaeological investigation.

1.1.4 Climate Impact

Iceland has been a center for the study of climate impact on human society for many years and positions have ranged from near climate-determinism (Lamb 1977) to profound skepticism about any climate impact whatsoever (Gunnarsson 1980a & b). Most recently, as the new high-resolution (annual and seasonal) proxy climate data begin to become available to archaeologists from the GISP2 and GRIP ice core projects in Greenland (Barlow 1994), climate impact research in Iceland appears to be entering a new era. Initial cooperation with the ice core scientists focused on impacts on the Norse Greenland colony (Buckland, Amorosi, Barlow, Dugmore, Mayewski, McGovern, Ogilvie, Sadler and Skidmore 1996), but a major effort is now being made to link the two high-resolution cores at the top of the Greenland ice sheet

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with sea cores and lake cores that can connect to Iceland with its richer documentary record (Ogilvie 1991, 1992). Our initial expectations of a clearly marked "Medieval Warm Period" (ca. AD. 800-1300) followed by a colder so called "Little Ice Age" (ca. AD. 1300-1850) have been modified by climatologists' realization that both periods were marked by both warm and cold episodes. However, it seems clear that climate change in the 14th-15th centuries was profound, producing important changes in growing season, pasture viability, sea ice, and human subsistence options.

There are a number of implications that can be asked of the zooarchaeological record. Stress indicators should appear with the onset of the so called "Little Ice Age", especially in the low Arctic zones and in higher elevations. Use of alternate resources over domestic livestock should be seen in the animal bone data. The ratio of sheep to cattle should also rise universally around Iceland. The boreal zone areas around Iceland should show fewer indications of stress or coping by use of alternate resources.

1.1.5 Human Interactions

The transition from Settlement to Commonwealth period was associated with wide ranging social changes: the effective

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end of slavery, attempted societal limits on number of chieftainships' power bases, tighter regulation of landuse and tenantry. The end of the Commonwealth and the loss of independence to the Danish-Norwegian crown has been discussed as a type of failed transition to statehood, with all the associated anthropological concern for such events. The later Middle Ages saw growing impoverishment and tenantry coupled with the rise of church and state property holdings. The Early Modern period saw growing conflict over fishing stations and imported goods with multiple legal restrictions on fishing imposed both from without and by the Icelandic landowners themselves. The influence of Danish colonial rule was felt throughout the island, but probably most strongly in what was to become the greater Reykjavik area. All of these social processes and events should have some correlate in the subsistence economy partially reflected by the zooarchaeological evidence. Throughout Icelandic history, even great magnates were active participants in the management of their own farms and an aristocracy largely divorced from subsistence production simply never existed on the island.

Implications such as economic indicators of social ranking should be visible in the zooarchaeological record. As in Greenland, some correlation between animal bone

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proportions (perhaps caprine/cattle ratios) and other archaeological indicators of wealth and status should be detectable. In the later Middle Ages these divisions should sharpen and new site types (fishing stations) should provide archaeofauna distinct from full-scale farms. The rise of commercial fishing should have profound social and economic impacts that should be visible in the zooarchaeological record. The impact of Danish "Georgian" culture and manners in the 18th-19th century should be visible in the colonial deposits in the greater Reykjavik area.

1.1.6 Historical Ecology

The zooarchaeology that is portrayed within these pages is different from the 1960's/70's processual archaeology. It has done so by fitting into a much larger and wider focused agenda that explicitly includes archaeological data (zooarchaeological data as well) for the study of Global Change problems. These problems have a long term interactive sequence that can be tied to the dynamics of a changing landscape. Many theoretical thinkers (Balee in press; Crumley 1994; Greenberg and Park 1994) have viewed

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this dynamic history, or *Historical/Political Ecology* [1]. This broad movement has been explicitly linked to a widely perceived need for a more effective social science contribution to environmental management (Crumley 1994:243). Arctic and North Atlantic regional zooarchaeology has just begun to play a key role in the evolving agendas of Historical and Political Ecologies and forms a corpus of funded circumpolar interdisciplinary programs (Amorosi 1989a, 1991; Buckland 1988; Ingimundarson 1995; McGovern 1994, 1995; Serjeant 1991). This work represents an attempt to describe the zooarchaeological record of Iceland and, by doing so, contributes to the widening discussion of the appropriate use of zooarchaeological data in the context of dynamic landscape reconstruction and paleoeconomy. This research effort views the circumstances of human action and decisions as pivotal in the understanding of how and why a

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1. At the same time there are many theoretical thinkers who have become dissatisfied with the increasingly sterile debates between processual and post-processual or positivist and post-postivist perspectives. As a result there is a growing attempt to integrate the rich data resources of the former with the cognitive sophistication of the latter. This evolving movement is now being called *Historical Ecology* and *Political Ecology* within anthropology. There are clear parallels in the environmental history movement and extensive cross-fertilization between anthropology, history, geography, evolutionary ecology and paleoecology are a central part of the movement's agenda (Cronon 1983, 1991; Crosby 1986, 1994).

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landscape formed and developed. It is these human actions that are in a sense fossilized in the archaeological record, which in the case of this thesis can be seen as past landuse and management decisions. Such decisions are often reflected in the mix of domestic livestock species kept by a farmer and, in an archaeological sense, the mix of species present in a recovered archaeofauna.

This "interrelatedness" of humans and the natural environment can be read from the landscape (Crumley 1994:6). Crumley states that, by inference, the charting of changing human attitudes and needs toward the environment can be identified. More importantly, these attitudes and needs (whether conscious or unconscious) are decisions that have impacted "human lives, livelihood and change the face of the earth" (Crumley 1994:6). It is this tangle of complex multi-causal relationships that require a patient pulling apart if they are to be understood. The zooarchaeological data that is presented here represents one vital set of information that has been serious overlooked in the study of Iceland's economy. Yet, if this faunal data is used within an inter-disciplinary framework, it offers an important opportunity to explain the black box mechanisms of Iceland's paleoeconomy.

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It would seem that zooarchaeology is particularly well suited to this integrative task. Zooarchaeological data blends nicely with both archaeological and ethnohistorical information. Perhaps the most important part of this mixture is the ability to cross-check these and other sources of data. One very fruitful example has been the examination of the collapse of the western settlement of Norse Greenland (Buckland, Amorosi, Barlow, Dugmore, Mayewski, McGovern, Ogilvie, Sadler and Skidmore 1995). This research is inter-disciplinary in nature, involving numerous archaeological, bioarchaeological (zooarchaeological and environmental) and climatological (historical and the ice core data from the GISP2 project) lines of evidence. The zooarchaeological data not only provided a cross-check of the environmental data but also provided a means to establish what past land-use decisions were.

1.1.7 Global Change Initiatives

Vertebrate zooarchaeology (or Archaeozoology) has many disciplinary goals articulated in standard textbooks and review publications (Bogan and Robinson 1987; Casteel 1976; Davis 1987; Klein and Cruz-Uribe 1984; Hesse and Wapnish

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1985; Luff 1984; Rackham 1994; Wheeler and Jones 1989). Animal bone collections have been employed in biogeographic searches for rare species identifications, quantification and data management experiments, the investigation of Quaternary taphonomic processes, the reconstruction of paleo-environments and the reconstruction of past human decisions interacting with the behavior and biology of past animal populations. However, in recent years, zooarchaeologists have been increasingly asked to use their data and expertise to contribute to large scale integrative projects and national or international initiatives that go beyond the normal confines of this subdiscpline.

There is a proliferation of international programs investigating past, present and possible future environmental changes on a global scale. Zooarchaeologists, along with their paleoecological/ environmental colleagues, are now being invited to contribute to the creation of plans for the long-term sustainable development of resources. Such plans are broad in scope, as shown by the goals which the U.S. National Science Foundation's Arctic System Science (NSF-ARCSS) program is attempting:

> " - to understand the physical, geological, chemical, biological and social processes of the Arctic system that interact with the total Earth system and thus contribute to or are influenced by global change.

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and

> - to advance the scientific basis for predicting environmental change on a decade to centuries time scale and for formulating policy options in response to the anticipated impacts of changing climate on humans and societal systems (McCauley and Meier 1990:6)".

Although broad in nature, the goals the ARCSS plan has a more refined question to which zooarchaeological data (among other anthropological, archaeological and paleo-environmental data) is now being applied:

> "How have past human societies in the north reacted to long-term climate fluctuations and alterations in political and economic linkages to the south? (McCauley and Meier 1990:25)".

Many scholars now agree that there is an urgent need to expand the paleo-types of data in order to avoid errors resulting from a short term observational series of the last century. There is also a push to avoid false analogous arguments drawn from data collected in the Temperate zone. Zooarchaeological data, along with other paleo-types of data, is thought to have a "considerable underdeveloped potential" for integration with archaeological, historical and anthropological modeling. This connection of the past with the present "involves the systematic integration of paleoeconomic data" with historical and ethnographic records, where regionally oriented, long-term linkage of

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different data sets is highly desirable (McCauley and Meier 1990:25-26).

1.2 HISTORY OF ICELANDIC ZOOARCHAEOLOGY

The history of Icelandic zooarchaeology is so closely interwoven with its archaeology that it would be impossible to discuss one without the other. Although this is a somewhat personalized view of the history of Icelandic archaeological research, it nonetheless traces the zooarchaeological efforts in Iceland. It is *not* the author's intent to provide an exhaustive summary of this subject. Such a review is beyond the scope of this thesis and would require a more in-depth discussion than can be given at this time. For a more detailed set of "Icelandic archaeological history" surveys, see Thordarsson (1912) for the earlier part of this century, for the mid-to-late this century review see Eldjarn (1962, 1980) and Fridriksson (1994). The Fridriksson reference is written in English and serves an invaluable guide to the subject for the non-Icelandic specialist.

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1.2.1 The 19th Century

Icelandic archaeology and, to a lesser degree zooarchaeology, both got their start in the late 19th century (McGovern 1990). This research was spurred on by the popular interest in looking for physical evidence of the Icelandic sagas-history. This effort was closely interlaced with "proper" linguistic studies of the Icelandic language and the growing sense of Icelandic nationalism and independence from Denmark.

The research that typifies the early part of this period were various foreign travellers' accounts (Annadale 1905; Banks in Rauschenberg 1973; Boucher 1989; Burton 1875; Collingwood in Hannesson, Bjornsson, Hannesson and Jakobsson 1988; Hooker 1809; Holland 1810 in Wawn 1987; Mackenzie 1810; Russell 1914). These reports were not solely archaeological in nature. Rather these works covered a host of natural science/historical observations where a curious ruin was investigated. Often these ruins were thought (by the local tradition) to be associated with a particular "saga-hero" or event. These reports follow the "all-too-familiar" 19th century style that describes the archaeological ruin and setting in some detail. The ruin

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would receive a cursory excavation at best by today's standards, with the major finds (such as swords, "turtle-back" broaches, human skulls, etc.) and some of the stratigraphy described (see Bruun 1928 and Bruun in Steindorsson, Magnusson and Bjornsson 1987).

By 1863, the Museum of Antiquities had been established in Reykjavik. This was shortly followed by the establishment of the Icelandic Archaeological Society in 1879, and a year later the publication series of the Arbok (Arbok Hins Islenzka Fornleifeflags) was begun. The senior Icelandic scholar, Sigurdur Vigfusson, became the first curator of the museum, later to be the vice-chairman and chairman of the Archaeological Society (Fridriksson 1994a & b).

By the 1880s-1890s, the standard for archaeological research progressed to a more scientific approach to validating the sagas. Vigfusson was partly responsible for this with his research at the site of Bergthorshvoll. Recovered from this site was a "white" substance, assumed to be *skyr* or milk curd:

> "In the Bergthorshvoll ruins, Vigfusson also found some "white material", which was sent to Dr. Storch, the director of the Royal Veterinary and Agricultural Laboratory in Copenhagen. In celebration of Vigfusson's discovery, the Icelandic Society of Archaeology published the whole of Dr. Storch's report in Danish, complete with an Icelandic translation, titled "Chemical

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> and Microscopic Investigations of a Curious Material, found in an Excavation... at Bergthorshvoll". In the preface to his report, Storch (1887b:3) says: "In a letter from Sigurdur Vigfusson... which came with the white material, he says that many believe that the white material is the remains of Berthora's (Njall's wife) *skyr* (curdled milk), i.e there were remains of some dairy products, that were made at Bergthorshvoll in the year when Njall and his sons, according to the saga, were burned, in 1011." (Fridriksson 1994: 173-174, and personal communication 1994).

This same period saw a more systematic style in research. This was when Iceland was first topographically mapped by the Danish Geodetic Survey. This survey represents the first modern cartographic series of topographic maps where archaeological sites or ruins are mapped (Sigurdsson 1978). Auxiliary archaeological surveys were also carried out at this time. The first set of these surveys were published by the well-travelled Captain Daniel Bruun, who worked with the Danish Geodetic survey (Bruun 1898a & b; 1899; 1903; 1910; 1928; Bruun in Steindorsson, Magnusson and Bjornsson 1987). In Bruun's surveys, his travels took him around the island, traveling almost the same route that Icelanders today call the "Ring Road" (or Route 1). Bruun managed to map an extraordinary number of ruins, detail the sites' settings [2],

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2. Bruun's field sketches are so detailed that some are still used by archaeologists to locate poorly preserved archaeological sites, usually the site's final phase of

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and collect not only local ethnographic information pertaining to the site but, in some cases excavate the ruin saving artifactual and zooarchaeological materials. Many of these finds can now be found in the archaeological collections at the National Museum of Iceland in Reykjavik and the Zoological Museum in Copenhagen, Denmark. However, the animal remains that were saved [3], were never clearly marked and were scattered between these two institutions. Those collections that might have been derived from Bruun's efforts were stored at the National Museum of Iceland and detailed in the following chapters 4 and 5. The collections stored at the Zoological Museum in Copenhagen, still remain to be detailed. [4]

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destruction has only a remnant of the site, such as a turf wall (Sveinbjarnardottir 1989).

3. Although Bruun collected only small samples of hand-picked animal bone, it is important to remember that these were the first biological ecofacts saved at a time when the rest of the world often ignored this archaeological resource.

4. Because of the cost and time, the author's research effort was better spent in the recovery of new, well documented assemblages. While it's still the author's intent to analyze these 11 small collections (the largest having a sample size of 213 fragments), the problems of inadequate site documentation, inadequate sample size and poor recovery standards makes these materials almost useless for the discussion of paleoeconomy, global climate change and human impacts. Dr. Morten Meldgaard very kindly glanced at these collections for the author for bio-geographic interest, but the search only yielded

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It can be said of Bruun's research:

> "Rather than attempting to identify the dead by name, his (1903:20) main concern was with information that could be derived directly from the finds, to gain "knowledge of various kinds about heathen burial practices of the ancient's in Iceland". To achieve this Bruun initiated scientific analysis of human, animal, and plant remains. Human bones were analyzed for physical condition, and endeavor's were made to reveal their age and sex (Bjornsson in Bruun 1903:21-24). Bruun also sent a horse skeleton to be analyzed by the Zoological Museum in Copenhagen. The results were then compared to the modern Icelandic horse, as well as one from early Iron Age Denmark and a Stone-Age horse from Solutre in South France (Bruun 1928:58-64). A chip of wood from a boat grave was analyzed and found to be oak (Kolderup-Rosenvinge in Bruun and Jonsson 1910a), " and therefore", Bruun (1928:68) concluded "the boat could not have been built in Iceland". (Fridriksson 1994:82; also personal communication 1994).

Bruun's research efforts were followed by several Icelandic antiquarians: T. Erlingsson (1899); B. Jonsson (1894, 1902, 1906, 1911), P. Palsson (1895, 1897), and the continued efforts of Sigurdur Vigfusson (1880-1881, 1882, 1883, 1886, 1887, 1888-1892). These scholars provided the first site area maps and test excavations for such famous places as Pingvellir (Vigfusson 1880). These reports also contained some description of the artifacts and stratigraphy

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the "usual Icelandic domesticates", cattle, caprines, some horse and dogs.

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that is encountered. Unlike Bruun's work, organic remains were not regularly recovered nor described.

1.2.2 The Early 1900s

The first professional post in Icelandic archaeology, that of the *State Antiquarian*, which was established in 1907. This year also marked a change of the *Antiquities Collection* to what is now know as *the National Museum of Iceland (or Pjodminsafan Islands)* . Matthias Thordarson became the museum's first *Antiquary*, carried out several small-scale excavations and issued several hundred *preservation orders* for archaeological sites thought to be of Saga-Age (see Fridriksson 1994; also Thordarson 1920, 1922, 1929, 1931, 1932a & b, 1936).

The only truly systematic, if only partly multi-disciplinary effort of the pre-war (WW II) period was a joint Nordic project, in which a series of excavations were carried out in western Greenland and in south-central Iceland. The Greenland effort saw the excavation of many major archaeological sites, such as the church farms of Brattahlid, Gardar, Herjolfsnes and Sandnes. The findings were published in the well-known monograph series, *Meddelelser om Gronland* (MOG), (Norlund 1924, 1929; Norlund

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& Stenberger 1934; Roussell 1936, 1941) with preliminary zooarchaeological reports by Magnus Degerbol for the Greenlandic materials (Degerbol 1929, 1934, 1936, 1941, 1943b). However, much of the archaeological (McGovern 1979, 1980; McGovern & Jordan 1982; Vebaek 1982, 1991a & b, 1992, 1993) and especially the zooarchaeological findings were not reported at the time, but were much later detailed by Tom McGovern (1980, 1981, 1985a & b, 1989, 1991, 1992a & b) and his colleagues working closely with him (McGovern & Bigelow 1984; McGovern, Buckland, Sveinbjarnardottir, Savory, Skidmore and Andreasen 1983; McGovern, Bigelow, Amorosi, Woollett and Perdikaris 1993).

The Icelandic part of this Nordic project was headed by the Danish architect/archaeologist, Aage Rousell and was known as the Thjorsardalur Project (Rousell 1943). This project was centered in an abandoned valley, where the valley's mouth is bordered by the river Thjorsa and the volcano known as Hekla in the east. The intent of this ambitious project was to map systematically and excavate a series of turf-built farm structures thought to have been first abandoned by the AD. 1104/58 eruptions of the volcano Hekla. [5]

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5. The conclusions of this project have been subjected to a rigorous review by Vilhjalmsson (1988, 1989b) who has

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Rousell's Nordic team included three young Icelanders now well known in the Icelandic archaeological literature. Sigurdur Thorarinsson's geological writings concerning tephrochronology (1956, 1958, 1961, 1968, 1970a & b, 1974, 1975, 1976, 1979, 1981a & b -- that is, the dating volcanic eruptions by the ash (tephra) layers) are well known, and the Thjorsardalur Project marks Thorarinsson's first applications of this dating method. Another Icelander, Jon Steffensen, began his career (and formulated the nature of what will become Forensic Anthropology in Iceland for the next 50 years) by detailing the human remains recovered from the Skeljastadir graveyard. Finally, Kristjan Eldjarn started his long career and played the central role of grand synthesizer of Icelandic archaeology. Also part of Rousell's team was the pioneering Danish zooarchaeologist Magnus Degerbol. Degerbol (1943) not only detailed the animal remains from the site of Strong, but placed into the literature another small collection recovered from the Hofstadir site near the Lake Myvatn area (located in northeast Iceland, and probably collected by Daniel Bruun in 1908).

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argued that the abandonment of this valley did not occur in AD. 1104/58, but as a gradual movement out of the valley that persisted to the beginning of the 13th century.

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Less systematic archaeological research was continued well into the post World War II period where a number of Viking period graves and finds are detailed (Thordarson 1920a & b, 1921-22). Most of these findings are published in a summary fashion in the National Museum's Yearbook -- *Arbok Hins Islenzka Fornleifafelags*. These same Viking period materials are also summarized in Kristjan Eldjarn's Ph.D. dissertation in 1956.

1.2.3 The Post War Period

The post War period saw a renewed interest in archaeology and survey work. Results of field research were regularly reported both at home in the *Arbok* and in other European publications. Kristjan Eldjarn (1943, 1949, 1952, 1956, 1957, 1958, 1961, 1962 1964, 1965a & b, 1967, 1969, 1971a & b, 1973a & b, 1974a-c, 1975, 1978a-c, 1980, 1983b, 1984), Sturla Fridriksson (1959, 1960), Gisli Gestsson (1955, 1959, 1960, 1962, 1965), Porkell Grimsson (1962, 1965), Porkell Grimsson and Porlief Einarsson (1969), Marta Hoffmann (1965), Por Magnusson (1966), Jon Steffensen (1958, 1959; Eldjarn and Steffensen (1959) and Matthias Pordarson (1963) became the Icelandic archaeologists, working from the National Museum of Iceland.

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Their particular focus was not on one particular time horizon such as all Viking period sites. Rather than following the "North American" template of temporal periods within any particular region, i.e. the Late Woodland of the Northeast United States, these scholars classified archaeological materials into a more Icelandic cognitive set of categories. Fridriksson (1994) has classified these as Prehistory (improbable Roman and Celtic settlement), Religion (these include ritual sites, Pagan burials, Christian remains, and the saga ritual sites), Administration (the assembly sites) and Farmstead sites. This classification of archaeological materials on the basis of their function rather than chronology is partly the result of lacking a prehistoric component to their archaeology, such is found in North America or Europe. Also, it is important to remember that these scholars were not trained as anthropological archaeologists or prehistorians. Most of their training was within Scandinavian departments of Medieval archaeology.

Nonetheless, Eldjarn did attempt to construct a temporal phasing of Viking (Pre-Christian) and Medieval (Christian) materials. His comprehensive work on Viking period graves and small finds in Iceland is still a much sought after volume for Norse scholars (1956). In this thesis, Eldjarn

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describes the then known Viking period sites and grave finds. What is interesting from a zooarchaeological point of view are the summaries of the Viking period graves include associated horses and domestic dogs. Unfortunately, the animal remains were only briefly described, usually listing the animal's "common name" and usually illustrating the position of the body (often a rough field drawing) in the grave, but the descriptions lack any detailed forensic recording. None of the animal bones were saved for future study, since most were recovered by local farmers and thought to be unimportant to the research effort of the time. A listing of these animal graves can be found in chapter 3.

When Eldjarn was elected to the presidency of Iceland, he had little time to conduct archaeological research. Still he managed to initiate survey work on the island of Papey, in southeast Iceland. There Eldjarn conducted a number of excavations on Early Medieval ruins but died before completing this work (Sveinbjarnardottir 1988). At the same time, Eldjarn also played an important role by attempting to synthesize earlier works and analyze methods and trends within Icelandic archaeology. He also continued the site registration program that had begun under Vigfusson and Thordarson. Added to this program, was a strong rescue

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element as Icelandic farmers started to modernize their field flattening and plowing programs. Clearly the interruption of World War II had ended, but this archaeological effort still lacked a paleoecological and zooarchaeological research design. The only major environmental finds made during this period was the recovery of barley at the Medieval site of Grof, southeast Iceland (Fridriksson 1959) and the Tjarnargata 4 bone assemblage from downtown Reykjavik (Grimsson and Einarsson 1969). Otherwise, only stray, but interesting animal bones from archaeological sites were catalogued into the National Museum's holdings.

This style of post-war archaeology continued well into the early 1970s. Through Eldjarn's guidance Icelandic scholars were trained, and ties with the Scandinavian world were further strengthened. The discovery of more Viking period sites in the downtown part of Reykjavik near the southwest part of the Tjorn (or Lake) in the early 1970s became the training ground for the now senior Icelandic archaeologists. This research has been published outside Arbok and in a wider reaching set of sources (Nordahl 1983, 1988; Nordahl, Slyta and Arrhenius 1981). Unlike earlier research, these reports take on what now can be called a Cultural Resource Management (CRM) or rescue aspect.

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Although there was no large scale regional research design (as applied in North American sense), the national registration and site protection program took on this aspect. This program included a vast array of site survey information, as well as excavation (mitigation) if the site was endangered. The part lacking in this program was again the paleoecological aspect, as there was almost no recovery of ecofacts or animal bone samples.

Interests were also focused outside the greater Reykjavik area. While the downtown excavations in Reykjavik were in operation, many other smaller projects were simultaneously being run out of the National Museum. These include the Thjorasardalur site of Samsstadir (Rafnsson 1976), investigations of the Hegranes ruins (Olafsson and Snaesdottir 1975) and perhaps one of the earliest landnam (or settlement period) sites in Iceland, the Herjolfsdalur site situated on the island of Heimaey in the Westman Island group (Hallsdottir 1983; Hermanns-Audardottir 1986, 1987, 1989). Although there has been a major dispute of Hermanns-Audardottir's claims of an earlier Merovingian occupation at this site (Crawford 1991; Hermanns-Audardottir 1991 & Reply; Kaland 1991; Mahler and Malmros 1991; Morris 1991; Sigurdsson 1991), the Herjolfsdalur site represents the second quantifiable animal bone assemblage recovered. Jon

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Steffensen also attempted the first forensic synthesis of Viking and early Medieval period burials (Steffensen 1975). While these efforts were underway, Eldjarn's registration and rescue program continued to record many Icelandic ruins, monuments and ethnographic objects (Eldjarn 1971a & b, 1973a & b, 1975, 1978a; Gestsson 1971; Magnusson 1971, 1972, 1978; Olafsson 1979; Rafnsson 1970, 1974) and there was some interest in the North Atlantic as well (Eldjarn 1978b; Sigurdardottir 1979).

In the late 1970s and early 1980s, Icelandic archaeology took on a split personality. There remained the more "traditionalist approach" as begun by Eldjarn in the post war period, and the first formulations of "Environmental Archaeology" as developed in the United Kingdom (cf. Butzer 1971, 1982; Evan 1978). By the mid 1980s, these two approaches blended to some degree, but some opposition to environmental archaeology can be seen in the academic literature and the Icelandic newspapers (cf. Steffensen 1981).

Although not "traditionalist" in their view of archaeology, Gudmundur Olafsson (1983a & b, 1987a & b), Gudrun Sveinbjarnardottir (1986) and Mjoll Snaesdottir (1980) continued Eldjarn's efforts, and also attempted to blend the two views into a coherent picture. For these

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scholars the British-styled "Environmental Archaeology" provided another view that could be added into the national rescue and site registration program. It is at this point in 1978 that the British team of Paul Buckland (Simon Butler, Andy Dugmore, John Gerrard, Jon Sadler and Pete Skidmore) began working in Iceland. The British effort was teamed with Gudrun Sveinbjarnardottir to concentrated on a systematic site survey program of three regions, the Thorsmork and Eyjafjallasveit in southern Iceland, the Austurdalur and Vesturdalur in Skagafjordur in northern Iceland and the Berufjordur area in eastern Iceland (Buckland, Dugmore, Perry, Savory and Sveinbjarnardottir 1991; Sveinbjarnardottir 1982a-c, 1983, 1989, 1991a & b; Sveinbjarnardottir, Buckland and Gerrard 1982). Other survey work was conducted with Gudmundur Olafsson in the west and north and excavation of the farm mound at Storaborg by Mjoll Snaesdottir. There were also smaller scale efforts conducted at the site of Strong in the Thjorsardalur of south central Iceland was begun by Vilhjalmur Vilhjalmsson (1983, 1984b, 1986, 1989b). Although environmental samples (samples such as soils, insect, macrofloral, and pollen fossils, tephra) were now being systematically collected according to an over arching regional research design, still missing was a strong zooarchaeological perspective.

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Buckland's team started to publish their results and met strong opposition from several Icelandic scholars, most notably by Jon Steffensen (1981). Work continued in Eyjafjallasveit, and the first opportunity to excavate an entire farm mound presented itself in 1979-1980 at the site of Storaborg (Buckland and Perry 1989; Perry, Buckland, Snaesdottir 1985; Snaesdottir 1980, 1987a & b, 1988, 1989a & b, 1991a - d, 1993; Sveinbjarnardottir, Buckland, Gerrard, Greig, Perry, Savory and Snaesdottir 1980). It was at this time that discussions between Stefan Adalsteinsson, Paul Buckland, Tom McGovern, Mjoll Snaesdottir (then working for the National Museum of Iceland) and Sigurdur Thorarinsson occurred, and plans were made to add zooarchaeology into the program of excavation at Storaborg. All animal bone materials from the site of Storaborg were sent to the Bioarchaeological Laboratory at Hunter College in New York for analysis. McGovern paid a site visit in 1980, and while in Reykjavik analyzed a third smaller quantifiable collection from the east interior site of Adalbol (McGovern 1982) [6].

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6. The zooarchaeological research design for the Storaborg project was part of a larger effort intended to examine the paleoeconomy of the Norse Western North Atlantic colonies of Iceland and Greenland. In Iceland, Paul Buckland and Gudrun Sveinbjarnardottir would continue their research (Buckland nd.). Simulteously the

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1.2.4 The Icelandic Paleoeconomy Project

Interest in Iceland's zooarchaeological record was further helped along by the natural historians, and in 1986, Stefan Adalsteinsson was asked by McGovern if a long term program could be developed in Iceland. It was in this year that the author and McGovern came to Iceland to start a zooarchaeological program with Icelandic scholars. Up to this time, only the Storaborg and Adalbol collections had been preliminary treated by McGovern's team (McGovern 1982; Russell 1985; Russell, Amorosi and McGovern 1986). It is interesting to note that although Buckland's team had been working on paleoecology and environmental archaeology for at least seven years prior, a review of the Icelandic archaeological literature revealed only one article by Buckland's team. There does not seem to be any further

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international "Sandnes Rescue Project" (site no. KNK4 or V51) went into full operation with Tom McGovern acting as the principal investigator and chief zooarchaeologist, while Buckland's team analyzed the other organic remains. It was hoped that both excavations would allow a reasonable set of zooarchaeological and paleoecological samples for comparative purposes. Unfortunately, with the untimely death of Kristjan Eldjarn, the Iceland end of the project suddenly fell through and remained in discussion for some time afterwards (personal communication, Paul Buckland 1996).

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mention within the literature to indicates that the Icelandic archaeological community incorporated these methods wholesale within their research designs. Archaeological research was reported in a timely and extremely well detailed fashion (Agustsson 1987a & b, 1990, 1992; Eldjarn, Christe and Steffensen 1988; Finsen and Hiort 1978; Fridriksson 1991; Gudjonsson 1991; Hjartarson, Gudmundsson and Gisladottir 1991; Kristinsdottir 1987; Magnusson 1991; Matthiasson 1987; Olafsson, Vilhjalmsson and Sigurdsson 1991; Steffensen 1988b; Sveinbjarnardottir 1992), but clearly lacked a strong environmental component. The only work that has received substantial criticism from this period is that of Rafnsson (1990), see McGovern and Amorosi (1992) and Sveinbjarnardottir (1991c).

The zooarchaeological program envisioned by Adalsteinsson, Buckland, McGovern and Amorosi got off to a slow start in 1986. At that time the zooarchaeological project was entitled the Icelandic Zooarchaeology Project or IZP. This project was designed to be part of a larger joint undertaking by Gudmundur Olafsson, Gudrun Sveinbjarnardottir, and Mjoll Snaesdottir of the National Museum of Iceland, Jeffrey Parsons and Kevin Smith of the University of Michigan, Vilhjalmur Vilhjalmsson of the Institut for Middlealder-arkaeologi, Denmark, Tom McGovern

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and the author (Bioarchaeological Laboratory, Hunter College, C.U.N.Y.).

The IZP was designed to perform a preliminary archaeological and zooarchaeological survey (a Phase I reconnaissance in North American terminology) for the Thistilfjordur (northeast Iceland), Skagafjordur (north Iceland, and as a complement to Olafsson's survey (1991c), the Hrafnkelsdalur (the eastern interior of Iceland), the Eyjafjallasveit (south coast) and the central interior valley of the Thjorsardalur. Survey findings for the Thistilfjordur and Eyjafjallasveit survey were detailed in Amorosi (1986). The Skagafjordur materials are yet to be detailed by Smith, and the survey and excavation work at Strong were detailed by Vilhjalmsson (1986).

The seven week field season saw the accomplishment of most of these goals. Hrafenkelsdalur did not receive any coverage, due to the late melt of the winter snows, and the team lack of a four wheel drive vehicle to access the deep interior valley. Offsetting this disappointment was the recovery of four surface assemblages of animal bone (Fornusandur 2, Baegisstadir, Svalbard's central erosion face finds, and Gammel-Grimstadir) and several other small bone collections made available for study (Grunnasundes, Eldvorp, Esjuberg, Nesstofa's house interior, Skalholt test

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finds, and Hjallholl's erosion face finds). In addition to these collections, the larger collections of Hofsstadir, Nyibaer, Stong's pit house materials and Thingness, plus the surface samples were sent to New York for further study. In summary, the IZP was able to add 15 new archaeofauna including the discovery of the Svalbard site to the zooarchaeological record. The site survey results were also satisfying, with the IZP adding 13 new sites to the site registration program (Amorosi 1986).

The 1987 field season took on a Phase II aspect (again using the American terminology), namely the testing of several very promising bone middens in the east. In the meantime, Gudmundur Olafsson arranged that several long term Icelandic projects incorporate zooarchaeology into their research designs. These projects included:

1. - the ongoing Storaborg excavations,

2. - the excavations on the island of Videy (Amorosi and McGovern 1993; Snaesdottir 1987c; Hallgrimsdottir 1987a-d, 1989, 1990, 1991, 1992; Sigurdadottir 1990),

3. - the excavation of the Danish colonial governor's residence of Bessastadir (Amorosi, Buckland, Olafsson, Sadler and Skidmore 1992; Baldursson 1990; Olafsson 1991b; Smith 1987),

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4. - the excavations of Snorri Sturlunson's farmstead site at Reykholt (Grimsson and Olafsson 1987; Buckland, Sadler and Sveinbjarnardottir 1992) and associated upland farm of Hals (Smith 1992).

5. - the rescue excavation of Adalstraeti 8 in the downtown Reykjavik area (Hallgrimsdottir 1987a).

The IZP 1987 field work was conducted in the northeast of Iceland in the areas of Borgarfjord-estryi at the Hjallholl, the Thistilfjordur at Svalbard, and the general Egilsstadir area at the Vad dog burial (Kristinsdottir 1987) and the Hallfredarstadir graves (Amorosi 1987; Kristinsdottir 1987). The preliminary findings are reported in Amorosi (1987) and results are described in later chapters 3 and 4. Also recorded, were the 80 Viking period graves mentioned in Eldjarn (1956 - see chapter 3), 11 small collections in Copenhagen's Zoological Museum, the loan of the Tjarnargata 4 collection (see chapters 4 and 5), 4 small samples from the Icelandic Natural History Museum (see chapter 4), and 3 additional bone collections from the Hrafnkelsdalur (see chapter 4 and 5) were also examined.

Based upon the results from the 1987 season, the 1988 field efforts were focused in the northeast and at this time the IZP project was re-named the Icelandic Paleoeconomy

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Project (IPP) for purposes of funding. The Hjallholl site yielded a Viking period longhouse firepit with associated animal bone refuse. However, because of the paucity of diagnostically datable artifacts, the oil storage facility atop the site and the fish-canning plant on its north-west border, the site was deemed heavily disturbed. The major part of the 1988 field efforts (9-10 weeks) was shifted to the other promising site at Svalbard located in Svalbardhreppur in the Thisilfjordur area. A smaller two week archaeological survey was also conducted in the north-west part of the country in the parish of Arneshreppur, Strandasysla (see chapter 5).

In the meantime, the Icelandic projects at Bessastadir, Storaborg and Videy continued to add zooarchaeological samples to the IPP for study. It was at this time that the Reykholt project in Bogarfjordur (south-west Iceland) went into full operation. Plans were made to incorporate Buckland's paleo-environmental team at both the Reykholt and Svalbard sites. Although zooarchaeological reconnaissance at Reykholt and Hals in 1987 indicated that bone preservation was extremely poor (soils were acidic with pH of 3 or lower), any animal bone samples recovered would be sent to the IPP for study.

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Svalbard's research design was set to excavate the bone midden and test the adjoining farm mound and conduct a field survey of the coastal areas of Svalbardhreppur. The 1988 season was extremely successful, the midden yielded almost one metric ton of animal bone, an approximate 3,000 artifacts (of which 500 or so are diagnostically datable), numerous environmental samples, plus 200 newly registered archaeological sites (see chapter 9). While preliminary studies have been published (Amorosi 1989, 1991, 1992; Amorosi and McGovern 1988; Inigmundarson 1989, 1995; Molloy 1993; Molloy, Henshaw and Marino 1993; Zutter 1989, 1991, 1992, 1994), the Svalbard materials promise to keep the author's IPP team busy for the next 5-10 years.

In 1989, a more restricted field season (2 months) was carried out by testing two new localities, Midbaer on the island of Flatey in Breidafjordur (north-west Iceland) and Nesstofa located at the tip of Seltjarnarnes (just south-west of the city of Reykjavik). The site of Midbaer was reported to the author by Dr. Aevar Petersen (who has conducts a long term orthniological survey of the entire fjord system for the past 15 years). The Midbaer site yielded a well preserved set of turf ruins and structures, a deeply stratified midden with a large collection of animal bone that dates either to the Early Medieval period (1st

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sigma range, AD. 1277-1388) or perhaps of the earlier Landnam period (see Amorosi and McGovern 1989 and chapter 5).

The Nesstofa site was the residence of the Danish colonial doctor during the Early Modern period (Egilsson, Jakobsson, Petersen and Hilmarsson. 1991; Vilhjalmsson 1989a). The site's test excavation was successful from a zooarchaeological perspective. The farm mound is still intact with a large and well stratified midden, which yielded another quantifiable animal bone sample. Preliminary findings are reported in Amorosi and McGovern (1989, 1992b) and Amorosi, Buckland, Magnusson, Sadler and McGovern (1994), and more detailed zooarchaeological report can be found in chapter 5.

The final large scale field season was conducted in 1990 in the parish of Arneshreppur in Strandasysla, northwest Iceland. The 1988 survey had revealed a new and potentially rich area for further IPP research goals. But, because of the commitment of time and funding to the Svalbardhreppur excavation and site survey for 1988, work in this region had to be postponed until 1990.

The 1990 plans called for a similar research design to that of the Svalbardhreppur. In addition to the work conducted in Arneshreppur, Olafsson and Buckland were to

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conduct a similar project in the west fjords area (Olafsson 1996). In theory these two projects would then add to the growing body of full and partial hreppur (an Icelandic community of 20-25 farms) site survey coverage and would be able contrast data on climate change and human response/impacts. The 1990 season also marked the year when new Icelandic laws governing archaeological resources went into effect. Due to many internal Icelandic political difficulties, the 1990 zooarchaeological materials remained in Iceland and are yet to be detailed. In the future when circumstances improve, the author hopes to fully research these materials. The preliminary field report is included here to give the reader some idea as to the scope of work conducted in 1990.

Since the 1990 season, IPP members conducted site visits in 1992. The visits were multi-purposed, involving site inspection to attempt to halt further erosion of known midden sites, refine tephra dating sequences in the area of known midden sites and collect modern mollusk and sea/fresh water samples for contemporary base-line O16/O18 isotope analyses (Molloy 1993). Additional archaeofauna materials were also added to the IPP study. These include the test excavation under the church floor at Holar (Snaesdottir 1991c), and the Granastadir excavation in north Iceland

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(Einarsson 1992, 1994). Thanks to the North Atlantic Bio-cultural Organization (NABO) initiatives, there is a strong commitment for the joint publications and site monographs for the Bessastadir, Storaborg and Svalbard materials [7]. Plans are also underway for a series of joint field stations, where a new set of excavations will yield an even more complex set of archaeological, zooarchaeological and environmental materials).

Since 1992 there has also been numerous advances made in the paleoentomological and paleobotanical aspect of the environmental research. One Ph.D. dissertation has appeared detailing the "pre-settlement" flora communities in southwest Iceland (Hallsdottir 1987), the Svalbard plant macro-fossils were detailed as a Master's Thesis (Zutter 1989) and numerous articles by Buckland's team (Buckland 1988, in press; Buckland, Gerrad, Larsen, Perry, Savory and Sveinbjarnardottir 1986; Buckland, Perry, Gislason and Dugmore 1986; Buckland and Sadler 1989; Sadler 1991; and see

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7. The North Atlantic Bio-Cultural Organization, NABO, is a multidisciplinary, non-governmental regional research cooperative involving over 180 scholars from 30 institutions in ten countries. NABO is affiliated with IASS (international Arctic Social Science) and IASC (International Arctic Science Committee). NABO works to serve scholars interested in the North Atlantic region and is dedicated to improving communications among the North Atlantic social science and natural science communities.

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Stotter and Wilhelm 1994). The prognosis of the "Icelandic situation" still remains somewhat like the Icelandic weather reports. But like promise of the occasional sunny day, new changes to the current laws are being implemented.

1.3 THESIS ORGANIZATION

The thesis has several subdivisions, were the next chapter deals with the protocols used for the creation of this data base, ending the introductory information. The faunal data is divided into seven chapters, where chapter 3 describes the known Norse and Late Medieval horse and dog graves and chapter 4 deals with the small sample sized faunal collections. In chapter 5 the older pre-1980s open air excavations and 1980s column tests are detailed. Chapters 6-10 will depart from this format by describing single site archaeofauna from the sites of Bessastadir, Granastadir, Storaborg, Svalbard and Videy. Chapter 11 will examine the taphonomy of the Icelandic archaeofauna and the summation of the thesis can be found in chapter 12.

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Chapter 2

METHODOLOGY

2.1 INTRODUCTION

The second chapter essentially represents the zooarchaeological sets of protocols used for the creation of this record or data base (borrowing the System Science terminology that is now so prevalent in Arctic research). More simply phrased, the chapter describes the various "nuts & bolts" used to construct the Icelandic zooarchaeological record, and the means for other zooarchaeologists to compare this particular record with their own work. The three main topical areas that are included within this chapter describe: the problems in the quantification, computer coding, sample size, and recovery of the Icelandic archaeofauna, how the identification of the Icelandic materials were accomplished and how the various Icelandic archaeofauna were dated.

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2.2 PROBLEMS OF QUANTIFICATION OF ARCHAEOFAUNA

2.2.1 Problems of Quantification

Within the zooarchaeological literature there are a host of quantification measures that have been used to "count" archaeological animal bone (cf. Bogan and Robinson 1987; Grayson 1983, 1984). Many zooarchaeologists informally argue that these measures, are context specific and should be used accordingly. For example, a Bison Kill site (cf. Frison and Stanford 1982; Frison, Wilson and Wilson 1976) found in the American Southwest has been argued to be a catastrophic event, where bison are driven over a cliff and killed. This event takes place on a relatively cleared surface and deposition or incorporation of these materials into the ground is rather quick with no subsequent deposition of materials. Analysts agree that statistical measures such as Minimum Number of Individuals (MNI) can be applied to this type of collection. Conversely in the Western North Atlantic, most Viking, Late Norse and Early Modern period deposits are of an accerational nature. Deposition of these materials is gradual over a period of

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months or even years. Many researchers think that Counts, such as the Number of Identified Specimens per Taxon (NISP) should be applied.

The Icelandic archaeofauna for the most part can only be interpreted using ordinal counts. There is only one case in the Icelandic record where a quick deposition of faunal material was recorded. In this case ratio counts such as MNI (Minimum Number of Individuals) have been used at the site of Svalbard (6706-60) in northeastern Iceland, in a deposit described as the whale bone layer (Amorosi 1992a:114). This deposit consisted of a continuous ground surface covered with axe-cut whale bone fragments, suggesting an open-air workshop. There were a number of large stone cobbles marking the perimeter of this feature, surrounding the whale bone chunks. It was also observed that areas of turf were recovered from and between the whale bone chunks. Together with the dates provided by the diagnostic artifacts and radiocarbon dates, this stratum is older than the immediate deposits above them, which would indicate that deposition was rather quick. The whale bone chunks were dumped onto a grassy knoll and covered with a tarp, later the tarp was removed and the midden deposition continued again. But such archaeological cases are rare, especially in Icelandic archaeology and in the Western Norse

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North Atlantic region (see Speth 1983; Thomas and Mayer 1983 for a rather convincing use of MNI measures).

It should be pointed out that these higher level statistical measures suffer from numerous other methodological problems as well. The popular methods of Meat Weight Yields and MNI have been severely criticized (Amorosi 1984, 1991b; Amorosi et al. 1987; Casteel 1977, 1978; Gilbert 1978; Gilbert and Singer 1982; Grayson 1978, 1979, 1981, 1983, 1984; Klein and Cruz-Uribe 1984; Lie 1980; McGovern 1985; Speth 1983) primarily because the archaeological context does not match the quantification measure. Simply stated, ratio measures require faunal deposits to result from single depositional episodes where faunal remains are buried on newly exposed, clean surfaces and immediately sealed after occupation (Grayson and Thomas 1983; Thomas and Mayer 1983).

There are other methodological problems with the use of ratio measures that preclude use with most Icelandic collections. MNI measures lack the ability of being easily replicated, since different analysts employ different criteria for distinguishing nonmatching element pairs and therefore obtain significant differences in results. This is because ratio values are a function of the technique used to form the specimen clusters from which they are defined

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(Grayson 1983:101). This is especially true of MNI counts and the derivation of Meat Weight Yields which are directly dependent on the calculation of MNI (in most cases). Since these measures do not yield accurate and replicated results or significant differences (based upon personal experimentation, MNI counts are not significantly different from NISP counts when used on the same materials) with ordinal counts, many of these measures are prone to error (Amorosi et al. 1987:8; Klein and Cruz-Uribe 1984:24-38; McGovern 1985:12-13).

Although ratio scale measures are not heavily used in this work, the use of ordinal scale counts does seem to be a more reasonable approach. Grayson has pointed out (1983, 1984) that ordinal counts carry virtually all of the same information embodied by ratio measures and are statistically valid levels of analyses. These counts, variously called TNB (Total Number of Bones), E (Element counts) or the more popular NISP (Number of Specimens per Taxon) also have the advantage of dealing effectively with small sized archaeofauna (300+ bones) as well as the larger assemblages (5,000+ bones). Researchers in the North Atlantic (Amorosi 1989a, 1991a; Bigelow 1984; Jones 1991; Morris et al. 1989; Morris et al. 1992; McGovern 1979, 1985; Serjeantson 1988)

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have also widely accepted their use, despite the obvious problems of specimen interdependence (cf. Grayson 1984).

The descriptive summary of the Icelandic collections that follow in this chapter make use of both ratio scale (MNI) and ordinal counts (NISP). Thanks to the micro-computer, spreadsheeting these measures is possible with the touch of a button. The MNI measures included on these spreadsheets are calculated by dividing the number of bones by the individual bone elements represented within the body, i.e. humeri are divided by two. The NISP counts are simply the number of bones per taxon. At the 1990 International Congress of Archaeo-Zoologists (ICAZ) meeting of the North Atlantic zooarchaeologists, it was decided that fish spines should not be counted as a time saving device. All analysts agreed that these bone elements are useless for species identification and only inflate the sample size. Likewise, the Icelandic fish bone counts will not include counts of spines as well.

Other statistical measures used in this summary include many standard measures that will be familiar to most scholars and do not require much explanation. Included are the relative percentage, mean, standard deviation and range. The coefficient of variation (CV) is used to compare the relative dispersion of two or more groups around a mean (as

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opposed to absolute measures such as the standard deviation --Thomas 1986:82-85). The CV measure is applied to check the comparability of one assemblage to the next. McGovern (1985) demonstrated that this measure is a more reliable means to compare archaeofauna when carefully examined with the archaeological context.

The use of relative percentages of NISP counts is heavily relied upon within this text. Relative percentage data eases the problems of comparing NISP counts from different sites. For example, one assemblage might number 5,000 identifiable bones where another could number 50,000. If one were to compare these two samples, statistically one is caught in an Apples and Oranges comparison. However, if these numbers are converted into a simple percentage, comparison of similar taxa become available. Since intra-site comparison is one of the strengths of zooarchaeology, relative percentages is the most effective and simplest means to compare similar temporal collections. This approach is not new to zooarchaeology. Guilday (et al. 1978) made a rather convincing use of relative percentage data in his research at Baker Bluff and other early Holocene sites in the Southeastern part of the United States. The author has also made use of relative percentage comparisons

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of similar taxa in numerous discussions of Icelandic archaeofauna (Amorosi 1989a, 1991a; McGovern 1985a).

Tied to this issue is yet another problem, can counts of different classes of animals, like mammals vs. fish be compared to each other? It was been argued that fish bone counts help to inflate the sample size of an archaeofauna, since there are more bone elements in a fish than mammal. Therefore, comparisons of raw bone counts between animal classes might not be meaningful. This same point was also raised at the 1990 ICAZ meetings and the general consensus argued for that the use of percentage data would ease this type of comparison.

2.2.2 Problems of Sample Size

One cannot realistically accept that all faunal data can be equally evaluated for paleoeconomic reconstruction. North Atlantic zooarchaeologists have attempted various means to construct a *triage-style* method to evaluate their materials. One very plausible means was developed by McGovern (1985a) working with Norse Greenlandic assemblages, where the collections are classified by simply dividing the materials into three categories:

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1. - collections too incompletely documented to quantify further

2. - collections too small to reasonably quantify further

3. - collections which are believed to be *broadly* comparable and which can reasonably be quantified further. (McGovern 1985a:76)."

The first two categories represents collections (usually numbering less than 300 fragments) that were excavated late in the last century, or early in this century. These materials were often hand picked from their *in situ* deposits and represent an odd or interesting bone that might be used later for a photograph for the site monograph. Such materials are listed in tabular form in McGovern's work for bio-geographic interest. Likewise, there are a number of Icelandic assemblages that were collected at this same time and for the same purpose. These materials will be included both in tabular form along with any site documentation that the author was able to acquire while working at the National Museum of Iceland.

The next category represent larger sample sizes and hence more can be done with these materials. While the 300+ number of specimens worked well with the Norse Greenlandic collections, this number is thought to be too small for the

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Icelandic materials. Rather than arguing that sample size in hundreds of bone fragments is required, it is more appropriate to say that a quantifiable Icelandic archaeofauna may range within a 1,000-5,000+/- bone fragment count. Although this is not a hard and fast rule, it was interesting to note the mammalian component of an archaeofauna should fall within the 300+/- fragment count to be of use for paleoeconomic reconstruction. Also strongly tied to this sample size problem are arguments concerning methods of excavation and recovery. Clearly a multi-component, deeply stratified site that was excavated in phase, screened with different sized wire mesh and covered a large horizontal area will yield more bone than a small test trench. This method of excavation will ensure a "representative" sample from the archaeological site.

Similar to McGovern's threefold approach, the reporting of the Icelandic archaeofauna are divided into five sections. The first section dealing Viking to Early Modern animal graves and sacrificial remains. This particular category has a strong interest in current thinking about a landscape approach to the Viking period in Icelandic archaeology (cf. Keller 1993; Einarsson 1994). The next section deals with the problematic collections that are only of use for bio-geographic purposes. These collections were

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rarely screened and represent hand picked samples whose numbers usually fall below the "300 fragment" rule.

The quantifiable materials are divided into three sections. Those derived from well controlled, stratified or multi-component sites that received a horizontal, in phase method of excavation (see chapters 6-10). The sample size numbers for these collections are usually in excess of 10,000 fragments, and more often can be measured by a sample size that falls within the tens of thousands, but under the 100,000 fragment size. Secondly there are the modern column sample excavations, and thirdly older style open area excavations (dug in the 1960s-1970s -- see chapter 5). For these collections, the sample size is truly large, where sample numbers are in the thousands, but the area coverage of the excavation is small and might not be representative of the site's activities, or structural remains cannot be tied to the bone collection and even worse the bone remains lack locational information (as with the older style open area excavations).

2.2.3 Problems of Recovery and Taphonomy

Both these areas of concern are often site specific. Rather than trying to generalize all the geological,

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chemical and biological agents that bias bone assemblages, these problems will be covered in their separate sections and in the conclusion (Chapter 11). What can be generalized here, is the good to excellent state of preservation of most Icelandic material. In fact, much of the materials had *not* been thoroughly processed for marrow and fat extraction (a situation that commonly occurs with the Norse Greenlandic collections -- cf. Buckland, Amorosi, Barlow, Dugmore, Mayewski, McGovern, Ogilvie, Sadler, and Skidmore 1996), nor was there a great deal of gnawing on bones (neither carnivore nor rodent). This does indicate that many of the bone deposits were in a primary context.

2.3 THE QBONE SPREADSHEETS AND CODING

There are numerous routes used by zooarchaeologists to code, tabulate and quantify their data. The author (with Tom McGovern) designed a set of spreadsheets to work with a commonly available PC program, *Quattro Pro*. These templates, known as *Quattrobone* (current version 3.0), offer significant improvements to the mid 1970s main frame programs which used a specifically written alphanumeric coding systems, 80 column punch cards, card readers that

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never work, shredded punch cards and arguments over priority use at the local university computing center. The most current *Quattrobone* manual is included in Appendix A and will not be detailed here.

2.4 IDENTIFICATION OF THE FAUNAL MATERIAL

The faunal materials within this text were identified by direct comparison with modern skeletal materials from the American Museum of Natural History, Departments of Mammalogy and Ornithology, the collection of the Bioarchaeological Laboratory at Hunter College (C.U.N.Y.), and private collections owned by Tom McGovern, Jim Woollett and the author. The Bioarchaeological Laboratory and the author's collections served as auxiliary materials for the more common types of identification of mammals and bird species. The Bioarchaeological Laboratory's collection of North Atlantic game fish was heavily relied upon for fish species identification.

A number of faunal manuals also were used in order to guarantee comparability in the identification of animal bone. These manuals were consulted for Circumpolar, North Atlantic and European livestock species, but at no point

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were manuals substituted for good comparative collections. Rather, these manuals were used as auxiliary guides to keep the analyst consistent in the "20th hour" of identification on any given day.

Faunal manuals that were used for mammals are: Amorosi (1988, 1989b, 1992b); Ashdown & Done (1987); Boessneck (1970); Boessneck and von den Driesch (1975); Brained (1939); Brown & Gustafsson (1979); Brown and Twigg (1969); Burt and Grossenheider (1976); Carter (1976); Cornwall (1956); Clutton-Brock et al. (1990); Ellenberger and Dittrich (1959); Flower (1885); Getty (1975); Gilbert (1980); Glass (1951); Grigsson (1974, 1975, 1976, 1978); Hall (1981); Hildebrand (1949, 1954, 1955); Hillson (1986); King (1983); Howard (1949); Lawrence (1951); Lavocat (1966); Mead (1975); McCuiag-Balkwill and Cumbaa (1992); McGovern and Amorosi (1986); Payne (1985); Olsen (1951, 1960, 1961a, 1961b, 1967, 1979, 1980); Peyer (1968); Prummel (1987a & b, 1988, 1989); Robinette and Stains (1970); Sisson and Grossman (1966); Schmid (1972); Walker (1982); and Wolsan (1982). Standardized measurements follow Spiess (1976), Spiess and Hedden (1983) for Pinnipedia and von den Driesch (1976) for all other mammals.

The following manuals were used for avian remains, Butenbieck & Wissdorf (1982); Cohen & Serjeantson (1986);

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Cowles (1987); Gilbert et al. (1981); Hargrave (1970); Hargrave & Emslie (1979); Holman (1961); Koch (1973); McKusick (1986); McLelland (1991); Olsen (1979a); Schmid (1972); Woolfender (1961). Metric analyses also follow von den Driesch (1976). Modeling of avian body masses follow Dunning (1993).

Manuals pertaining to fish remains include: Amorosi (1988); Beachman (1985); Canon (1987); Casteel (1972, 1973, 1974, 1976a & b); Clothier (1950); Gregory (1933); Frost (1981); Harkonen (1986); Harrington (1955); Jollie (1984); Kazakov et al. (1982); Mujib (1967); Norden ((1961); Olsen (1968); Parker (1873); Pichugin (1983); Rojo (1991); Schultz & Welander (1935); Tchernavin (1938); Vladykov (1962); Wheeler & Jones (1989); Wilson and Veilleux (1982). The the measurement and regression analyses of codfish, Gadus morhua, mouth parts follow Wheeler and Jones (1976) and Jones (1991). Although not generally accepted as a standard reference for metric analyses, Morales & Rosenlund (1979) was also consulted. Because of time limitations and the probability of producing comparable results, Rojo's (1986, 1991) regression formulae were not included.

The taxonomic usage follows Adalsteinsson (1981); Clutton-Brock (1981); Einarsson (1980); Hall (1981); Hewer (1974); King (1983); Lawlor (1979); Ridgway & Harrison

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(198_); for mammals. Avian taxonomy follows Bardarsson 1986); Bruun & Singer (1979); Einarsson (1987, 1991); Ehrich et al. (1988); Freethy (1987); Harrison (1983); Hayman et al. (1986); Lewington et al. (1991); Lofgren (1984); Nettleship & Birkhead (1985); Peterson (1980); Salomonsen (1981). Fish taxonomy follows Casteel (1976); Harkonen (1986); Jonsson (1983); Mills (1989); Rojo (1991); Wheeler (1975); and Wheeler & Jones (1989). Shellfish references are Emerson & Jacobson (1976) and Oskarsson (1982).

2.5 REGIONAL OSTEOLOGIES

It has been the author's experience, that there are several learning curves a zooarchaeologist encounters when working on a regional study. Most researchers quickly understand the diagnostic, non-metric traits of the major taxa in their study area. However, the more problematic species, those species whose non-metric traits are hard to distinguish upon first glance, can take years to understand. Rarely does this critical information get passed along to subsequent researchers, instead it essentially passes along into the "grey" or unpublished zooarchaeological literature.

Although there are numerous faunal manuals (cited above), the effort to "formalize" this material has been sporadic at

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best. The literature suffers from numerous ills. Perhaps the easiest to cure is the problem of hard to access journals and many "short run" reports. A good library with access to inter-library loan helps. But the major problems of funding and finding a publisher who print such studies, has made this research a low priority for most zooarchaeologists (cf. Amorosi 1989). Worst still, faunal data are often separated from the method used to distinguish closely related species. Essentially, the reader is left to wonder "how" this identification was made. In an attempt to avoid these ills, the following section will illustrate many of the problem osteologies encountered within this study.

Lastly one word of warning for the lazy or unwary. DO NOT SOLELY RELY ON BONE MANUALS for the identification of zooarchaeological materials. It is ABSOLUTELY NECCESSARY to have access to large and properly identified reference collections while the identification phase of analysis is in progress. Rather the following guides should be viewed as working notes, used while working in a "bone room". The following notes were prepared by the author to ensure that criteria for distinctions of bone materials remained constant.

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2.5.1 Domestic Mammals

The major thrust of zooarchaeological osteology has been spent at looking at domestic livestock. Rather than spending time in discussion of these relatively well known species, the reader is recommended to review the following set of manuals:

2.5.1.1 General and Age Groups

Amorosi (1989), Prummel (1987a & b, 1988, 1989): zooarchaeological texts useful for the concentration on neonatal and juvenile post-cranial osteology, and aging of osteological specimens.

Ellenberger and Dittrich (1959), Getty (1975), Sisson and Grossman (1966): veterinary works useful for adult osteology, growth studies and muscle structure.

Cornwall (1956), Schmid (1972) and von den Driesch (1976): zooarchaeological texts useful for adult osteology.

Carter (1976): Although Carter does *not* recommend that the vertebrae (with the exception of the first two cervical

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vertebrae) of domestic species be used for identification, this publication may be of some use. [8]

2.5.1.2 Dental Guides

Hillson (1986), Payne (1985), and Peyer (1968): osteological texts covering teeth only, and the broad sweep of mammalian species.

2.5.1.3 Specific Species Guides

Grigson (1974, 1975, 1976, 1978); Lawrence (1951); McGovern and Amorosi (1986); McCuiag-Balkwill & Cumbaa (1992); Olsen (1960): a suite of zooarchaeological articles and manuals useful for cattle.

Boessneck (1970), Boessnech and von den Driesch (1975), Clutton-Brock et al. (1990), Payne (1985): zooarchaeological texts useful for the distinction of caprines (Ovis aries and Capra hircus).

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8. The old osteological axiom does apply here, that one can always distinguish between two vertebrae of two different species, such as a cow and horse. But the problem of having a 100% success rate with numerous small vertebral fragments can be another matter.

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Walker (1982): a useful dissection guide which covers the general osteology of the domestic cat.

Amorosi (1988), Brown and Twigg (1969): guides for the distinction of rodents.

2.5.1.4 Aging

Brown (1902), Brunni and Zimmerl (1951), Curgy (1965), Silver (1969), Lesbre (1897), Wilson et al. (1982): various works useful for the aging of domestic livestock.

Dyrmundson and Thorgeirsson (1989), Palsson and Verges (1951), Thogeirsson (1981): veterinary growth studies on caprines.

Navia and Narkates (1980), Wirtschafter (1960): vetinary growth study for rodents.

2.6 NON-METRIC DISTINCTIONS FOR THE NORTH ATLANTIC PHOCIDAE

Unlike so many terrestrial mammals, seals show an extremely wide range of intra-specific variation in both the appendicular and axial skeletons. Many bone elements which hold useful diagnostic characters in other taxa (such as the

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scapula, cervical vertebrae, etc.) are not reliable for species specific identifications for Phocids. As Ulrik Mohl has claimed, "With two comparative specimens for each species, identification is easy, with three, abit harder, with four nearly impossible, with six abit easier again...". Most of the hard won expertise behind the following descriptions consist of knowing "what we don't". It may seem simple to add characters to this list, especially if there is only one single comparative specimen. However, one can only do so with a large and well documented collections, and the aid of those who have tried before (T.H. McGovern, M. Meldgaard, U. Mohl and A. Spiess, personal communication).

The osteological material that are illustrated here was derived from several sources. The known materials were derived from the American Museum of Natural History, Department of Mammalogy, the Bioarchaeological Laboratory, Department of Anthropology, Hunter College, the private collections of Tom McGovern, Jim Woollett and the author. The AMNH catalog numbers are indicated with the pen & ink study. The archaeological specimens used from the Bioarchaeological Laboratory at Hunter College, were taken from the collections of Sandnes (KNK4) in West Greenland, the Svalbard site (6706-60) in Northeast Iceland and the

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Nunaingok site located in Northern Labrador. Most of the illustrations are drawn at natural scale (1:1), those that are not are so indicated.

2.6.1 Cranial Distinctions

2.6.1.1 Bony Palate

There are few diagnostic parts of the skull that are useful for species identifications among the Phocids. The bony palate and the bullae are such regions. The palate, lies within the dental arch and is formed by the palatine process of the maxillae, premaxillae and horizontal plates of the palatine bones and separated by the cruiform sutures (premaxillary, intermaxillary, interpalatine and palatomaxillary sutures).

Located in the premaxillary region (the anterior part of the palate) are the incisive fossae, which in phocids can be heavily grooved. The incisive foramina which allow the greater palatine vessels and nasopalatine nerves to pass are contained in these fossae.

Posteriorly, a vascular groove on or near the palatomaxillary suture leads to the greater palatine

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foramina. This groove is deep posteriorly near the foramina, but shallow anteriorly. The greater palatine foramina allows the palatine nerve and vessels to pass.

The following distinctions can be observed in the phocids (Figures 2.1 and 2.7):

Phoca vitulina -- Common or Harbor Seal

1. - The palate is narrow.

2. - The cheek teeth (or postcanines) are large and frequently set obliquely in the palate. The anterior postcanines are usually more obliquely set than the posterior postcanines.

3. - The greater palatine foramina are situated on the maxillae.

4. - The posterior margin of the palate is notched and can have an inverted "V" to an inverted "U" shape. The horizontal plates of the palatine bones arches downward toward the pteryoid bones.

Phoca hispida -- Ringed Seal

1. - Cheek teeth are small and the 3rd postcanine is the largest among the postcanines.

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2. - The greater palatine foramina are situated on or posterior to the palatomaxillary suture.

3. - The posterior margin of the palate is notched with either an inverted "V" or "U" shape. The horizontal plates of the palatine bones arches downward toward the ptyergoid bones.

Pagophilius groenlandicus -- Harp Seal

1. - The cheek teeth are small having accessory cusps. The 3rd postcanine is the largest.

2. - The greater palatine foramina are situated on, or posterior to the palatomaxillary suture.

3. - The posterior margin of the plates of the palatine bones do not arch and are straight.

Hallichoerus grypus -- Gray Seal

1. - The incisive fossae are large, running the length of the premaxillary. The incisive foramina are large and originate at the premaxillary suture.

2. - The greater palatine foramina are located on or just below the palatomaxillary suture.

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3. - The posterior border of the palate has an inverted "U" shape and arches toward the pterygoid bones.

Erganthus barbatus -- Bearded Seal

1. - The palatal area is broad and somewhat oval in shape.

2. - The incisive fossae and foramina are located on the premaxillary.

3. - The greater palatine foramina are situated on the palatomaxillary suture.

4. - The posterior border of the palate is notched (emarginate), with an inverted "V" shape. The horizontal palate of the palatine plate, of the palatines bones arches downward toward the pterygoid.

Cystophoca cristata -- Hooded Seal

1. - The incisive fossae and foramina are small and located on the premaxillae.

2. - The greater palatine foramina are situated on the palatomaxillary suture.

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3. - The palatines can be slightly emarginate (notched) on the posterior border of the palate, but often are not.

2.6.1.2 Bullae

Besides the bony palate, most researchers will agree that the bullae is the only other diagnostic non-metric trait of the phocid skull useful for species identification. Unlike the bony palate or other parts of the cranial region, there is little variation to be seen on a intra-species basis. If rated as to which character is the most reliable for species identification, the bullae ranks first (see Figures 2.8-2.13).

Harbor Seal

The auditory canal is "hooded" only on the ventral side. The lateral surface (as indicated by "B" in the bulla sketch, Figure 2.8.) is strongly marked and grooved. The lateral edge of "B" is sharp.

Ringed Seal

The auditory canal is "hooded" on the ventral side. The lateral surface, "B", is strongly marked and grooved. The bulla's lateral edge is rounded.

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Harp Seal

The opening of the auditory canal is surrounded by a continuous "hood" of bone. It's lateral surface, "B", is relatively smooth on the ventral and lateral sides. The medial surface has a roughly triangular shape to it.

Gray Seal

The auditory canal is "hooded" by bone on the ventral side. The bulla's lateral and medial surfaces are not clearly divided as in other phocids. The "B" portion of the bulla is relatively bulbous along the lateral edge.

Bearded Seal

The auditory canal is "hooded" by bone along the ventral side. The medial surface is roughly rectangular, while the lateral surface is grooved and indented.

2.6.2 Mandible

There are a number of reliable morphological features seen on the mandible which can distinguish the various phocids. Please note that these non-metric traits are described in their most exaggerated state. These traits might not be as noticeable as described because of the high degree of individual variability (Figures 2.14-2.18).

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2.6.2.1 Occlusal Surface

There is only one feature that can be seen on the occlusal surface and in only one species, the Common or Harbor Seal. The alveoli of the postcanines are slanted (obliquely set) in a posterior-buccal to anterio-lingual position, in usually the first two or three postcanine positions. All other phocids possess "straight" alveoli within the mandible's dental arcade.

2.6.2.2 Coronoid Process & Ramus

The phocids exhibit a wide range of variability concerning the coronoid process (usually rounded) and thin ramus portions of the mandible. The Gray Seal processes a sharp coronoid process with a thick ramus. The Bearded and Hooded Seals have a rounded coronoid process, but a thick ramus.

2.6.2.3 Angle

The angle of the mandible is a useful morphological feature for species distinctions. For the sake of argument, the angle portion of the mandible will be described in terms

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of a human face, since there are few osteological landmarks that describe this region of the mandible.

The *Phoca* are all varied, but with a consistent pattern. The Ringed Seal possesses a flat face, with no nose, and a tiny protruding chin (the actual angle of the mandible). The Common Seal possess an up-turned nose and normal chin. The Harp Seal has a bulbous nose, and an extremely fat chin. The Gray Seal has a long flattened face, slanted outward and the smallest of the angles or chins in the phocids. The Bearded Seal (similar to the Ringed Seal) also has a long flat face with a tiny chin, but is almost twice the size of the Ringed Seal. One other characteristic that helps to distinguish these two, is the buccal to lingual fold in the "nose region" of the mandible in the Bearded Seal. The Hooded Seal has no protruding chin and long flatten nose.

2.6.2.4 Mandibular Foramen

Similar to the angle, the mandibular foramen and its position on the mandible can be used to distinguish the various phocid species. However, the angle and the mandibular foramen characters should be looked at together, if examined separately these traits can lead to much confusion and a miss-identification.

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The *Phoca* work in a series from the shortest distance to the mandibular condyle, to the longest distance. The shortest distance is found in the Harp Seal, the Ringed Seal has a medium distance and finally, the Common Seal has the longest distance. Also, the relative size of the mandibular foramen increases, with the Harp Seal being the smallest, the medium size is the Ringed Seal and the largest is the Common Seal.

The Gray, Bearded and Hooded Seals have an almost equal distance to the mandibular condyle. However, the shape of the foramen is different in each species. The Gray Seal has a large semi-circular shape, the Hooded Seal possess a small-ish "U" and the Bearded Seal has a double foramen, which is higher up the ramus than the other two phocids.

2.6.2.5 Postcanines

Phocids have a simple dentition, where there are reduced incisors, a prominent cone-like peg canine (which lacks the waist of enamel as seen in carnivores on the distal or posterior side) and a series of postcanines. The postcanines have a rather simple triconodont cheek teeth (Peyer 1968:250-252) usually lacking the more complex accessory cusps seen with carnivores.

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Within the Phocidae, the distinction of teeth are not that simple. Hillson (1986:51) describes the distinction between *Phoca* and *Halichoerus* as follows: "In *Halichoerus* there are no real accessory cusps and there is again a recess on the lingual sides of these teeth. *Phoca* has two prominent accessory cusplets to distal, with the addition of further cusps to mesial in the lower cheek teeth."

Perhaps even more simply put, the Gray Seal has spike-like postcanines, where *Phoca* has a trident set of postcanines. However, the trident-like postcanines can appear in a Gray Seals. Another problem to keep in mind is when the dentition becomes heavily worn, this distinction cannot made.

Peyer (1968:252) also notes that the Hooded Seal's postcanines are small and single cusped. Based upon practical working experience, Hooded Seal postcanines are very distinct, heavy teeth. Similar to the Hooded Seal, the Bearded Seal postcanines are large, but not as mineralized as the other phocids. The Bearded Seal postcanines tend to wear down quickly giving them an appearance of a simple peg raised above the mandible's occlusal surface.

In Figures 2.18, the maxillary dentition is portrayed. Again similar distinction can be noted. However, the phocids are broken up into three groups (no implication

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towards a cladistic diagram), the *Phoca* with their trident-like postcanines, *Halichoerus* with its spike-like postcanines and *Erignathus* and *Cytophoca* cheek teeth. The Bearded and Hooded Seals share both trident and spike-like postcanines, however, there is a difference in scale. The Bearded Seal and Hooded Seals are larger then *Phoca*, almost by a factor 1/4.

2.6.3 Phocid vs. Odobenid Dental Distinctions

Although there are few morphological characters that can distinguish the different Phocidae by dentition, there are several useful distinctions that can be made. A fairly obvious distinction is the size of the Odobenid postcanines. In most cases, these postcanines are larger, heavier, and have a cusp pattern that appears to be well worn.

Small fragmentary Walrus postcanines can be problematic for "anatomical gross means" of identification. However, there are several qualitative aspects on the "gross" level to keep in mind:

1. - Walrus postcanines will appear to be more densely mineralized than the Phocid postcanines.

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2. - Phocid cementum has a low or almost no luster appearance. Walrus cementum is the direct opposite, having a high luster appearance.

3. - Walrus cementum tends to be less calcified than Phocid cementum.

4. - Phocid enamel tends to be highly crazed in appearance (somewhat similar to a clear glazed, crazed piece of ceramic). Walrus enamel has a much more uniform glaze.

5. - Archaeological walrus enamel and dentine, "ivory" in general has a warm amberish/burnt umber tone.

2.6.4 Postcranial Distinctions

2.6.4.1 Humerus

There are two very distinctive non-metric traits that can distinguish the proximal humeri of the Harp Seal from the Common and Ringed Seals.

Medial Aspect

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The Harp Seal possesses a "straight" edge along its superior crest of the greater tubercle. In the Common and Ringed Seals, the greater tubercle is bifurcate (Figures 2.19-2.21).

Anterior Aspect

The Common Seal possesses a pointed surgical neck as compared to either the Harp or Ringed Seals. This character can range from a true point to a diminished rounded edge.

2.6.4.2 Ulna

There are two non-metric traits that are useful for species distinction and are found on the proximal ulna. These traits can be used to distinguish the Harp Seal from the Common and Ringed Seals. However, these traits will not distinguish the Common Seal from the Ringed Seal.

Trochlear Notch

Looking at the trochlear notch, the incisura semilunaris extends across and distally over the olecranon process forming a bifurcate pattern and extending downwards (distally) along the lateral side. The radial notch extends medially forming a lobe-like structure. When these characters are examined together, the trochlear structure

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forms a tri-lobed notch. This is unlike the trochlear notch of the Common Seal and the Ringed Seal were the trochlear structure is bi-lobed.

Another useful point to mention is the relative thickness of the olecranon process. In Figure 2.23, point "A" is greater in Harp Seals than in either the Common and Ringed Seals.

2.6.4.3 Femur

The femur of the Harp Seal can be easily picked out from the rest of the Phocids. However, the down side of this osteological note is that no other Phocids can be distinguished by non-metric means at this time.

The Harp Seal is one of the three Phocids to possess a nutrient foramen, positioned on the lateral aspect of the femoral shaft. The foramen can be located midway along the femur's longitudinal axis. The actual size of the foramen can vary from a slight opening to a very prominent foramen (Figure 2.24). It should also be noted that the Gray and Ringed Seals have nutrient foramen on the lateral aspect of the femur, but this foramen is NOT located along the longitudinal axis. Rather this foramen is position off the

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longitudinal axis (posteriorly) on the proximal end of the femoral shaft (Figure 2.25).

There are two metric indices that can also be used for species distinctions. These measures are derived for the proximal end, where measurement "A" is the minimal breath of the femoral neck, and "B" is the minimal breadth of the greater trochanter, taken at the height of the head of femur. A summary of average metric data is presented here as derived from Spiess (1976) and Spiess and Hedden (1983). Note that these measurements are metric, using a cm scale.

2.6.4.4 Summary of Femoral Metric Data

"A" Measurement

	P.groenl.	P.vit.	P.his.	E.barb.	C.cris.
mean	1.34	1.06	0.92	1.64	1.71
range	1.54-1.19	1.15-1.00	1.06-0.74	1.71-1.57	1.77-1.65

"B" Measurement

mean	1.88	1.75	1.18	2.32	2.69
range	2.03-1.66	1.86-1.50	1.43-0.87	2.61-2.03	2.70-2.69

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2.7
NON-METRIC DISTINCTIONS BETWEEN *RATTUS NORVEGICUS* AND *RATTUS RATTUS*

The osteology (Amorosi 1989) and biogeography of these two North Atlantic rodents are poorly understood and are currently being subjected to review by zooarchaeologists (Achilles and Erynck personal communication 1988; Armitage personal communication 1991). Proper identification of these two rodents will carry implications for further studies in epidemology of the North Atlantic. One such question that still remains to be resolved, was the "Black Death" ever transmitted via the associated rodent vector or from the Human pneumonic form to Iceland from Medieval Europe?

The biogeographic evidence indicates that only the Brown Rat, *Rattus norvegicus*, was present in Iceland by the 17th century (Amorosi 1988), and this does not carry the plague virus in its fleas! [9]. This species has only recently arrived in Iceland, the proper identification of *Rattus*

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9. The earliest occurrence of this species in Iceland is by AD. 1600-1650 at the site of Bessastadir on Iceland's Southwest coast (Amorosi, Buckland, Olafson, Sadler and Skidmore 1992:173).

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skeletal remains is critical if we are to understand whether "Svartidaudi" was the same as the "Black Death".

The identification of these two species based upon non-metric traits requires some experience, and a truly large reference collection. Like so many other small rodent species, the post-crania are practically useless for identification of osteological remains to the species level (cf.Brown and Twigg 1969). It is only the cranial material that can be used for this distinction.

However, some words of caution should be noted. Many of these cranial distinctions are age specific. These non-metric traits can easily be discerned in young to senile adult individuals, but the neo-natal to juvenile stages can be somewhat more problematic. Unlike many other mammalian species, the neo-natal and juvenile growth stages in these species occurs rather quickly. For rats, the adult dentition appears within 30-40 days (cf. Amorosi 1989; Navia and Narkates 1980). This causes the skull to goes through a transitional phase where immature Brown Rats tend to look very similar to young adult Black Rats. Another problem arises from the longevity of these animals.

It is not unusual for these two species to have a life span of 5-6 years. In the course of this short period of time, dental wear can become very pronounced if the diet

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contains coarse materials, or the mouth is subject to injury. Thus the extra cusp that the Black Rat possesses can become quickly erased before other adult cranial characteristics become pronounced.

Therefore, it is suggested that a large and well aged cranial collection of both species be obtained. Without this osteological collection, less reliance can be place on the identification of these species. The cranial guide that follows was developed from numerous comparative collections from the American Museum of Natural History, Department of Mammalogy (thanks to the very kind assistance of Dr. Guy Musser), the zooarchaeological collection derived from the site of 175 Water Street in New York City's South Street Seaport collections (again thanks to the very kind assistance of Drs. Joan Geismar and Diana Wall) and the author's private collection.

2.7.1 Molar 1

A very clear non-metric genetic marker that can be used to distinguish these two species is the auxiliary cusp found in Black Rats, *Rattus rattus*, on the first molars (Figure 2.26). This cusp or outer notch is positioned on the anterolingual style on the Procingulum on the lingual aspect

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(or first row of cusps). This notch is below the occussal surface, and can easily be seen within the first year (usually unless the diet is coarse, or an injury occurs) of life. This character will quickly become eroded once dentum extends to the Procingulum.

2.7.2 Dental Arcade

The dental arcade (Figure 2.27) can be of use in differentiating these species, but these characters are relative and local population specific.

Black Rats tend to have smaller, somewhat more block-like (shorter when comparing length) teeth than Brown Rats. Chomko (1980:89) has noticed that the Black Rat's first molar is shorter than the combined length of the second and third molars as seen on the maxillary row. In fact a general tooth ratio between the molars can be observed. Brown Rats posses a 2:1:1 (Molar 1: Molar 2: Molar 3) while Black Rats have a general ratio of 1:1:1.

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2.7.3 Mandible

In Brown Rats there is a higher frequency of Molar 3, being visible from the ramus as seen from the lateral aspect (Figure 2.27). [10]

2.7.4 Non-Metric Cranial Characters

Dorsal Aspect

1. - Black Rats posses a border lipping or rim along the frontal, parietal and occipital bones. This border lipping is usual missing on adult Black Rat individuals (Figure 2.27).

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10. The following are dental landmarks and terminology after DeBlase and Martin (1974) for Figures 2.28. In the Maxillary: MF - Major fold and NF1 - First minor fold. In the Maxillary cusp pattern of the molars: 1-protocone, 2-hypocone, 3-paracone, 4-metacone, 10-anterolingual style, 11-anterolabial conule, 12-anterolingual conule, and 10-12 are the procingulum. In the Mandible: MF-major fold, SH1-first secondary fold, and SF2-second secondary fold. In the Mandibular cusp pattern of the molars: 1-protoconid, 2-hypoconid, 3-metaconid, 4-entoconid, 8-anterolingual stylid, 10-anterolabial stylid, 8-10 are the procingulum, 18-ectostylid, 11-anterolingual conluid, 12-anterolabial conulid, and 11-12 are the procingulum.

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2. - This border lipping does not form a continuous edge or rim on the parietal of the Black Rat (Figure 2.27).

3. - The general shape of the cranial vault is not a reliable diagnostic feature. Although Brown Rats possess a more rectangular overall shape in adults, younger individuals will resemble the adult "U" shape of the Black Rat (Figure 2.27).

Occipital Aspect

The occipital region of these two species have five subtle characters to watch for (Figure 2.29):

1. - Brown Rats have a much more extended set of condyles, reaching away from the skull.

2. - Brown Rats possess a prominent styloid process.

3. - In overall appearance, the occipital of the Brown Rat, takes on a rectangular shape while Black Rats possess a more curved shape.

4. - The foramen magnum of Brown Rats has a well developed set of crest in the nucal region.

5. - Black Rats posses an "arching" extension of the foramen magnum, although this character has not always been observed by the author.

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2.8 NON-METRIC DISTINCTIONS FOR ICELANDIC GADIDS

The following material was designed to meet the specific task of identifying the fish remains in the Iceland collections. Specific emphasis has been placed upon the North Atlantic Gadids, and especially focused upon the North Atlantic Cod (*Gadus morhua*), Saithe, (*Pollachius virens*), Ling (*Molva molva*) and Haddock (*Merlanguis merlangus*). Apart from this guide, readers are highly recommended to review:

1. - Canon (1987) -- a simplified comparative atlas useful for arctic species.

2. - Gregory (1933) -- an atlas of fish crania, but as seen from "green mounts" only.

3. - Harkonen (1986) -- an atlas of North Atlantic otoliths.

4. - Heinrich (1987) -- a useful account of the differences in Gadid vertebrae.

5. - Jones (1991) -- a general and very useful discussion of non-metric traits. Jones' notes are most useful

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for the identification of Gadid remains for Orkney, Caithness and Northern Scotland.

6. - Rojo (1991) -- a useful dictionary of fish osteology, and effectively deals with the headache osteological nomenclature.

7. - Wheeler and Jones (1989) -- a general guide to fish osteology.

8. - Williamson (1902) -- an excellent account of general Gadid (cod, saithe and lythe) osteology.

2.8.1 Cranial Non-Metric Distinction

This guide is concerned with gadids that are represented in the Icelandic archaeofauna. These species of cod fish represent one of Iceland's most important marine resources. The remains of these species are frequently encountered and represent one of the most numerous bone materials in the Icelandic archaeofauna. The osteological distinctions that are described below are also working notes, that represent a number of years of accumulated research and testing against archaeological remains. These notes are the result of a

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team effort by Dr. Gerald Bigelow, Dr. "Bones" (A.K.) Jones and the author.

2.8.1.1 Gadid Material

The material selected for this guide deserves some comment. It should be mentioned that the osteology of fishes is extremely varied and a study of this type must necessarily be limited. Nonetheless, the material illustrated in this section are derived from two sources. Two of the otolith drawings are derived from Davis (1987). The bulk of the material was selected from the collections of the Bioarchaeological Laboratory, Dept. of Anthropology at Hunter College. The material illustrated is:

Catalog No.	Latin Name	Common Name
HC1	*Gadus morhua*	Atlantic Cod
HC2	*Pollachius virens*	Saithe, Coalfish or Common Pollack
HC4,16,260	*Molva molva*	Ling
HC6,7	*Merlangius merlangus*	Haddock

Please note that the illustrations are essentially organized in this same order as is the written descriptions, unless noted otherwise. The use of a scale has not been applied to the illustrations, the reason being that emphasis is placed upon the non-metric morphological traits.

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2.8.1.2 Most Commonly Recovered Material

Figure 2.30 represents the most commonly recovered bone elements (those not subjected to a high degree of fragmentation) in the Gadid component of the Icelandic archaeofauna. The purpose of the illustration is to ease the task of initially sorting potentially identifiable elements from fragmentary scraps.

2.8.1.3 Terminology

The terminology used in this paper follows Casteel (1976), Jones (1986:60-61; 1991), Gregory (1933:88-96), Morales and Rosenlund (1979) and Rojo (1991). The following list are the terminology used in the illustrations.

Abbreviations:

1. Ar -- Articular
2. Cl -- Cleithrum
3. Dn -- Dentary
4. Mx -- Maxillary (or Maxilla)
5. Op -- Opercular
6. Ot -- Otolith
7. Pas -- Parasphenoid
8. Pmx -- Premaxillary (or Premaxilla)
9. Pop -- Preopercular (or Praeoperculum)
10. Pot -- Posttemporal (or Posttemporale)
11. Scl -- Supracleithrum
12. Vo -- Prevomer

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Figure 2.31 portrays the directions and the planes of the fish, Figure 2.32 looks at the fleshed gadid skull and Figure 2.33 looks at an exploded gadid skull. The bone elements that are visible in the fleshed gadid skull of Figure 2.32 are:

1. Ar -- Articular
2. Dn -- Dentary
3. Mx -- Maxillary
4. Op -- Opercular
5. Pas -- Parasphenoid
6. Pmx -- Premaxillary
7. Pot -- Posttemporal
8. Scl -- Supracleithrum

2.8.2 Toothed Elements

In order to make sense of the following descriptions, a diagram showing a cross section (Figure 2.34) of a Gadid tooth is provided. Peyer (1968:109) has described the teeth of the gadidae as large and somewhat depressable. In fact Gadids possess a posteriorly curved set of teeth, which because of it's movable attachment, can tilt backwards during the ingestion of prey. Subsequently, the forward tilting of the tooth is prevented by the vertical shape of the anterior part of the thecodont pit (Peyer 1968:Plate 27b).

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2.8.2.1 Prevomer

Occlusal Aspect (Figure 2.35)

Gadus morhua: There are larger thecodont pits on the posterior edge. There is no regular organization of the thecodont pits on the anterior point of the element and the pit arcade has a triangular shape.

Pollachius virens: Younger individuals have a uniform, single row of thecodont pits. Older individuals possess several disorganized rows of uniform thecodont pits, but with age these pits will disappear. Also, the pit arcade has a triangular shape.

Molva molva: The thecodont pits are large and irregularly spaced with the pit arcade forming an inverted "U' shape.

Merlangius merlangus: The thecodont pits are both large and small. There are single rows running toward the anterior point. There are multiple thecodont pits at the anterior point and the pit arcade has a triangular shape.

2.8.2.2 Premaxillary

For the lateral aspect (Figures 2.36-2.37) the distinctions are based upon the anterior dorsal "winged-lobed" portion of the element.

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Gadus morhua: The "winged-lobed" portion of the element is uneven, with the larger lobe facing anteriorly. The anterior lobe is divided by a furrow, creating two equal parts.

Pollachius virens: Similar to ***Gadus morhua***, the anterior lobe is larger than the posterior lobe. There is a definite notch dividing the anterior and posterior lobes, with a series of furrows dividing the anterior lobe into three equal parts.

Molva molva: The anterior and posterior lobes are of equal size, and are clearly divided. There is some evidence of furrowing on the anterior lobe.

Merlangius merlangius: The anterior lobe is larger than the posterior lobe. The lobes are clearly divided by a sulcus.

Medial Aspect:

Gadus morhua: The anterior lobe possesses a large articular surface, running the height of the lobe. The articular surface cover one-half the anterior lobe. The posterior lobe has a small articular surface, located on the posterior margin. The articular surface over-hangs the medial border.

Pollachius virens: The articular surface is visible on the anterior most margin, running the height of the anterior

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lobe. There is a small anterior recessed at the base of the articular surface. The posterior lobe has a small articular surface, located on the posterior margin.

Molva molva: The anterior lobe has a large anterior recessed shelf, but no clear articular surface. The posterior lobe also forms a recessed shelf with no clear articular surface.

Merlangius merlangus: The anterior lobe has a small anterior recessed shelf with no clear articular surface. The posterior lobe is flatten, again no clear articular surface.

Occlusal Aspect:

Gadus morhua: The thecodont pits are larger on the buccal side. The anterior thecodont pits are densely packed as compared to the corpus and posterior sections. The anterior part of the element can have 4-6 rows of thecodont pits, but the rows are not clearly organized and the anterior-most end is rounded off. The posterior section is "squared-backed".

Pollachius virens: Similar to ***Gadus morhua***, the thecodont pits are larger on the buccal side. The posterior section is sharply pointed. The buccal surface is thin with 2-3 rows of thecodont pits.

Molva molva: The thecodont pits are the larger on the buccal side, subsequent rows are neatly organized with the

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anterior portion being somewhat "squared-off". The posterior section is pointed.

Merlangius merlangus: The thecodont pits are the largest in the comparative series with no subsequent rows. The posterior section is sharply pointed.

2.8.2.3 Dentary

For the lateral aspect (Figures 2.38-2.39) the most diagnostic trait can be seen in the corpus region where the bone divides proximally and ventrally forming a shelf.

Gadus morhua: The shelf can be described as "D" shaped.

Pollachius virens: The shelf is slanted to the left (caudally) but still appearing as a "D" shape.

Molva molva: No shelf is present and the division of the lateral surface is sharp, and "V" shaped (the bottom of the "V" is pointed anteriorly).

Merlangius merlangus: A small "D" shaped shelf is present.

Occlusal Aspect:

Gadus morhua: The buccal thecodont pits are smaller than the lingual pits. The thecodont pits will extend posteriorly into a fossa behind the dorsal ramus.

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Pollachius virens: The thecodont pits are small, uniform and in a single row. The thecodont pits extend posteriorly into a fossa behind a dorsal ramus.

Molva molva: The thecodont pits are large, irregularly spaced, and in a single row. The thecodont pits extend posteriorly into a fossa behind a dorsal ramus.

Merlangius merlangius: The thecodont pits are both large and small, but in a single row. These pits do not extend posteriorly behind a dorsal ramus.

Figure 2.38 portrays the distinctions between ***Gadus morhua*** and ***G. macrocephalus*** were ***G. morhua*** has a shorter anterior portion ("chin") before the mental foramen than ***G. macrocephalus***. Figure 2.40 also portrays another distinction between ***Gadus morhua*** and ***Merlangius merlangus*** where the anterior portion in cross-section is more of a rounded hour-glass shape in ***Gadus morhua***. ***Merlangius merlangus*** has an angular hour-glass shape.

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2.8.3 Other Elements

2.8.3.1 Articular

Gadus morhua: There is a large ventral portion under the articular hinge (Figures 2.41-2.42). The proximal margin is thick and well defined. The margin is straight with the posterior articular hinge pointing laterally. The articular hinge is large, heavy and a right angle "saddle" shaped. There are multiple furrows on the articular hinge surface. The inferior crest also has a right angle shape.

Pollachius virens: There is a small ventral portion under the articular hinge. The proximal margin is thin and has a lateral convex surface. The articular hinge is in-line with this convex curve.

Molva molva: There is little or no ventral portion under the articular hinge. The proximal margin is thin and straight. Both the margin and the anterior articular hinge point medially.

Merlangius merlangus: There is a small ventral portion under the articular hinge. The proximal margin is thin and straight. Both the margin and the articular hinge point proximally. The inferior crest has a "hook" shape to it.

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2.8.3.2 Cleithrum

The cleithra of gadids (Figures 2.43-2.44) are distinguished by their medial surface. This surface has a shelf which differs from species to species.

Gadus morhua: The shelf is positioned 1/3 the length of the bone. The medial shelf is also triangular in shape and pointed horizontally. The anterior margin has a gently even curve and the medial margin above the shelf is straight. In cross section the medial shelf has an inverted "U" shape.

Pollachius virens: The medial shelf is positioned 1/2 the length of the element. The medial shelf is triangular in shape and in cross section has an inverted "V" shape. The medial shelf points ventrally.

Molva molva: The medial shelf is located within the upper 1/3 of the bone. There shape of the shelf is different in appearance, having more of a "ballpeen-hammer" shape. On the lateral aspect, this shelf extends out caudally. There is a foramen on the medial surface, pointed cranially.

Merlangius merlangus: The medial shelf is positioned in the upper 1/3 of the bone., triangular in shape and pointed dorsally. Caution should be applied since the cleithrum of the haddock is similar to the atlantic cod.

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2.8.3.3 Maxillary

Figure 2.45 portrays the maxillary of *Gadus morhua* and *Pollachius virens* can be distinguished by the medial aspect. *Gadus morhua* has a straight shape while *Pollachius virens* has a curved shape. Also the anterior tuberosity of *Gadus morhua* extends an approximate 1/3 of the bone. In *Pollachius virens* the tuberosity appears to extend to 1/2 the length of the bone.

2.8.3.4 Opercular

The opercular (Figure 2.46) in *Gadus morhua* and *Merlangius meralngus* appears to be "fish tailed" in shape. *Molva molva* has a rectangular shape.

2.8.3.5 Otolith

Figure 2.47 portrays the osteological landmarks for the otolith. It should be noted that the North Atlantic Gadids (and North Pacific species as well) have no true exisura or opening of the sulcus on the margin of the otolith. Instead there is a shallow notch, both anteriorly and posteriorly that is sometimes present. The sulcus on the medial surface

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is shallow and poorly defined. The collum is either poorly defined or not present. Gadid otolith lengths tend to be nearly twice their width. The greater width of the otolith tends to be nearer the anterior end. The otolith generally tapers towards the posterior end. Lobular margins are present an can extend over the entire medial surface.

Distinctions:

Gadus morhua on the lateral surface has a well defined concave surface (Figure 2.48). The medial surface is covered by extensive ridge and furrow lobulations and can be separated by a midline. The lobulations can extend well beyond the margin. The medial surface is strongly convex and generally has a smooth surface. The sulcus and collum are present and lobulations may be seen on the margins.

Pollachius virens on the lateral surface has a concave shape. The lobualtions are gently rolling, may extend beyond the margin and are separated by a midline (Figure 2.48). The medial surface is convex and smooth. Its sulcus and collum are poorly defined and some lobualtions may be seen on the margins.

Molva molva on the lateral surface is a poorly defined concave shape with a smooth surface and midline (Figure 2.48). The surface may have some wrinkling and its lobulations are also poorly defined but extend over a wide

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area. The medial surface is a poorly defined convex shape, the sulcus is poorly defined with no collum evident. There is also a possible dorsal furrowing.

Merlangius merlangus on the lateral surface is slightly concave and smooth (Figure 2.48). Its surface is wrinkled and the lobulations are separated by a midline. The dorsal edge has a lobulated surface but not as well defined as in ***Gadus morhua***. A posterior tail to the otolith may be present. The medial surface is slightly convex and smooth. Its dorsal furrow is evident, separating the dorsal lobulated margin from the rest of the otolith. There is no sulcus or collum and a posterior tail may be present.

2.8.3.6 Vertebrae

There is some debate about the distinction of the Gadids using vertebrae, however, Gadid can be distinguished from Salmonids (Figure 2.49). In general , Gadid vertebrae tend to be larger than Salmonids. There is a noticeable size range between Gadid vertebrae, Salmonids tend to be more uniform in size. The neural and haemel spines in Gadids are irregular and will taper to a sharp needle-like point. Salmonids have a more uniform spine and curve caudally. The articular surfaces on the body of the Gadids are round but

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irregular in general appearance. Also there tends to be an inwardly pointing arch which forms part of the neural and haemel channels. The articular surface of the Salmonids varies, but tends to be circular in nature. The notochord canal in Gadids often appears either as a pin point or a fused canal. Salmonids have an open and visible canal. The surface texture between the articular ends varies. Gadids take on a texture of "corrugated cardboard", while Salmonids have a "sponginess" texture.

2.9 TEMPORAL SEQUENCING OF THE COLLECTIONS

The Icelandic materials present a truly rare archaeological opportunities to work with a series of dating methods that help to establish a regional chronology. The collections of Icelandic archaeofauna can be dated by several means, radiocarbon dating (both conventional and AMS samples), volcanic tephera or ash (tephrachronology), artifactual dating, to a lesser degree architectural associations (although they are more problematic) and historic documents. However, it is not the intent of the author to review each and every method here as this is already being conducted for geochronological methods in a

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rigorous fashion (cf. Arundale 1975; Gillespie 1986; Gowlett and Hedges 1986; Olsson 1992; Taylor 1987; Vilhjalmsson 1990, 1991). Rather, it may be more productive to offer some suggestions for future control of the geochronological methods.

The Icelandic collection of radiocarbon dates is not large by North American standards. There are a 101 samples known to the author as of this writing,(see also Vilhjalmsson 1990, 1991 for a complete listing up to 1991). The number of archaeofauna dated by radiocarbon within this sample are 7 in total and presented in Table 2.2 and 2.3. Much of the dated materials are based upon charred birch and birch samples (54 charred birch and 9 birch samples or 62% of all the radiocarbon dates, see Table 2.1). The dated animal bone, both human and mammal, are far less (21% of all radiocarbon dates, with 5% being human samples, 13% domestic mammals, 1% marine mammal and 2% unidentified mammal) and represent an underutilized source for dating in Icelandic archaeology. Unlike the numerous problems in dating driftwood (Arundale 1981; Dekin 1975; Eggertsson nd.; McGhee and Tuck 1976) and arguments of association for birch samples (Crawford 1991; Hallsdottir 1982; Hermans-Audardottir 1986, 1987, 1989, 1991 & Reply; Kaland 1991; Malher and Malmros 1991; Morris 1991; Sigurdsson 1991; Smith

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1995), a more productive avenue might focus on the use of animal remains. Animal bone and specifically domestic mammals because of the Icelandic agricultural system, offer some advantages over the sole use of charred birch and birch samples in that:

1. - If there is bone preservation on an archaeological site the animal bone materials will be numerous enough to perform multiple and repeatable bulk and AMS dates. Currently, bulks samples require 200 or more grams and AMS samples far less with 1–0.002 grams.

2. - Terrestrial mammals, especially domestic livestock in the Icelandic materials, are extremely localized around a particular farming community and hence, contemporary with that community. The same can not always be claimed with a birch sample.

3. - Bovids (cattle and caprines), especially cattle, have a controlled diet with a limited intake of marine fodders such as dried fish and seaweed. In hard winters cattle were often hand- fed stored summer grasses. The known C13/C12 ratio (d C13‰) values for the Icelandic cattle and sheep are presented in Table 2.16. The Icelandic materials have values well within the parameters of a terrestrial biome (Ambers 1994).

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Therefore, a strategy for dating archaeological deposits that contain numerous animal remains could recommend that:

1. - the use of terrestrial mammals be given first priority for dating samples. This would be followed with charred birch samples and other organic remains. The use of marine mammals and driftwood species (such as pine, *Pinus sp.*; spruce, *Picea sp.*; larch, *Larix sp.* and other broadleaf tree species) should be avoided unless there is a special case study that needs to be performed.[11]

2. - faunal samples should be identified to the species level for biogeographic purposes. This would also aid in the extension of the d C 13% data and help to

---

11. An example of this is the dating of a partially complete polar bear skeleton from the site area of Drangar in Northwest Iceland. The remains were recovered by a local farmer as it eroded from a raised Holocene beach terrace near the site of Drangar. It was hoped on the outset that these remains might help to provide a first chronological date for a series of raised Holocene beach terraces that are found in several locations within this hreppur. It was also hoped that this date and the remains would add new data for the study North Atlantic Holocene period polar bears (currently there are only three known finds, one from Northwest Greenland, another from Southern Norway and the third from the Thames River near London). Unfortunately, the bear remains return with a fairly recent date, within the last 300 years BP.

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identify the terrestrial or marine pathways in the Icelandic agricultural system.

3. - in order to further minimize possible marine reservoir effects in the radiocarbon date (there is a strong possibility that marine fodders could help to skew radiocarbon dates) single species samples should be prioritized. Such a priority would use bovids (using cattle, *Bos taurus* before using sheep, *Ovis aries* then goat, *Hircus capra*), before equids, carnivores (canids and felids) and suid remains. This selection order represents animals with the most "buffered" diet (i.e., cattle being hand-fed terrestrial grasses) to the least "buffered" diet from external marine biases (i.e. such pigs being fed fish offal or seaweeds as a fodder supplement).

4. - the use of mammalian remains will contribute to several growing data bases that have immediate payoffs for the study of climate change such as: oxygen isotope (O18/O16) studies used to determine localized temperature variables over time (Fricke, O'Neil and Lynnerup nd.), the extension of the C13/C12 dietary pathways data, which at this moment is relatively

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small, and monitoring biogeographic change of species distributions over time.

5. - using a dated set of animal remains will aid the yet-to-be-performed incremental and bone chemistry studies of archaeofauna. Using a well dated collection will allow incremental (i.e. tooth sectioning) studies to establish annual and seasonal events in a past animal population's stress periods. This could then be tied to climatic variables and failures in past agricultural conditions. There is also the current problem that many Arctic species are endangered by environmental contaminants (i.e. heavy metal pollution). Although there are models to discuss what a "pre-industrial base-line" signature should look like, and hence management plans are now being developed for most Arctic areas, there is no actual data to confirm and support these models. Zooarchaeological data will be of greater use if the dating of these faunal materials is regularly pursued.

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2.9.1 Corresponding Data Tables

The various chronological dating of the Icelandic archaeofauna are provided in Tables 2.1-2.18 and Figures 2.50-2.56. Table 2.1 provides a listing of the organic materials used for radiocarbon dates. Table 2.2 illustrates the number of radiocarbon dates per archaeofauna and where the archaeofauna is now curated. Table 2.3 has the actual radiocarbon dates with the 1st and 2nd sigma values. Tables 2.4-2.14 has the calibration of the radiocarbon dates and the intercept and maximum ranges done with the PC-program known as "Calib" (this program was very kindly provided by the Quaternary Isotope Laboratory of the University of Washington). The sites of Granastadir and Herjolfsdalur have multiple radiocarbon dates and are thought to be single phased occupations. Tables 2.4-2.14 also has the multiple dates weighted average for these two sites. Table 2.15 lists the archaeofauna that have associated tephra dates. This is followed with Figures 2.50-2.56 that plot out the "high/low" 1st sigma radiocarbon values against the tephra dates (if any). It should also be noted that only those tephra that were within the temporal range of the 1st sigma radiocarbon date are plotted. These tables are followed by

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Tables 2.16 and 2.17 that provide the known C13/C12 (d C13‰) ratio values for the Icelandic and Norse Greenland materials. Table 2.18 is an attempt to temporally phase all other archaeofauna that are not dated by radiocarbon and/or volcanic tephra.

The point of Table 2.1 is to illustrate that most of the Icelandic radiocarbon dates were performed on charred birch samples usually recovered from hearths (54% of the entire sample). It should also be noted that two of the cattle dates are from paired samples of the same material (Ua-1419 & K5365; and Ua-1420 & K5366). The first samples were submitted by Degerbol (Ua-1419 & Ua-1420) and then re-analyzed by Vilhjalmsson (K-5365 & K-5366). Interestingly, sample Ua-1420 has a older date then sample K-5366. The other paired dates (Ua-1419 & K-5365) show the exact same age with a difference of 10 years in the standard deviation. It remains uncertain why the discrepancy occurs with the first paired dates.

Another curious anomaly can be seen in Table 2.16. The C13/C12 ratio listed for the Drangar polar bear is surprising in that the value (-27.4) is well within the values for a terrestrial pathway. The Norse Greenlandic materials listed in Table 2.17 are even more curious. These values, which fall between -17.70 to -19.90, suggest a

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marine pathway not only for the domestic species but also for the local caribou population. Although one sample such as the polar bear values might be thought to be erroneous, the Greenlandic materials suggest that some regional background effect might be obscuring these data. In future, a means to calibrate one region with the next will have to be attempted. This will have to also be done in conjunction with the development of a modern base-line set of values for each region's set of species.

The radiocarbon plots in Figures 2.50-2.56, chart out the "high/low" 1st sigma values against associated tephra dates for the sites of Granastadir, Herjolfsdalur, Midbaer, Strong, Svalbard, Tjarnargata 4 and Videy. Sites with single radiocarbon dates are not plotted. Sites with multiple radiocarbon dates were aggregated in descending order of the youngest date at the top of the graph to oldest date at the bottom in order to aid in interpretation.

The Adalbol site (not graphed) shows a discrepancy between the radiocarbon date and associated tephra date. The radiocarbon date's 1st and 2nd sigma values are older than the tephera date with the difference being that the 1st sigma values are older by 321-110 years and the 2nd sigma values are older by 334-84 years, respectively. This might be the result of dating two different samples from the

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same site area. The bone assemblage analyzed by McGovern in 1981 and subsequently re-analyzed by the author were not radiocarbon dated. Adalsteinsson, who recovered these materials, dated them by the association of the H1, Hekla AD. 1104 ash. The association of the bone deposit to the charred birch sample is not clear and an animal bone sample will be sent off for radiocarbon assey in the near future.

Hermanns-Audardottir's conclusion that the Herjolfsdalur site was settled earlier than the traditional settlement period (the Icelandic Landnam of AD. 870-900) is hotly contested (Crawford 1991; Fridriksson 1994; Hallsdottir 1983; Hermanns-Audardottir 1986, 1987, 1989, 1991 & Reply; Kaland 1991; Mahler and Malmros 1991; Morris 1991; Sigurdsson 1991; Smith 1995). Hermanns-Audardottir's argument rests solely on the charred birch and one larch sample dates. There are also two unidentified samples used by Hermanns-Audardottir. If one discounts the larch sample as driftwood and the two unidentified samples there are only three dates that fall before the traditional Landnam date. Couple this fact with the numerous problems of associating the contemporaneity of the birch to the site's occupation and these earlier dates can be discounted.

The Herjolfsdalur dates, if taken on face value, clustered in three distinct groups. There are three dates

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that would easily fall within the more traditional settlement date of the AD. 870-900s, three within the early part of the Commonwealth (AD. 900-1000) and one date well within the later Middle Ages (AD. 1319-1427). Interestingly enough, when these dates are plotted on the architectural site plan (Hermanns-Audardottir 1989:47) a characteristic accumulation of the farm buildings "snaking" around it's farm mound can be observed (cf. Amorosi 1992:115) and do not suggest single phase occupation. It would seem that the older dates (Settlement and Commonwealth dates) cluster in the southwest part of the site and the one Medieval date is found in the northeast part of the site. Unfortunately, the site's archaeofauna was reported as a single phase assemblage (Hermanns-Audardottir 1989:121-125) with no means to determine how this fauna could be located within it's architectural setting. Therefore this fauna will be treated as a single phase assemblage dating within the settlement period since most of the radiocarbon 1st sigma values (again taken at face value), tephra and architectural remains point in this direction.

The presentation of the Strong and Videy dates were limited by the constraints of the quattro-pro program's labeling capacity. The key for Strong sample numbers equate 1 to sample Ua-1419, 2=Ua-1420, 3=Ua-1421, 4=Ua-1422,

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5=K-5365, 6=K-5366, 7=K-4488, 8=K-4489, 9=K-4490, 10=K-4491, 11=K-4492, 12=Ua-1427, 13=K-5014 and 14=Ua-1428. Likewise the Videy samples are similarly arranged, 1=Beta-49857, 2=Beta-49859, 3=Beta-49860, 4=Beta-49866, 5=Beta-49867, 6=Beta-49869, 7=Beta-49870, 8=Beta-49872, 9=Beta-49878, 10=Beta-49879, 11=Beta-65536, 12=Beta-65537, and 13=Beta-65538.

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Chapter 3

VIKING AND LATER PERIODS ANIMAL GRAVE DATA

The Icelandic zooarchaeological database is large, with 58 archaeofauna and 88 animal graves now known to exist. However, many of these assemblages are of uneven quality and poorly documented. This particular chapter will attempt to summarize the animal portion of Viking -to- Medieval and Early Modern period burials. New forensic data recovered during the course of field work in 1986 and 1987 will also be addressed.

3.1 VIKING AND EARLY MEDIEVAL PERIOD ANIMAL GRAVE DATA

At present there are 68 horse and 14 dog burials reported in the Icelandic published literature [12]. Most of these

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12. These include 2 cemetery groups of horses (Hrifunes with 2 horse grave sites and Ytra-Gardshorn with 5 individual

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animal burials were found in association with human inhumations. Currently the Icelandic Viking/Norse and Early Medieval sample of graves consists of 304 burials, thought to pre-date AD. 1000. Of this sample, there are 160 grave sites. Contained within these sites are 100 isolated graves, 76 of which are paired and 71 at 11 cemetery sites with five or more graves each (see Figure 3.1, Einarsson 1994:46).

Eldjarn in both his doctoral dissertation (Eldjarn 1956) and subsequent articles (Eldjarn 1957/58:130-144, 1965:5-68, 1967:94-109; Jonsson 1967:90-93) provided the preliminary details of the human portion of these burials and grave goods. The human forensic studies of most of these graves can be found in Steffensen's work (1943, 1958, 1959, 1966a & b, 1975, 1988a &b). Einarsson (1994) has also recently attempted to synthesize what is currently known about Viking period materials in relationship to the Norse period site of Granastadir. However, the animal interments were only summarily treated in a list of graves by Eldjarn (1956), and in the Icelandic journal *Arbok Hins Islenzka*

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horse burials), 12 individual grave sites that had combined horse and dog burials and 2 grave sites with a single dog in each.

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Fornleifafelags, in which some field drawings and photographs are published.

At the outset of this research it was hoped that the missing forensic detail of the animal portion of these graves could be provided. Such a large sample population of Viking/ Norse to Early Medieval period horses and dogs has not been detailed in the zooarchaeological literature. Unfortunately, most of the animal remains were not saved at the time of discovery by the local farmers, or thought impossible to recover due to the state of preservation of the bone.[13]

There are several other factors that should be kept in mind in considering these graves:

1. - Many of these graves were discovered in the mid to late 19th century when the discipline of archaeology had just begun. Eldjarn and Steffensen were attempting to put order to a messy situation.

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13. Often Icelandic burials are encountered in decalcified and somewhat adipocere state, where the bone leaves little more than a soap-like impression in the ground. This state of preservation might be attributed to a high degree of ground water saturation, acidity, frozen ground conditions and micro-drainage problems within the grave where the original grave excavation serves as a sump for ground water over time.

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2. - Numerous graves were encountered by farmers attempting to flatten their home fields (tuns) or by road construction crews exposing a grave with a bulldozer pass. Having personally documented the Viking period grave at Hallfredarstadir (Kristinsdottir 1987:95-97) after a bulldozer pass, it was almost impossible to reconstruct mortuary behavior let alone any clear forensic detail of this grave.

3. - It should also be kept in mind that the sub-field of zooarchaeology as it is practiced today is only 30-50 years old. Questions concerning animal population parameters, genetic markers of a population, etc., were not part of the standard recovery of human burials in Scandinavia, let alone in North America for that matter. Therefore, interest in the forensic detail of the animal portion of these graves did not exist and was thought to be secondary to the focus on the human portion of the burial.

Nonetheless, this section will attempt to bring together what is known about the animal portion of these graves. Although there is little forensic detail to report, there is some patterning in the interment of the animal and geographic locational information. When these factors are

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viewed with a eye toward a time period or cultural landscape, questions of Viking/Norse period cognitive landscape organization arise.

The following sections summarize data from the Icelandic journal Arbok Hins Islenzka Fornleifafelags since 1955. Materials in this journal that date from 1880-1922 are not detailed enough to make any sort of forensic and mortuary assessment. The only volume that does provide more than a mere mention of finding an animal associated with a Viking/Norse period grave is in 1909 at the site of Granagil. The site plan is provided in Figure 3.2 as a part of this record. However this map is only a sketch map and is not derived from surveyed data. The *Arbok* journal years between 1923-1954 are almost impossible to locate outside Iceland. Copies are kept at the National Museum of Iceland Library, however, this library was not available to the author at this time. Plans are being made to acquire these burial reports and related sections of Eldjarn's thesis (1956) in order to make a more detailed assessment of these data.

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3.1.1 The Animal Portion of the Viking-Early Medieval Period Graves: The Horses

3.1.1.1 Austariholl, Haganeshreppur, Skagafjardarsysla

The grave site was located 100 meters southwest of the Austariholl farmstead, in Flokadalur (see Figures 3.3-3.4; Eldjarn 1965a:22-33). The grave was rectangular in shape, being 4 meters long and 1 meter wide. The grave was encountered in a gravel layer, 20-30 cm below the current ground surface. The grave was situated northeast-southwest. The horse materials were situated in the northeast end of the grave with an associated iron fragment that the excavators call a "horse sting" or prod. The other end of the grave contained the human interment but the skeleton was not found at the time of excavation. The excavators felt that the human remains were removed some time in the past and that perhaps the human remains were transferred to a Christian cemetery. Interestingly, the horse remains would tend to bear this out in so far as what can be seen in the field plan and photograph. The skeleton of the horse was placed in a bundle which was spread out in a crude semi-circular fashion. There is no particular anatomical order

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to the placement of the remains (seen in the photograph from left to right in the foreground: a humerus is placed next to femur (?), against a scapula, next to a broken tibia, some tarsals (?), the vertebrae and the skull were under several bone elements that can not be clearly identified). Some of the bone elements appear to have been broken post-depositionally, as evident with the broken tibia in the foreground, which was broken into a proximal shaft fragment and a distal end. This suggests a secondary interment of the horse remains and that its owner was removed at this time.

The grave also yielded some grave goods, which included, 1 iron spear point, 5 iron arrow points, 1 pair of iron scissors, 1 lead spindle whorl, some fragments of a composite bone comb, 1 iron horse sting and some iron fragments and charcoal. The kind and quality of these artifacts is suggestive of a male burial (cf. Dommasnes 1982).

The forensic detail that can be assessed from the field plan and photograph are that the horse was a mature adult (as based upon the size of the bone elements, the state of epiphyseal fusion and possible muscle markings, all are suggestive of a mature adult). However, the state of health and sex cannot be determined from these materials.

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3.1.1.2 Bransstadir, Bolstadarhlidarhreppur, Austur-Hunavatnssysla

The Bransstadir grave was encountered when a farmer was erecting a barn (see Figures 3.5-3.6). Eldjarn (1967:94-109) was unable to recover more information since the barn construction had destroyed most of the grave and scattered the human and horse remains around the grave site. However, Eldjarn noted that the grave had been disturbed prior to the barn construction. The field plan indicated that the grave was divided, separating the horse from its owner by an earthen baulk.

3.1.1.3 Elivogar, Seylurhreppur, Skagafjardarsysla

The grave was encountered in a poor state of preservation by Eldjarn (1957-58:132-134). Eldjarn attributed the grave's state of preservation to soil erosion and "looting" sometime in the past. The Elivogur grave contained an "old" or senile human male with an associated horse located to the north-west of the human interment (see Figure 3.7). The only associated grave goods with the human burial were some iron fragments. Eldjarn noted that the horse's forelegs remained. According to Eldjarn's field plan (Figure 3.7)

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there was only one foreleg represented by an articulated metacarpal and phalanges (I-III). The articulated metapodia and phalanges were orientated with the phalanges faced toward a general west direction. The manner in which Eldjarn drew the bones suggest an adult animal whose state of health and sex are unknown.

3.1.1.4 Grimsstadir, Skutustadahreppur, Sudur-Thingeyjarsysla

This grave was encountered during road construction when a bulldozer struck the southern end of the grave. The grave had a rectangular shape, shallow depth (even with the bulldozer pass) and the dimensions were 2 X 1 meters. Eldjarn (1967:94-109) does not spend much time detailing the human portion of this grave (one gets the feeling the bulldozer destroyed this part of the grave) but goes on to discuss the horse remains (see Figure 3.8).

The horse portion of this grave had the odd feature of two horses being placed stomach to stomach. Looking at the field photograph, both horses generally face the west. Both horses are also missing their skulls, and seem to be butchered, pre-depositionally. The field photograph also indicated that the horse at the top of the photograph, had

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the thoracic-lumbar-sacral portions of the axial skeleton and one rear leg seems bundled toward the rib cage (a form of tethering the horse?). The other hind limb is pushed out but articulated below the bundled hindquarter. The second horse (at the bottom of the photograph) had the cervical (it hard to tell from the photograph if the atlas was present, but the axis was present) -thoracic and maybe early lumbar series of the axial skeleton. Both the forelegs were articulated to their axial skeleton and were bent forward, cranially. Both animals seemed to be adults, but the state of health and sex can not be determined.

3.1.1.5 Hrifunes, Skaftartunguhreppur, Vestur-Skaftafellssysla

The first of the Hrifunes graves was encountered in 1958 when a horse grave eroded from the edge of the Hrifunes home field as the Holmsa river cut through this field (see Figures 3.9-3.11; and Eldjarn 1965:5-68; Eldjarn 1983a:6-21; Magnusson 1983:22-27). At that time the grave was covered by a thick accumulation of earth in which there were four dated tephra layers. These ash falls were the Katla AD. 1918, AD. 1755, AD. 1625 and the AD. 1416. The tephra

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immediately above the grave was identified in 1982 as the "E-1" ash layer, dated to AD. 934+/- 2 (see Figure 3.12).

The grave treatment is rather odd for a horse burial in that there was an oblong rectangular stone setting around the elliptical horse grave (see Figure 3.13). These stones had been laid out with the dimensions of 4.75 X 1.25 meters and in the middle was the elliptical horse grave with the dimensions 1.00 X 1.50 meters. An iron bridle and strap buckle were recovered from the horse grave. Although there are no published field plans or photographs of the horse skeleton, Eldjarn did mention that the horse was "not clearly beheaded" but implied that the horse's throat had been cut. Apart from this statement, little forensic data can be ascertained about this animal.

In 1982 when further erosion of the home field (tun) by the Holmsa occurred several more graves were encountered at the Hrifunes farmstead (Eldjarn 1983a:6-21; Magnusson 1983:22-27; Gestsson 1983:28-30; Larsen and Thorarinsson 1983:31-47). Hrifunes II was the grave of a horse with no associated human interment (see Figures 3.14-3.18), located on the eastern most edge of the Hrifunes tun. The grave was elliptical, approximately 1.10 X 2.20 meters in area and between 70-80 cm below the current ground surface. The top of the horse's grave was lined with rounded river cobbles.

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The horse was found in a flexed position, with its forelegs situated to the north (the authors note that the animal was seemingly resting on its back, perhaps due the elliptical nature of the grave). The excavators also report that the horse was "beheaded" and the head was placed behind the neck of the animal. Iron fragments of a bridle were found in the mouth region of the skull and there were other iron fragments which the excavators interpreted as parts of a saddle (presumably found along the animal's back). There was no further forensic detail other than the photograph that was published in Magnusson (1983:23-24). Based upon the photograph, the nearly complete skeleton seemed to belong to an adult horse. However, neither the animal's state of health nor sex can be assessed at this time.

The dating of the grave can be placed within the 10th century. The grave was found below the Eldgja tephra (E-1) dated, at AD. 934 +/-2. The excavators mentioned that the top of the grave mound was situated directly below this ash.

3.1.1.6 Oxnadalsheidi, Akrahreppur, Skagafjardarsysla

This grave was found near the 1960's road through the mountain pass of the Oxnadalsheidi (Eldjarn 1967:5-68). What is interesting from a landscape point of view (cf.

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Keller 1993; see Figures 3.19-3.20) is that this grave is not associated with a farmstead. The burial was found on the "edge of a very steep and rocky" riverbank. Having driven on the 1980s road through this same mountain pass (which is situated above the 1960s road that Eldjarn described), the grave is oddly placed, as if marking a boundary were any traveler would have to cross over it.

The grave had already been disturbed when Eldjarn choose to excavate the burial. The grave's dimensions were 1.80 X .75 meters, Eldjarn could not determine the original depth of the grave (presumably because of the disturbance), and the orientation of the grave was in a SW-NE direction. The human remains were placed at the SW end of the grave and determined to be a young woman. The horse remains were found in the NE part of the grave. The field photograph also indicated that a low earthen baulk separated the horse from its owner. The grave goods included 2 glass beads, 2 tin buttons and "several" fragments of iron. The horse grave contained an iron trap buckle and iron rivets (from the saddle ?).

The horse remains seemed to be composed of long bones and some irregular bones. These bone elements were placed in a bundle with little regard to anatomical order and were in a crude semi-circular shape (the wider spread faces the NE

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side of the grave). The skull was missing from the bundle burial. The animal appeared to be an adult, based upon its size and the state of epiphyseal fusion seen in the field photograph. The state of health and sex could not be determined.

3.1.1.7 Solheimar No. 2, Seylnurhreppur, Skagafjardarsysla

This grave was encountered in the summer of 1956, when a road construction team uncovered two graves in a gravel bank. Kristjan Eldjarn had preliminarily described the grave find in 1957-58 (1957-58:130-132). Solheimar No. 2 is a shallow grave which contained a "mature" human male with a partial horse skeleton set just south of the human interment (see Figure 3.21). According to Eldjarn the human portion of the grave was "looted" some time in the past.

Little was said of the horse skeleton. Eldjarn does not list the bone elements present. Although the field plan is no more than a sketch, one can get the sense that the rear portion of the animal remained with an associated iron "strap buckle". The bone elements present seemed to be the articulated sets of right and left calcanei, a possible tarsal bone (on the left side ?), a metatarsal (right ?) and the phalanges (I-III). Based upon the manner in which the

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bones are drawn, it would suggest that the horse was an adult, the state of health and sex are unknown.

3.1.1.8 Ytra-Gardshorn, Svarfadardalshreppur, Eyjafadarsysla

The Ytra-Gardshorn graves are one of the most extensive Viking/Norse period burial fields in northern Iceland (Eldjarn 1967:5-68). There are 10 graves in total and all were "looted" some time in the past (see Figures 3.22-3.23). The general grave orientation is from the SW-NE, with the heads of the buried human placed in the SW end of the grave. In graves nos. 1, 3, 7, 8 and 10, horses were found in association with their human counterpart. In general, the grave sites were rectangular in shape, dug 50-80 cm below the current ground surface, usually divided into two sections by a low earthen baulk, with the original grave surface was often covered by a layer of river cobbles. It was Eldjarn's contention that the river cobbles were covered by earth, forming a small mound over the grave. However, any earthen mounds had eroded by the time of excavation.

Ytra-Gardshorn No. 1: The grave dimensions were 4.70 X .80-.90 meters, orientated in a SSW-NNE direction (see Figure 3.24). The grave was disturbed when encountered.

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The human remains were found in the SW end of the grave and two horse skeletons were found at the other end (NE). The human grave was situated stratigraphically higher up than the horse grave and both sides of the grave were separated by a low earthen baulk. The grave goods included 1 amber bead, 1 glass bead, 3 stone gaming pieces, 1 lead balance weight and some iron fragments, which might suggest that the sex of the human individual was female (cf. Dommasnes 1982).

Based upon the field photograph, one of the horse skeletons was laid out in a semi-flexed position (forelegs bent to the NE and the hind quarters bent behind the animal to the SW). The skeleton was resting on its left side, with its cranial end generally facing south. The skull of this animal was missing (as evident from the field photograph), and the fore-section of the animal seems disturbed. The other skeleton was placed further to the south of the first horse. The second horse was positioned as a bundle burial, spread out in a crude semi-circular fashion (the wider spread faced the north), with no anatomical order to the layout of the visible long bones in the photograph. Both horses appeared to be adult, based upon the size the bone elements and state of epiphyseal fusion of the long bones, again viewed from the photograph.

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Ytra-Gardshorn No.3: Grave No. 3 had the dimensions of 3.60 X 1.00 meters, laid out in a rectangular fashion and surrounded by (and presumably covered with) large rounded river cobbles (see Figure 3.25). The SW end of the grave contained a young woman, the NE end of the grave contained a horse. The grave goods included 1 iron "fire steel", a fragmentary pair of iron scissors and some iron and charcoal fragments.

The horse was found laying on its right side with the cranial end facing generally facing north. The horse skeleton was also placed in a flexed position, with the forelegs bent to the SW and the hindlegs bent to the NE. The horse was also missing its head. Two iron strap buckles with rivets were found in association with the lumbar section of the animal. Based upon the field plan the animal would seem to be an adult individual. Nothing of the state of health nor sex can be determined.

Ytra-Gardshorn No.7: Grave No. 7 had the dimensions of 3.20 X .70 meters, laid out in a rectangular fashion, and was orientated in a SW to NE direction (see Figure 3.26). The grave was disturbed when encountered, leaving a scatter of human and horse elements in the grave. The grave goods included 7 lead balance weights, 1 piece of flint, 43 small rivets that were round in shape and bronze capped (Eldjarn

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thought these to be the rivets from a saddle) and some iron fragments.

The field plan shows the long bones and vertebrae (?) of a horse placed in a crude semi-circular bundle with the wider end of the bundle facing in a northwesterly direction. There was no apparent anatomical order, but the vertebrae (presumably the sacrum) divided the bundle into two halves. There was no indication in the field plan that the skull was found. There also seemed to be an articulated metapodial and phalanges set, at NE end of the grave near the southern wall. Based upon this sketch, the bone elements were from an adult animal, whose state of health and sex can not be determined.

Ytra-Gardshorn NO.8: This grave's dimensions were 4.00 X .75-.90 meters, laid out in a rectangular fashion, with a SW-NE orientation (see Figure 3.27). The human remains were situated in the NW end, the horse in the eastern end. The human remains are situated stratigraphically higher up than the horse remains and separated by a low earthen baulk. The grave goods include 1 iron spear head, 1 iron knife and fragments of a bone composite comb. The grave was disturbed some time in the past as evident by the bundling of the horse skeleton's hind quarters (Eldjarn also indicated this is his description).

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The horse remains were found in a flexed position, resting on its right side with the forelegs extended out toward the head, the hind legs were bundled and tucked toward the rib cage. The cranial end of the body faces the NE end of the grave. The skull was missing from the skeleton. The animal seemed to be an adult based upon size of the bone elements in the field plan. The state of health and sex could not be determined.

Ytra-Gardshorn No. 10: Grave No. 10 had the dimensions of 4.00 X .70 meters and was orientated in a SW-NE direction (see Figure 3.28). The grave was laid out in a rectangular fashion and divided by a low earthen baulk, which separated the horse from its owner. The human remains were scattered along the NW side of the grave (Eldjarn is not clear as to whether this was due to secondary interment, Eldjarn's term for "looting"). The horse skeleton was found on the NE side of the grave. The grave goods included 5 glass beads, 1 whetstone, some iron fragments, parts of a composite bone comb, and 2 iron strap buckles were associated with the horse skeleton. These buckles were found near the humeri and ulnae of the forlegs.

The horse skeleton seemed to be fairly complete as evident from the field plan. The animal was laid out in a flexed fashion, resting on its right side. The cranial end

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of the skeleton faced the NE. The skeleton was presumably associated with its skull, but the skull was placed off to the northeastern corner of the grave away from its body. The forelegs were tucked under the rib cage (in a NW direction) and the rear legs were bundled, tucked toward the rib cage (facing the NE). The drawn elements suggest an adult animal, but the state of health and sex could not be determined.

3.1.2 Animal Portion of the Viking-Medieval Period Graves: The Dogs

3.1.2.1 Dadastadir, Prestholarhreppur, Nordur-Pingeyjarsysla

The Dadastadir grave was well preserved in comparison to many of the Icelandic graves from this period (Eldjarn dated this grave to ca. AD. 900). Eldjarn thought the grave could be associated with the 10th century farmstead of Kleifargerdi, 150 m. south of the grave site. The human portion of the grave had an "old" woman lying with her head placed towards the north-northwest. The woman was interred with rich grave goods (Eldjarn 1957-58:134-142), these

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included 2 bronze tortoise broches, 1 bronze trefoil broach, 2 rock-crystal beads, 1 amber bead, 49 glass beads, 1 bronze headed pin, 1 bronze amulet, 1 bronze bell clasp, 1 fragmentary composite bone comb, 1 pair of iron scissors, 1 iron knife, 2 steatite spindle whorls, 1 linen crochet of iron, 1 piece of flint, 1 small iron hook, 1 iron strap, 1 small bronze cylinder, and 5 fragments of unidentified iron. Two molars, identified as "dog" by Eldjarn were also recovered. However, Eldjarn is unclear as to the molars locational information within this burial.

3.1.2.2 Vad, Skridalshreppur, Sudur-Mulasysla

Only one dog grave (in association with a human burial) was available for examination by the author. The Vad grave was discovered in 1987 by Gudrun Kristinsdottir (1987:89-95, working out of the Safnastofan Austurlands branch of the National Museum of Iceland) when a bulldozer uncovered the human portion of the grave as a farmer was building a new farm house. The grave was located just opposite of the confluence of two small rivers in the Skridalur, Sudur-Mulasysla. The larger river is named the Grimsa and the smaller river is known as the Grjota. The grave was discovered outside the homefield wall (tungardur) of the

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Baerjarhus farm, near the farm's tree orchard (see Figures 3.29-3.32).

Like so many other Norse period graves, this grave's upper levels were covered by a rock cairn. When the grave was unearthed, it revealed a flexed human burial with 1 grave good (a whetstone), and a small to medium sized dog at the feet of the individual (see Figures 3.32). The human was male, aged at 40 years at the time of death. The relative health of the individual was not assessed. The human was positioned with its head in a SW orientation, facing east. Likewise the dog was positioned on its left side, facing in an easterly direction. The grave was situated below the Oraefajokull 1362 tephra and therefore dates before AD. 1362.

The dog skeleton was in a poor state of preservation, with a crushed skull and a missing thoracic - lumbar section of the spine (possibly due to the bulldozer pass). The osteological remains are represented by: a skull; mandible; atlas; axis; fragmentary cervical, thoracic, lumbar and sacral vertebrae; Rt. & Lt. scapulae; Rt. & Lt. humeri; Rt. & Lt. radii; Rt. & Lt. ulnae; Rt. & Lt. innominates; Rt. & Lt. femora; Rt. & Lt. tibae; fragmentary metapodia and phalanges. The osteometrics for the crania and long bones are presented in Table 3.2.

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The dog was assessed to be a senile adult at the time of death of by the following criteria:

1. - The fusion of primary and secondary ossification centers had long been fused, indicating an individual well beyond 18+ months of age (cf. Amorosi 1989b).

2. - The eruption of the permanent dentition had long passed, with the reabsorption of premolar 2 and molars 2 and 3, again indicating a senile adult age.

3. - The advance state of arthritis and bony lipping found in the articulated surfaces and joints associated to this neo-plastic disease also demonstrate an advanced age for this animal.

The animal appeared to have been killed by a blow to the head. The facial area between the orbits was penetrated by a blunt object or tool which "crushed in" the area causing death.

The was also a cultural modification to the dog's teeth in that the lower molars (2 & 3) and lower premolar (2) were missing and the bone around the alveloi was reabsorbed. This condition is seen in many Arctic dogs, especially in Inuit sled dogs. The practice was to knock out these teeth

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so that the dog could not bite through muzzles, leather thongs or the hand that feeds.

The skeleton exhibited signs of a viral infection. The infection was spreading from the neural canal and base of the skull. There was a lesion evident on the dorsal aspect of the foramen magnum. The dog's hearing was impaired, with the auditory canal of the left bulla being fused over. Similarly the right bulla's auditory canal was fusing over at the time of death. The vertebral column exhibited signs of arthritis with bony lipping in the mid-cervical series, later part of the thoracic series and all the lumbar and scaral vertebrae. Heavy bony lipping was evident on the ventral aspect of the scarum, and the articular surface of S1 exhibits eburnation.

The overall impression of this animal was an individual of advanced age. The dog was killed by a hard blow to the eyes. Whether this was done to the animal for burial with its master or after its master's death can not be ascertained at this time.

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3.1.3 Burial Patterning and Viking/Norse Period Landscape Questions

Although the Viking and Norse period animal grave record is spotty at best there are a number of observations and testable archaeological hypotheses that can be made at this time. But, like any other first re-examinations of old data, more questions arise than answers. The reader should keep in mind that these observations and proposals all require further corroboration with the existing published literature (especially Eldjarn (1956) and the Arbok journal years of 1923-1954), the unpublished rescue reports kept within the National Museum's archives and tested with further field work.

3.1.3.1 Possible Data Bias

Presently the known sample of Icelandic Viking/Norse period human graves number 304 and those associated with either horse or dog or both number 78 (a subset of the 304 graves). Any statistician would argue that the sample size is poor and little can be said of these materials. Indeed if one looks further than just the sample size problems, there are other noticeable problems with this data set.

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1. - The recovery of Viking/Norse period graves appear to be an artifact of where people (archaeologists, but also farmers who accidentally find graves) were looking for graves. Similar situations have been noted by many urban archaeologists, where the phenomenon of the "archaeology of parks" heavily influences the sample size. In Iceland's case, the northern and southwest areas do have the largest portion of the Icelandic rural population. As the east of Iceland is becoming more heavily settled now than in the past (especially around the township of Egilsstadir), more grave materials are just starting to appear (as in the case of the Hallfredarstadir grave: Kristinsdottir 1987).

This also coincides with the rise of soil erosion in Iceland, where major landform changes are now occurring in many parts of Iceland. Einarsson (1994) notes that the southwest area of Iceland, especially in Ranagarvallasysla, exhibits heavy soil erosion. Almost 74% of the grave materials (73.68% according to Einarsson's graph (1994:52)), were covered because of soil erosion. The northern part of Iceland has much less recovered (7%) due to erosion, but farming and

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road building activities account for an approximate 60% of the recovered grave sample.

2. - In addition to these factors, Einarsson (1994:46-54) also feels that interest in one's own archaeology heavily contributed to the recovery pattern seen today. These concentrations of graves were encountered during periods of "antiquarian activity" and or public interest (were the advocational effort was willing to report finds to the National Museum) in the local archaeology. Einarsson is able to chart peak period of time when local interest in the past occurred. The peaks of 1890-1910 and the 1930s through the 1960s account for the major recovery of these samples (Einarsson 1994:54).

3. - Taphonomic problems within the soil mechanics of a grave are poorly understood. The fact that bone can be reduced to a decalcified or adipocere states could suggest that a number of graves would go unnoticed in the archaeological record. Also, considering that the two peaks of "antiquarian activity" occurred well before archaeologist and zooarchaeologists were considering the nature of taphonomic bias in the

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archaeological record, many graves might have gone unnoticed.

4. - There is a lack of monumental mortuary behavior in Iceland as compared to the rest of mainland Scandinavia. This only helps to make graves "invisible" to the archaeological record.

5. - Different areas may practice different mortuary behavior. Fridriksson (1982:91) suggested that western Iceland had more of a Celtic character (as based upon place names), and might have practiced Christian burial customs. Sigurdsson (1988) built upon this and thinks that Christians from the Dublin area came to western Iceland, hence the absence of Viking/Norse type graves. In either case, and as Einarsson (1994:48) also points out, there is little archaeological evidence to argue this point of view.

6. - While there is little or no archaeological evidence for these arguments, problems in recognizing a different temporal and cognitive landscape from one's own could be a problem for researchers. In reality, this would be similar to attempting to do "archaeology on the planet Mars", a term first coined by D.K.Grayson in a discussion of the Pliestocene

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Overkill Hypothesis in 1984. Certainly Viking and later Norse period mortuary behavior was different from contemporary rural Icelandic and even 18th or 19th century patterns. If indeed there was a replacement of Viking and Norse period landscapes along with its mortuary behavior by subsequent generations, as suggested by some of these data, grave sites would become almost invisible. The spatial reasoning of where grave should be placed would not be part of a modern developer's or even archaeologist's cognitive model of the current landscape (cf. Keller 1993).

3.1.3.2 Observations and Questions

1. - The age of death for the animal, whether horse or dog, seems to be a mature to senile adult (as defined developmentally). In the Vad grave, the individual exhibit an extreme age, almost to the point of when the animal would be put down by contemporary standards. There is also the suggestion that the buried animals suffered from extreme cases of neoplastic diseases that could be attributed to old age.

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Both these propositions require further testing to ascertain if these observations are true.

2. - In many of the graves the animal remains were not the residue resulting from a buried carcass. Rather, the bone material looked to be re-interred as a bundle burial at the time when the human burial took place. This suggest two possibilities for this type of behavior. First, that a favorite pet died before his or her master, its remains saved and later interred when it's owner died. The other possibility is that both the animal and its owner were re-interred, hence disturbing the burial and making it appear to be "looted".

This type of mortuary behavior can be observed in many time periods and different parts of the world. Although it is not the author's intent to suggest a "Megalithic mortuary game", further research into Viking period mortuary behavior is needed. In the Icelandic case there are a number of common themes within the animal interment and grave location that need to be examined:

Some of the horse materials may exhibit a ritual slaughter before burial. Usually this ritual slaughter takes on the form of a beheaded animal, but

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there are variations such as the supposed "cut throat" of the 1958 Hrifunes horse or the quartering of the two horses found in the Grimsstadir grave. It is hard to say whether the dog materials exhibit this same ritual behavior because of the small sample size. However, the cause of death for the Vad dog was a blow between the eyes.

Many of the horses seem to be buried with riding gear. Based upon the small amount of published data, the gear seemed to be *in situ* on the torso of the animal, and, in the case of the 1982 Hrifunes II grave, the bridle was still in the horse's mouth. The dog burials (although a small sample), do not seem to have grave goods interred with them.

In many of the cited cases horse remains are separated from their human counterpart by a low earthen baulk. This might be due to the physical mechanics of burying a horse (requiring a deeper grave), however this earthen baulk is maintained for bundle burials as well. It is hard to say if the dog sample parallels this behavior.

A number of the horse graves (as well as human graves) were found on the edge of modern home fields in areas

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where one might construct a large structure and placed along pathways now converted to black-topped roads.

3. - There seems to be little geographical patterning of dog vs. horse burials. But do the graves match up with the Sturlung descriptions of Godi spacial patterns as seen in Byock's work (1982, 1988)? If so the archaeological implication that the human/animal burial might delineate the spatial territory of the founding Godar (cf. Amorosi, Buckland, Dugmore, Ingmundarson and McGovern in press).[14]

4. - Both species *seem* to be buried with adult human males and females? But if one believes this data base as it now stands, dogs seem to be buried with senile human adults. Further checking through the literature is required in order to establish:

   If this proposition is true, then, what social implications can be derived if animals are interred with different age grades of people? Likewise, is this then some indication of wealth assigned to these individuals that are buried with their animals within Viking/Norse society? Is the fact that animals, such

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14. The Icelandic words Godar (singular) and Godi (plural) translate to chieftain and chieftains.

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as a favorite horse or dog, being interred with an adult human represent a marker of status and/or wealth? This may be especially true if one considers that status in Icelandic Viking/Norse society is not as well marked as in other chiefly societies such as those found in contemporary Medieval Europe or else where in the Circumpolar Zone (i.e. N.W. Coast Tribes).[15]

If so, is there any patterning within these age grades? Do dogs belong to one age class, perhaps the elderly who have less material wealth, and horses to younger and more vital adults in Viking society. Miller (1990) makes mention that households go through a life cycle, the new couple has little material wealth, the older couple is more established, and the elderly turn over their wealth to the more mature couple. Do these grave data reflect this?

5. - The spatial patterns of both the human and animal graves need to be further examined, perhaps even to the point of performing "nearest neighbor analyses"

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15. Of course this proposition not be assessed without considering the burials without animals; and seeing if the presence of animals correlates with other grave goods or mortuary ritual.

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with different subsets of this mortuary data. Looking at all the known Viking and Norse period graves on a large scale map (as in Einarsson 1994) easily disguises what appears to be some interesting grave patterning.

When graves are subsetted (see Table 3.1 as an arbitrary example), and in this case looking at only human graves that have an associated horse and or dog, some patterns appear.

There does not seem to be any desired elevation where associated animal to human burials occur. In fact there is little of the "mounded earth over the grave" as seen with mainland Scandinavian Viking period graves. The Icelandic grave sites seem similar to many of the Scottish grave sites in this regard.

There does appear to be some spatial patterning in these data. A cluster of animal in associated human graves usually appears within 5-10km of each other. The next cluster of such graves appear 20+ km distance, often being over 25 km distance. This pattern seems to ignore the actual vertical relief of the north part of the country. However, some caution should be applied to this finding. Only the northern (which includes V.-Hunavatnssysla, A. - Hunavatnsysla,

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Skagafjardarsysla, Eyjafardarsysla and S. Pingeyjarsysla) and the southwest (includes Arnessysla and Rangarvallasysla) parts of Iceland seem to have adequate ground survey and archaeological coverage. Einarsson (1994) also suggests that several taphonomic agents (such as acidic soils) and farming disturbance from other districts around Iceland might also bias mortuary data.

Christian Keller (Keller 1993) suggested that the Viking and Norse period graves in Norway were used to denote the boundaries of farms and even chiefly holdings. Similarly, Icelandic human with associated animal graves might have performed the same function. In the northern part of the country, the grave at Oxandalsheidi (found near the road side in the Oxandalur) might have serve as a boundary marker. Another example can be seen with the cluster of the Mork, Stori-Klofi and Galtaleakur graves in Rangarvallasysla within Landmannahreppur. These three graves were less than 7 km apart with the next sets of clustered graves being approximate 20 km distant. Perhaps these farms delineated a farmstead in the now heavily eroded interior.

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At the outset of this cursory examination of spacial patterning, the author assumed that the sites of human with associated animal graves would later be reused as the sites of church farms in the Christian period (after AD. 1000). This does not seem to be the case. Only 5 cases of animal associated with human burials occur where church farms are now located near but not *at* these sites, the implication being that the Viking and Later period Norse cultural landscapes are spatially laid out differently from those of the Medieval Christian period. This also raises the question of how the "early turf walls" reported by Eldjarn (1977), Robertsdottir and Johannesson (1986) and Thorarinsson (1981c) are related to Viking/Norse period graves in their landscapes. Current thinking among Icelandic archaeologists points to these walls as being boundary divisions high enough to keep cattle from crossing from one side to the other. Although no one can yet say with certainty until further work is done, these long turf walls (some are reported to run over 10km up and down mountain sides) are now thought to be some sort of district boundary markers. If so, what are the political implications? Can Godar

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holdings be mapped out and compared to Saga related models such as those of Byock (1982, 1988)?

This raises another set of interesting questions. If the sites of human/animal burials are indeed the marker of social space in the Viking and later Norse periods, how then was this cultural landscape different from Medieval Christian organization? Why was there a replacement of earlier spatial territory? Could this change in spacial layout or even the entire landscape be related to larger scalar questions in political change and market economy of mainland Scandinavia and Europe, models of human/climate interactions, or some combinations of these factors? Unfortunately, questions such as these will remain as interesting questions for the time being, until further co-operative studies can be done with Icelandic and International scholars.

3.2 LATER ANIMAL GRAVE MATERIALS

The interments of horses and dogs do not seem to have ended in Viking/Norse period. However, the frequency of grave materials would seem to be far less and the mortuary

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treatment of the animal burial is different in nature during later periods. Unfortunately, these materials have received far less attention by archaeologists and the patterning in these materials is hard to observed due to such a small sample size. However, one general observation can be offered at this time. In the land registers of AD. 1700-1712 the counts of horses and cattle are very similar, exhibiting an almost 1:1 ratio. Yet, in the bone midden materials there are few horse bones, suggesting an off site deposition. Graves such as Landanrovi and Hallfredarstadir might explain where some of the missing horses can be found in the archaeological record.

3.2.1 Medieval Horse Materials

Landanrovi, Fljotsdalur, Nordur-Mulasysla: The horse remains were found eroding from its grave on the boundary line of the Adalbol and Vadbrekka farms in the Hrafnkelsdalur by a local farmer. The remains were thought to have been found under the "a" tephra, dating to AD. 1477. The remains were sent to Stefan Adalsteinsson in Reykjavik and made available for the author to study.

The remains consisted of the pelvic griddle (right and left innominates, and the sacrum) right and left femora, a

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mid series thoracic vertebra and phalanx I. When examined, the innominates were noticed to be separated by a broken set of symphyses. The sacrum exhibited an advance stage of spina-bifida. The osteometrics of these remains can be found in Table 3.3.

3.2.2 Mid 18th Century Horse Burial at Hallfredarstadir

3.2.2.1 Locational Background

A mid- 19th century horse burial pit was discovered while recovering a Viking period grave at the site of Hallfredarstadir, near Tungu in the Nordur-Mulasysla (65 30'N 14 28'W, Figures 3.33-3.34, also see Amorosi 1987; Kristinsdottir 1987). The grave was capped by a large, flat capstone. The grave itself was filled with a loose earth containing two horse skulls (designated as A & B at the time of recovery) and isolated animal remains. According to the local folk tradition, the farm of Hallfredarstadir was the home of a local poet who loved horses. Upon the death of his two favorite animals, the animals heads were interred upon the mound located between the present animal barns.

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3.2.2.2 Forensic Details of Horse Skull A

1. - Osteological Remains: Complete skull, mandible and hyoid.

2. - Estimated Age of Death: Between 12-15 years as based upon dental wear and suture closure/fusion.

3. - Pathology: An abnormal amount of dental plaque on the buccal aspect of the dental arcade, and lesion formation on the skull's articular facets. Teeth are in an extreme state of wear with dental caries evident on RT. upper PM4 and M1, LT. upper PM3, PM4 and M1. There is heavy re-absorption along the "gum-line". It would also appear that the upper canines were lost (more likely pulled, to avoid biting its owner) early in life.

3.2.2.3 Forensic Details of Horse Skull B

1. - Osteological Remains: Skull, missing the basi-cranium, and mandible.

2. - Estimated Age at Death: Between 12-15 years as based upon dental wear and suture closure/fusion.

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3. - Pathology: Similar to Skull A, Skull B has heavy dental plaque along the buccal aspect of the dental arcade. The teeth are heavily worn, with caries evident on upper RT. and LT. molars 2 and 3. The upper canines are missing, assuming early in life (pulled to avoid biting its owner).

3.2.2.4 Isolated Bone Elements

Recovered from below the two horse skulls (designated as A & B) was a jumble of long bones. Identified in this jumble were horse cranial and lower leg elements, dog and seal remains.

The horse remains are represented by 4 maxillae fragments, 2 hyoid fragments, 2 loose incisors, 2 carpals, 3 metacarpals, 5 metatarsals, 5 phalanx I, 3 Phalanx II and 2 Phalanx III. It is impossible to assign these isolated elements to either horse skull.

The dog remains might represent a fragmentary skeleton of a small sized animal. Present are a cranial vault fragment, 2 fragmentary maxillae, 1 atlas, 2 innominate fragments, 1 scapula, 2 humeri, 1 femur and 1 tibia. Assuming that these remains come from one individual, the age at death falls between 15-18 months. However, these materials were

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recovered in a disturbed fill, and assignment of these remains to one individual is impossible (although likely).

3.3 CONCLUDING REMARKS

Although there are a whole host of reasons why not to bother with this fuzzy data set, the fact that these data are strongly patterned should suggest a more detailed examination is in order. Although a further follow-up on the horse and dog remains is already in progress by the author, more interdisciplinary co-operation is needed not only among Icelandic scholars but the international community. There are a number of recommendations that can be offered at this time which would improve the kind and quality of mortuary studies in Icelandic archaeology.

These are:

1. - Improve the recovery standards for future grave excavation and rescue. Much has been written on "how to" recover and record mortuary data (cf. Bass 1971; Brothwell 1981; Steinbock 1976; Stewart 1979), and should be implemented. This might even entail a recovery team composed of archaeologists, zooarchaeologists, paleo-environmental specialists,

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forensic anthropologists, historians and geologists (for geo-chronological controls).

2. - Improve upon the survey, mapping and photographic coverage in the recovery program. A standard set of survey and photographic protocols need to be developed to in order guarantee maximum data return.

3. - Implement the use of bone chemistry and DNA studies within these guidelines. It has been observed (by the author, the Beta Analytic Labs, and by Dr. Alan Gilbert of Fordham University) that much of the Icelandic bone materials contain a high degree and quality of bone collagen, preserved by the semi-frozen nature of the soil. This fact would enable researchers to follow the established forensic laboratory protocols now available. There already is a new and growing body of forensic information concurring the Norse Greenlanders (cf. Fricke, O'Neil and Lynnerup nd. (1995); Lynnerup nd. (1995)), the Icelandic materials should be entered into this data base for comparative purposes.

4. - A standard guideline needs to be developed for the reporting of grave and mortuary data. Such guidelines should not follow a "minimum standard" style as this

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approach often encourages the "bath water" (and sometimes the baby) to be thrown out.

5. - A predictive locational model for different period graves could be developed, and easily toggled into the reactionary (rescue) nature that Icelandic archaeology has now become. This would help to further assess different period mortuary behavior and develop a better recovery standard by educating the public from destroying grave sites.

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Chapter 4

SMALL ARCHAEOFAUNA

This descriptive account details the many small archaeofauna that are contained within the Icelandic Zooarchaeological database. These materials are composed of those assemblages that are housed at the Zoological Museum in Copenhagen, Denmark, Arbaerjarsafn (the Reykjavik City Museum), Pjodminjasafn Islands (the National Museum of Iceland) and Natturufraedistofnun Islands (the Icelandic Museum of Natural History). The first half of this chapter details assemblages that have almost no archaeological documentation and a low NISP (Number of Identified Specimens per taxon) count that is under 100 and/or a total bone count (TNB) under 300 fragments. The second half of the chapter will describe collections that have more complete archaeological documentation and NISP counts larger than 100 and/or TNB counts of 300 or more.

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4.1 COLLECTIONS WITH MINIMAL ARCHAEOLOGICAL DOCUMENTATION AND A NISP COUNT OF 100 OR LESS, AND/OR A TNB COUNT OF 300 OR LESS

4.1.1 The Zoological Museum, Copenhagn, Denmark

The following information was provided to the author by the very kind help of Dr. Morten Meldgaard. These collections are yet to be analyzed due to time and funding constraints. Plans are being made for a Spring 1996 visit to the Zoological Museum in order to analyze further and document these materials for the Icelandic Zooarchaeological database.

These materials include:

4.1.1.1 Fljotsdalen

The assemblage was excavated in 1901 and is part of a grave find. These materials were received at the Zoological Museum on 2/9/1901. The collection is housed (as of

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5/12/1988) in the Indgaet storage area with the serial numbers 24/1901.

4.1.1.2 Hofsstadir, Myvatn

This collection was excavated in 1908 and received at the Zoological Museum on 12/31/1908. The assemblage is housed in the Indgaet storage area with the serial numbers 18/1908. These materials belong to the Hofsstadir site excavated by Daniel Bruun in 1908 (Bruun and Jonsson 1909) and are subsequently being reinvestigated by Adolf Fridriksson, Orri Vesteinsson, Mjoll Sneasdottir, Birna Gunnarsdottir and the author. The actual location of the site is not on Lake Myvatn itself, but on a tributary river known as Laxa on the southwestern side of the lake. The dating of this site is still under investigation and it may be 9th or 10th century date. A preliminary species list can be found in Table 4.1.

4.1.1.3 Hornafjordur

The materials were excavated and received in 1945. The assemblage is housed in the Indgaet storage area with the serial numbers 213/1945. A preliminary species list can be found in Table 4.1.

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4.1.1.4 Hvitarvatn

This collection was excavated in 1897 and received by the Zoological Museum on 8/12/1897. The bone materials are housed in the Indaet storage area with the serial numbers 34/1897. According to the museum's catalog, the bone fragments are derived from a "ruin". The preliminary species list can be found in Table 4.1.

4.1.1.5 Island

Oddly enough the collection bears the name of Iceland with no attached place name. The collection was received at the Zoological Museum on 4/8/1902. It is housed in the Indgaet storage area with the serial numbers 9/1902. The museum's catalog mentions that this assemblage was derived from a kitchen midden.

4.1.1.6 Kollafjardarnes

This assemblage was received by the Zoological Museum on 12/23/1909. The materials are housed in the Indgaet storage area, but there is no assigned serial number.

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4.1.1.7 Ljosavatn, Ofjord

This assemblage was excavated in 1896 and received by the museum on 12/24/1896. The collection is housed in the Indgaet storage area with the serial numbers 11/1896. According to the museum's catalog, the materials were derived from a "sacrificial site". The preliminary species list can be found in Table 4.1.

4.1.1.8 Odadahraun

The materials were excavated in 1897 and received at the museum on 2/11/1897. The materials are housed in the Indgaet storage area with the serial number 28/1897. According to the museum catalog, the assemblage was derived from a "ruin". The preliminary species list can be found in Table 4.1.

4.1.1.9 Stong

The collection was excavated in 1939 and received by the Zoological Museum on 2/13/1942. The materials are housed in the Ingdaet storage area with the serial number 102/1942.

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These are derived from the Roussell's (1943) excavation of Strong and detailed by Degerbol (1943a).

4.1.1.10 Tjarnargata 4, Reykjavik

The Tjarnargata 4 collection originally came to the Zoological Museum on 5/22/1951. The majority of this collection was returned to the Icelandic Museum of Natural History in Reykjavik. Only a small collection of Great Auk *Pinguinus impennis* materials (consisting of 1 humerus, 1 radius and 1 ulna) remain at the Zoological Museum with the serial number 101/1951. These remains have been detailed by Meldgaard (1988:164). The rest of the Tjarnargata 4 assemblage is detailed below in chapter 5.

4.1.1.11 Tjornes

The collection came to the Zoological Museum on 12/19/1922. The materials are stored in the Indgaet storage area with the serial number 24/1922. The preliminary species list can be found in Table 4.1.

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4.1.2 National Museum of Iceland

4.1.2.1 Baegisstadir, Svalbardshreppur, Nordur-Thingeyjarsysla

The farm served as a tenant farmstead to the larger church farm of Svalbard. Baegistadir was first established in the mid-1700s, abandoned sometime toward the end of that century, re-occupied in the 1820s-30s and finally abandoned in 1926. The Baegisstadir assemblage was collected in 1986 when the author was out on site survey in Svalbardshreppur (Amorosi 1986). The bone materials were found as a small cache eroding from a active stream bed. Unfortunately, the author was unable to stratigraphically record the bone material since the stream had badly turbated the profile (see Figure 4.1). The osteometric data for this assemblage is presented in Table 4.2, and Table 4.3 has the data for the taxonomic assignments.

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4.1.2.2 Eldvorp, Grindavikurhreppur, Gullbringusysla

In 1982, a outlaw's cave was discovered 4 km west of the current town of Grindavik (Gestsson 1983).[16] Several stone structures and a hearth were found within the southern end of the cave (see Figure 4.2). The animal remains from this cave were sent to the National Museum for further analysis.

The assemblage contains cattle and caprine remains. One proximal humerus belonging to a sheep exhibits a pathology of lapsed epiphyseal fusion. The suture crossing over the tuberculum minor as seen on the anterior aspect and the superior aspect between the tuberculum major and minor are open, while the rest of the epipshyeal region is fused (see Figure 4.3).

The collection also shows many of the caprine long bones fragments and one metacarpal exhibiting an unusual butchering pattern. These bones are split longitudinally,

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16. The use of the term "outlaw" has a specific connotation in Iceland. Often an outlawed individual is a person who has run afoul of either the Danish crown appointed officials, the church, or local landed farmers. Being convicted as an outlaw usually requires the individual to leave the sphere of human habitation and to reside in the sphere of the hidden world of elves, trolls and ghosts. Caves are the most frequently chosen habitation sites and are often situated in remote, inaccessible locations.

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presumably to extract the bone marrow. This suggests that the outlaw(s) were attempting to extract and possibly extend their food supply. The Eldvorp assemblage osteometric data can be found in Table 4.2, and the taxonomic assignments are found in Table 4.3.

4.1.2.3 Esjuberg, Kjalarnes, Kjalarneshreppur, Kjosarsysla

The Esjuberg collection represents a 19th century surface find that was brought into the National Museum by a local farmer. Based upon the farmer's description, the assemblage was derived from a badly wind-deflated midden (G. Olafsson, personal communication 1986).

The Esjuberg assemblage is a varied collection containing cattle, horse, caprine and an arctic fox. The only notable pathology is a cattle molar that exhibits wrinkled enamel. Additionally, two cow metacarpals exhibit string or cord marks around the mid-shaft of the bone. Data concerning the osteometrics for this materials is found in Table 4.2, and Table 4.3 has the taxonomic assignments.

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4.1.2.4 Grunnasundsnes, Stykkisholmur, Stykkisholmshreppur, Snaesfellsnes and Hnappadalssysla

The site of Grunnasundnes is one of the oldest known farmsteads in the Stykkisholmur area, first appearing in historical documents in AD. 1250. Although neither the site nor the faunal remains have been dated, the excavator felt that a 13th century date was probable (G. Olafsson; personal communication 1987). The bone materials consist of a left mandible and fragmentary ilium both identified as cattle. These remains were recovered approximately 70-75 cm below the 1984 ground surface (see Figure 4.4). Table 4.2 list the osteometric for the collection and Table 4.3 lists the taxonomic identifications.

The mandible is of particular interest from a paleopathological point of view. The teeth exhibit a dark brown color indicating a mineral replacement in the enamel of the teeth. The teeth also exhibit an extremely heavy cover of dental plaque. This would indicate an injury in the oral area preventing the animal from properly masticating. The teeth also exhibit dental hypoplasia and molar 1 exhibits an odd pattern of wear, consistent with chronic fluorosis poisoning (see Figure 4.5).

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4.1.2.5 Holar, Skagahreppur, Austur-Hunavatnssysla

In 1988, the floor of the Holar church was being renovated and repaired. Underneath the floor board a series of graves and an 18th century surface were encountered. Perhaps the most famous of the graves is thought to be the remains of Bishop Gisli Thorlaksson. The remains of these graves and the 18th century surface finds are detailed in Snaesdottir (1991). A pit containing rubbish and animal remains belonging to an 18th Century surface was encountered below the coffin graves and the mass grave (see Figure 4.6). This pit was 2-3 meters below the graves, located along the south wall of the central nave. Table 4.2 lists the osteometrics for the assemblage and the taxonomic assignments are found in Table 4.3.

4.1.2.6 Hellisandur, Neshreppur, Snaesfellsnes and Hnappadalssysla

In 1992 a known turf ruin was endangered by the proposed construction of a football field. A small team from the National Museum was sent to ascertain what damage the sports field would cause. Unfortunately, before the team could arrive, the field was built and some of the site area was

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damaged. The site's midden, however, lies outside the playing area and was placed under the protected site program of the National Museum. Table 4.3 lists the taxonomic assignment for this material.

4.1.2.7 Hergranes, Ripurhreppur, Skagafjardarsysla

Hergranes is the site of a local assembly site in the Skagafjordur area. In 1974 a bulldozer removed a barely visible turf ruin, located just outside the protected site area established by the National Museum. A small team was called in to excavate the disturbed ruin and discovered two sets of turf and stone wall foundations. The excavators (Olafsson and Snaesdottir 1975) interpreted these foundations as a set of exterior and interior walls. Contained within these walls were post molds and hearths yielding some animal remains.

The preservation of the animal bone was extremely poor and none was saved for analysis. However, the excavators did note that "Most of the bones are from adult sheep and some are one year old, which are traditionally used for marrow extraction" (Olafsson and Snaesdottir, personal communication 1986).

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4.1.2.8 Kolholtshellir

There is no locational information available at the time of writing this section. Table 4.3 list the taxonomic assignment for this material.

4.1.2.9 Reykholt, Reykholtsdalshreppur, Bogarfjardarsysla

Archaeological investigations at the site of Reykholt were conducted between 1987-1988. Reykholt was the 13th century farmstead of the famous saga writer and historian Snorri Sturluson. Although a number of paleoecological samples (Buckland, Sadler and Sveinbjarnardottir 1992) were recovered, the site's soil pH was very acidic (measured at a pH of 3.0) and bone preservation was extremely poor. The small zooarchaeological samples was collected in 1987, in the western end of the East-West trench (see Figure 4.7). The taxonomic assignment for the assemblage is listed in Table 4.3.

4.1.2.10 Skalholt, Biskupstungnahreppur, Arnessysla

These faunal remains come from the southern episcopal see of Skalholt. The remains were recovered from the fill of

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either an 18th or 19th century builder's trench found along the exterior foundations of the church. These materials were recovered 0-50 cm. below the 1986 ground surface (G. Olafsson, personal communication 1986).

The collection consists of cattle, horse, pig and caprine remains. The osteometric data for the collection is listed in Table 4.2, the taxonomic summary is found in Table 4.3. Of particular paleopathological import are a cattle upper molar 3 and a distal tibia. The upper molar 3 exhibits wrinkled enamel on the buccal side of the tooth (see Figure 4.8a). The distal tibia exhibits a healed lesion on the articular surface (see Figure 4.8b).

4.1.2.11 Sudurgata 3-5, Reykjavik

Nordahl (1988:89-90) makes note of a "fish bone layer" that was encountered along the south-western edge of the courtyard of the Sudurgata 3-5 excavation. In her description:

> "...the shaft wall was a layer of clay-mixed earth containing *unburnt bones*, mostly fishbones which were completely decomposed and sodden, so that generally they could only be studied in situ. [17]

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17. Although Nordahl makes this mention, she does not provide any zooarchaeological analyses of these bone materials in her 1988 report.

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> The layer extended partly also under the stones up from the courtyard. On top of this layer and the rest of the courtyard was a 10-25 cm thick layer of clay-mixed earth and overlaying it another layer with fishbones which extended from the southwestern shaft wall, where it continue into the area not investigated, and up to the sewer, though on a higher level. Also here it was nearly impossible to save any of the *bones*:...".

4.1.2.12 Thingness, Mossfellshreppur, Kjosjarsysla

The Thingness site is part of the Kjalarnes assembly, located by the Ellidavatn Lake, in Mosfellshreppur. In 1840, the Thingness ruins were attributed to the old Kjalarnes assembly (Hallgrimsson 1933; Olafsson 1987:15). According to the Landnamabok (Book of Settlements) and the Islendinga Sogu (Saga of the Icelanders) the Kjalarnes assembly was thought to be the site of Thorsteinn's assembly, established in AD. 900, and where the decision to establish a General Assembly or Althing for all of Iceland occurred.

Gudmundur Olafsson (State Archaeologist for the National Museum of Iceland) carried out a series of excavations in this area between 1981 and 1987. Encountered just below the surface were 18-20 structures. In the center of the site was a large circular stone enclosure with a diameter of 18 meters. Near the southwest side of this enclosure was a

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small structure, with the dimensions of 2.5 X 4.5 meters. The structure's walls were made of turf with a stone foundation and a floor layer visible in the structure's profile. Below this structure was another small building with a floor layer that contained badly burnt animal bone, a quernstone, irons lag and stone loom weights. Olafsson (1987:16) interpretation was that this second structure was a earlier and permanent farmstead. He feels that this structure dates to the early 10th century because the base of the second structure sat atop the "settlement or Landnam ash" dated at AD. 900 (Vo ~ 900). The taxonomic assignment is presented in Table 4.3.

4.1.2.13 Thorsteinsstadir

There is no locational information available at the time of writing this section. The taxonomic assignments are present in Table 4.3.

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4.1.3 Icelandic Museum of Natural History

4.1.3.1 Drangar, Arneshreppur, Strandasysla

The remains of a polar bear was discovered in 1990 by the local farmers at Drangar as it eroded from a raised Holocene beach terrace. This discovery raised hopes of adding a new entry for this poorly dated aspect of the North Atlantic, Holocene aged vertebrates and their paleoecology. Unfortunately, the radiocarbon date did not indicate a "ballpark" early Holocene date, rather a much more recent one, the first sigma values being AD. 1694-1955 (see Chapter 2, section on Temporal Sequencing of the Collections).

The remains consist of several bones that have a mineralized and worn appearance. The skeletal remains include the atlas, 1 late series cervical vertebra, 1 early series thoracic vertebra, 3 late series thoracic vertebrae, 1 lumbar vertebra, 2 dorsal rib fragments and 1 left femur. The atlas either exhibits cut marks or shovel marks on its neural arch area. One of the late series thoracic vertebra was used for the radiocarbon date. The Drangar remains are included in Tables 4.2 and 4.3.

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4.1.3.2 Haukadalur, Ranagarvallasysla

This small collection was recovered from the Haukadalur in June of 1948. The assemblage was found 3 meters below a surhey pit. [18] The note attached with the bone material claimed the collection probably dated to the Landnam period, certainly no younger than AD. 1300. The osteometrics for this collection can be found in Table 4.2 and Table 4.3 has the taxonomic assignments.

4.1.3.3 Lambastadir, Gardahreppur, Gullbringusysla

The bone collection was recovered from an eroding sea-side bone midden. The collection was added to the museum's holdings by Finnur Gudmundursson on August 9, 1949.

The collections was two specimens of paleopathological note. The molars assigned to cattle, exhibit dental plaque on the labial aspect. The caprine vertebrae have "bone-y lipping" on the facies terminalis carnialis, as seen on the ventral aspect. Osteometrics data for this assemblage can

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18. A silage feature dug either into the earth or a known burnt peat ash and midden area for the purpose of souring and freeze-drying animal fodder.

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be found in Table 4.2 and in Table 4.3 the taxonomic assignments.

4.1.3.4 Melstadir, Hunavatnsysla

The cattle crania was recovered on May 2, 1905. The bone fragment was found 6 feet below a probable graveyard at the site of Melstadir. The bone was recovered from a gravel and sand layer. Table 4.3 list the assignment for this remain.

4.1.3.5 Rofunum (Hraun), Vestmannaeyjar

There is very little locational information that is recorded for this assemblage. It is unclear if these materials were recovered from a bone midden or from some other context. The label kept with the collection mentions that the material is from the site of Rofunum, which is beside a lava field in the Vestmann Islands. A probable date of recovery is August 30, 1907.

The osteomemtrics for this collection can be found in Table 4.2; while Table 4.3 lists the taxonomic assignments. This is the only Icelandic assemblage in which the domestic cat, ***Felis catus*** has been recovered. As to why this is the only collection with domestic cat remains is uncertain. The

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cat remains also exhibit a lesion on the medial aspect of the astragalus. Similarly, a cow astragalus also exhibits a lesion on the medial aspect.

4.1.4 Material Curated with Dr. Stefan Adalsteinsson

Between the years of 1986-1988, Dr. Stefan Adalsteinsson acquired several small bone collections from his home valley, Hrafnkelsdalur. The horse grave of Landrovi is described in chapter 3. The Melholar site is discussed below and the Hakonarstadir site in the next section of this chapter.

4.1.4.1 Melholar, Hrafnkelsdalur, Fljotsdalshreppur, Nordur-Mulasysla

The Melholar site is located south of the Mulakot site. This collection was discovered eroding from an old road cut. The farmer who collected the material for Adalsteinsson reported that the assemblage was found just below the Hekla 1104 (H-1) tephera, dating the bones to pre AD. 1104. The osteometric data for Melholar can be found in Table 4.2 and in Table 4.3 the taxonomic assignments.

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4.2 COLLECTIONS WITH A MORE COMPLETE SET OF ARCHAEOLOGICAL DOCUMENTATION, A NISP COUNT > 100 AND/OR A TNB COUNT > 300

4.2.1 Arbaerjarsafn, The Reykjavik City Museum

4.2.1.1 Adalstraeti 8, Reykjavik

In July of 1987, a Reykjavik city property lot designated as no. 8 on the street of Adalastraeti was slated for new construction. The street of Adalstraeti (Nordahl 1988) and streets immediately east along the streets of Suduragata (Nordahl 1988) and Tjarnargata (Grimsson and Einarsson 1969; Nordahl 1988) had been a focus of earlier investigations. As a result of this earlier research, the area known as the Midbaejar section of downtown Reykjavik was considered to be highly sensitive for Landnam and Early Medieval archaeological resources and subject to investigation before any new construction could begin. Subsequently, this area is still receiving attention by the Arbaejarsafn staff

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archaeologists (Edvardsson 1994; Einarsson 1993, 1994a & b; Skia 1993).

The Adalstraeti 8 investigation was a large sized excavation covering an area 40 X 15 meters (see Figure 4.9). The excavation yielded three occupational horizons. The oldest was a thin, pale stratum that sat atop the Katla 1500 (K-1500) ash. The next horizon contained some remnant architectural features of a turf wall and earthen floor that the excavator attributed to the 17th and 18th centuries. The last horizon was graded over with a diatomaceous earth (possibly derived from manure) and a gravel helping to blur traces of the later 18th and 19th century timber and stone house named the Fjalakettinum (Hallgrimsdottir 1987a & c).

Figure 4.9 portrays the remaining 18th and 19th century stone foundations. The excavator felt that the planned foundations seen in Figure 4.9 are "in all probability" those belonging to the building constructed in 1880 (Hallgrimsdottir 1987c:22). A rubbish pit was encountered along the grid coordinate of X12, Y12 at the same depth as these foundations. The rubbish pit contained 19th century ceramics (earthen wares, English porcelains and kaolin clay pipe bowls) and animal bones. The rubbish pit was tentatively dated between the 18th and 19th centuries.

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Other animal remains were also encountered throughout the site area but were only designated with X and Y coordinates. This made the association of these materials to the three designated horizons impossible to link up. There are also recovery problems with this collection; the organic remains were neither screened nor bulk sampled. The collection is derived from hand picked samples and is not representative sample. Nonetheless, the osteometric data for this collection is presented in Table 4.4 and taxonomic assignments are presented in Table 4.5. Although this may seem a somewhat gloomy description of this assemblage, the future holds some promise. A re-analysis of the ceramic materials should be able to place the rubbish pit feature into a clearer 18th or 19th century context.

4.2.2 Icelandic Museum of Natural History

4.2.2.1 Oddbjarnarsker, Flateyarhreppur, Austur-Bardastrandarsysla

This small island served as a seasonally-occupied fishing station in recent centuries as well as a center for maritime hunting within Breidafjord. The assemblage was collected

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from a stone and turf foundation that were badly turbated by puffin burrows, making any stratigarphic assignments impossible. The collection is still under analysis and will be reported in future work by the author. Unfortunately, a winter storm in 1995 surged over the island, destroying the site area (Aevar Petersen, personal communication 1995).

4.2.3 National Museum of Iceland

4.2.3.1 Fornusandar II, Eyjafjallasveit, Vestur-Eyjafjallahreppur, Rangarvallasysla

The 18th century land register, generally known as the Jardabok, mentions a collective name in 1709 of Sandar for the five Fornusandar (FO I-V) sites. The Sandar farm was located east of the Markarfljot river on what is now a tidal beach flat. The shift in the Markarfljot stream bed and in ocean tides most likely occurred within the 18th century, killing the farm's pasture land and silting over the farmstead (Andrew Dugmore; personal communication 1995). Presently, the farmstead consists of five stone scatters set within a series of hollowed-out black beach sand dunes. The

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site area stretches out in a 1-2 km. path leading south toward the sea from the present day farm, also named Fornusandar. Based upon the surface artifact scatters, Sveinbjarnardottir (1992b:30-31) felt that the Fornusandar sites were not part of the original settlement farm.

The actual location of the Fornusandar sites is problematic from a Land Survey point of view. The sandar, or beach, is constantly shifting due to strong winds from the southeast, allowing no permanent land monuments. The FO I site lies 300 meters due SW of the present day farm of Fornusandar. The FO II site lies approximately 200 meters due SW of FO I. The artifacts found in 1980 and 1981 suggest a 15th-17th century occupation. Of particular note is a 15th-16th century English knife type and a 17th century cloth seal and ceramic fragment (Sveinbjarnardottir 1992b:33-34). The author had paid two visits to the site and general area in 1986 and again in 1995. The first visit resulted in the surface pick-up of the reported archaeofauna in Tables 4.6 and 4.7. At that time, the site appeared as a hollowed out beach dune, with the water table located just at the surface. The 1995 water table is now several inches above the ground surface (at low tide) making further documentation and collection for this site impossible.

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This collection is rather large for a surface pick-up, suggesting strong water action and/or wind erosion. Of particular bio-geographic interest is the recovery of the greenland or harp seal *Pagophilus groenlandicus*. This animal is usually found in the northern part of Iceland. Kristjansson (1980:314-316) notes that the area near the Fornusandar farm was an active sealing area in 1700. The whale remains are represented by large blocks of bone presumably used for building construction or artifact manufacture. There are several pathologies to note among this collection. An ulna of a Greenland Seal has two large canine punctures on the olecranon, indicating that dogs did have access to the bone midden some time in the past. This would further argue for surface turbation in the midden (if the site could be excavated). The other pathology to note is the high degree of dental plaque on the premolars and molars of the cattle and caprines, suggesting a low acidic diet.

4.2.3.2 Hofsstadir, Gardabaer

The site area of Hofsstadir was scheduled for development in 1985 by the Gardabaer town board. At that time the site consisted of an open field with various turf walls.

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Gudmundur Olafsson from the National Museum performed a test trench (roughly 2 x 5 meter trench) through one of the turf walls, revealing a long a deep profile. An Early Medieval stratum was encountered below the turf wall, approximately a meter deep from the ground surface and below this stratum was the "Landnam" (Vo˜900) ash. The bone assemblage was recovered from a small hearth pit dug into the "Landnam" ash and interpreted as belonging to a 9th or 10th century deposit.

The pit feature was interpreted as a sacrificial hearth, in which a large quantity of animal remains was burnt. The bone materials were extremely calcined with severe shrinkage, reducing the identifiable fragments to a 1/4 their original size. This type of calcined bone is consistent with a fire temperature 800-900 C (Stewart 1979:64-66). The net result of this burning is a white calcined and brittle bone, making the entire collection heavily fragmented. The taxonomic assignments for this collection are found in Table 4.10.

This site was re-opened in the summer of 1995 and the excavation was extended to cover a wider area than the earlier test trench. A silver Jellinge style pendant which dates the site to the early 10th century (Gudmundur Jonsson; personal communication 1995) was recovered early in this

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season. Also recovered were more burnt animal remains. Plans are being made for the author to continue the analysis of this archaeofauna.

4.2.3.3 Gammel-Grimstadir (Gomlu Grimstadir), Fjallahreppur, Nordur-Thingeyjarsysla

Unfortunately, the site of Gammel-Grimstadir was badly wind-deflated. Wind erosion had removed much of the site's midden and cultural deposits, making any stratigraphic distinctions impossible. Several historic ceramics suggesting an 18th Century date were recovered with the bone materials. There is also some corroborate evidence for this date in the archaeofauna. The recovery of a several Caribou or Reindeer fragments supports this date since these animals were first introduced to Iceland in 1771-1787 (Thorisson 1980). Also, the recovery of the Greenland Seal would suggest that the farmers had access to the fjords in the northeast which were becoming ice choked in the 18th century (Amorosi 1992). Other taxonomic assignments can be found in Table 4.8.

This site seems to have lost its Viking age component due to wind erosion in the early 1960s. Grimsson (1965) had

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visited this same site in 1962 and found three badly disturbed human graves and a small number of animal bones scattered about (it is uncertain if any of the animal remains were recovered). He was able to determine that one grave contained a young adult with a twelve year old; the sex of both could not be determined. The second grave had an adult woman and the grave likely dates to the 10th century. Also recovered on this wind blown surface was an small iron spearhead consistent with Viking period typologies.

4.2.3.4 Nyibaer, Eyjafjallasveit, Vestur-Eyjafjallahreppur, Rangarvallasysla

The Nyibaer assemblage was collected by Mjoll Sneasdottir when a farmer brought her a backhoe collected pile of old animal bones. The animal remains were discovered while digging a drainage ditch on the present day Nyibaer farm. Similar to the movement of the Fornusandar sites, away from the sea and Markarfljot river, the site of Nyibaer has moved. In the Jardabok of 1709, Nyibaer was reported to have moved three times (Sveinbjarnardottir 1992b:31), presumably away from ocean encroachment of the 18th century. This makes the actual location of the old Nyibaer farm hard

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to establish. Based upon a 1995 visit with Mjoll Sneasdottir, these midden materials were found approximately 500 meters southeast of the present day farm of Nyibaer, along a drainage ditch adjacent to Route 247 (see Figure 4.10 for a sketch map). The fields surrounding this area have been flattened, leaving no signs of turf architecture or midden deposits.

The osteometric data for this collection is presented in Table 4.11 and Table 4.12 has the taxonomic assignments. It is interesting to note that this assemblage contained horse remains, which are not usually found in 18th and 19th century bone midden materials from this region. The whale remains represent either building materials or raw materials for artifact manufacture. The only pathology to note is the heavy amount of dental plaque found on four mandibles assigned to sheep, *Ovis aries*.

4.2.3.5 Stong, Thjorsarsalur, Gnupverjarhreppur, Arnesssysla

This famous Thjorsardalur site has yielded bone materials from both the Roussell investigations (Degerbol 1943a; Roussell 1943) and from recent work by Vilhjalmsson (1983, 1984a, 1986, 1988, 1989b). The Strong archaeofauna,

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unfortunately, was largely represented by the early excavated samples identified by Degerbol. Thus, the total absence of fish bone in the assemblage is not particularly significant (Roussell did not screen his excavated soil). Also of particular interest is the high proportion of caprine remains in the collection. Table 4.13 presents the osteometric for the Vilhjalmsson materials. Table 4.14 presents the taxonomic assignments for Degerbol and Vilhjalmsson materials.

4.2.4 Material Curated with Stefan Adalsteinsson

4.2.4.1 Hakonarstadir, Jokuldalshreppur, Nodur-Mulasysla

The Hakonarstadir assemblage is the last of three collections made available for study by Stefan Adalsteinsson. The summary of the archaeofauna can be found in Table 4.10. The Hakonarstadir materials were recovered from a trench dug by farmers for water pipes. Adalsteinsson provided the following stratigraphic description:

Below Ground	Description Surface in cm
0	The ground surface was dated to AD. 1875
20-23	The "a" tephra identified as the Vatnajokull 1477 (V-1477) tephra

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28	The Oraefajokull 1362 (O-1362) tephra
45	Either the Hekla 1158 or 1104 tephra (H-1158/1104)
70	An unidentified black tephra
100-140	Animal bones and peat ash

In looking over Table 4.9, the caprine numbers reflect a heavy emphasis on sheep herding. There is also a suggestion that this early fauna reflects a "Landnam" animal mixture. The domestic mammals have the mix of species that is consistent with the Northern farming practice of converting forested land to grassland or pasture (Amorosi, Buckland, Dugmore, Ingmundarson and McGovern in press). It is also interesting to note the emphasis placed upon marine resources such as the atlantic puffin.

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Chapter 5

OLD COLLECTIONS, MODERN COLUMN SAMPLES AND EXCAVATIONS

5.1 INTRODUCTION

The collections which are described in this chapter include Icelandic archaeofauna that have the basic minimum sample size that can be quantified. This archaeofauna has fair to good archaeological documentation which allows for a more detailed discussion of economy rather than the laundry listing of materials that was the core of the previous chapter. The patterning found within these assemblages offers a unique look at the economy of the first generations of Icelandic settlement. The collections of Adalbol, Herjolfsdalur and Tjarnargata 4, although recovered prior to modern zooarchaeological standards, do offer some clues to how first generation farmers attempted to balance their mix of livestock in order to establish their farmsteads, and to exploit the natural resources were available. The modern

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excavation tests and column samples of Akurvik, Gjogur, Hjallholl, Midbaer and Nesstofa enable the construction of a diachronic view of Icelandic economy from the Viking/ Late Norse to the Early Modern periods (ca. AD. 870s-1800s).

Although these collections are certainly a "step-up" from those assemblages described in the last chapter, it would be naive to say that there are not some problems with these materials. Though the documentation of the older collections (Adalbol, Herjolfsdalur and Tjarnargata 4) is better, it is incomplete by current standards. [20]. This may be extended to discussions of recovery, locational detail and taphonomy. Additionally, there has been extensive discussion in the zooarchaeological literature (cf. Amorosi, Woollett, Perdikaris and McGovern in press) concerning the validity of samples derived from small area tests and column samples. It should suffice to say that the diachronic view offered by these excavation strategies is merely a window on the regional economy and not the complete view. The data presented from the "modern" tests is presented with this caveat in mind. Although imperfect, this information

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20. The excavators, however should not be blamed, rather the criteria that have become the basis of zooarchaeological assessment are now 30 years old. These excavations were dug some 50-30 years ago, before the first discussions of taphonomy and recovery were being formulated in archaeology.

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represents the only view these regions of Iceland have. If these patterns are viewed together, they are consistent with other regions in Iceland, the North Atlantic and other island archaeology (Burney 1993; Diamond 1989; MacPhee and Burney 1991; MacPhee, Burney and Wells 1985). Rather than viewing these data as "crippled" and arguing for the perfect zooarchaeological assemblage, which in the author's view is impossible, the discussion looks at the patterns within these site collections.

5.2 THE ADABOL SITE, HRAFNKELSDALUR, FLJOTSDALHREPPUR, NORDUR-MULASYSLA, EASTERN ICELAND

5.2.1 Site Background History

The site of Adalbol has received much attention by Icelandic scholars beginning in the late 19th century. Located in the Hrafnkelsdalur (Hrafnkel's valley), an eastern interior valley where much of the Medieval family saga of Hrafnkels takes place, is also the location in which

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a number of Viking-Early Norse finds have been recovered (Adalsteinsson 1981; Magnusson 1971; Rafnsson 1990; Porarinsson 1976). Much of the early work at Adalbol was an attempt to establish whether the farm mound located near the present house was the site of the home of the Saga hero Hrafnkell. Rafnsson (1990:53-55) provides a general description of early investigations by Sigurdur Vigfusson and Dr. Kalund.

The first real recovery of archaeological remains occurred in 1958 while the farmer at Adalbol was laying down a new house foundation. The farmer, Pall Gislason encountered a "pit-like" feature containing numerous animal remains. The remains that compose this collection were given to Dr. Stefan Adalsteinsson to curate at the National Museum of Iceland in 1960. In 1982, Adalsteinsson contacted Tom McGovern to analyze this collection. In a letter dated the same year (1982), Adalsteinsson wrote McGovern with the following background history of this assemblage:

> "These bones were found when the foundation was dug for the present farmhouse in 1958. A printed reference to this is found in the book: "Sveitir og jardir i Mulathingi", as a legend to a picture of the farmhouse at Adalbol, p. 290, and is as follows [the translation is Adalsteinsson's]:
>
> "Adalbol. In 1958 the building of a two story farmhouse of size 12.30 X 9 meters (m.) was begun, with an outbuild entrance 5.5 X 2.30 m. The Drawing Office for Agricultural Buildings. During digging for the foundation of the house, old wall

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remains were encountered in several places which shows that a farm has been on this site during the old self-government period [the Commonwealth Period]".

This description was written by Pall Gislason, the farmer at Adalbol, who built the house in 1958. Pall died in August 1981.

I phoned my parents who lived at Vadbrekka, the neighboring farm [to the north of the Adalbol by some 6 km], and asked them what they could tell me about this bone find. My father said on 25 August 1982:

"I don't remember what year they were found. The bones were below the ash layer from Hekla in 1104 [AD. 1104]. Pall investigated that. Former head of the Pjodminjasafn, Dr. Kristjan Eldjarn asked me what my opinion on the bones were. I told him that I imagined that they came from a feast that Samur Bjarnason had given for Porekell Leppur and Porgeir Pjostarsson when they helped him to drive Hrafnkell away from Adalbol. [Bjarnason, Leppur, Pjostarsson and of course Hrafnkell are characters in the family saga known as Hrafnekells Saga]. The bones were so close together when found that they looked like one large heap of bones from one meal".

My father did not himself see the bones nor the site where they were found, but had discussed the find several times with Pall. Asked about any peculiarities about the age structure of the bones he replied:

"The sheep seemed to be of all ages, from about 10-12 week old lambs up to adult age".

The oldest daughter of Pall, Dagny Palsdottir, born around 1940 had this to tell when contacted on 25 August 1982.

"The bones were in a thick layer, as if in one heap. There seemed to be very little if any soil in between the bones in this particular heap, but in other places there was soil between the bones". Dagny saw the bones *in situ* herself.

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> I myself recall from a discussion with Pall Gislason that he described the site as if the bones had been placed up against a bank of earth and covered with soil.
>
> I do not know for certain whether Pall Gislason knew with certainty the ash layer which Sigurdur Porarinsson termed H 1104 (Hekla eruption 1104) and which Gudrun Larsen recently (in ***Edlur er i Nordi***, Reykjavik, 1982) has shown to come from a Hekla eruption in 1158. The H 1104 (H 1158) layer is thin in Hrafnkelsdalur. It is of light colour. Another light tephra layer, from Oraefajokull in 1362, is very clearly visible in this area, and I would think it almost certain that the bones were found beneath that layer [Hekla 1104/1158]."

The Adalbol site received further attention from Sveinbjorn Rafnsson in the early 1970s and 1980s (Rafnsson 1990). However, Rafnsson decided to investigate the turf mound some 20-25 meters to the north of the present (1958-1960) farm house. He reported that a radiocarbon date (U-4367, 1110+/-65, 1st sigma AD. 876-1006) is from this area and not from the 1958 find.

5.2.2 Taphonomic Observations

McGovern notes in his 1982 report that the collection is in good to excellent condition, with little signs of prolonged weathering, chemical decomposition and carnivore chewing (McGovern 1982:1). Based upon a re-examination of this collection by the author, these observations can be

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verified. In fact, the preservation of very delicate bone elements such as the interior maxillae sinus and lachrymal-zygomatic bones were present and still articulated to the skull. These observations do indicate that the "pit-like" feature was primary in nature, with only a possibility of minor re-working of the deposit.

Although the collection was not recovered by screening/sieving strategy (which in 1958 was done), the standard of *"in situ"* recovery was high, as evidenced by the small skeletal elements and bone fragments in the archaeofauna. The observation of "no soil between the bones" and a "old heap of bones" (possibly derived from a "feast meal") all suggest that the deposition of the collection was relatively quick, possibly representing one episode of a kitchen/hearth dump. This is also further supported by the low frequency of observed carnivore gnawing (also noted in McGovern 1982). This indicated not only a quick single episode of kitchen/hearth dumping, but also that these materials were not exposed to many chemical and biological agents of attrition (hence the low frequency of carnivore gnawing).

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5.2.3 The Archaeofauna

The collection is composed of a total of 1,737 remains (NISP). The majority of the remains, 987 in total have been identified to the genus/species level, which indicates the primary nature of this "pit-like" feature. The remaining number of fragments, 750, could only be identified to the class level (see Table 5.1). Figure 5.1, charts out the relative percentage of the major taxa in the Adalbol collection and Figure 5.2 charts out the relative percentage of the domestic mammals.

It is interesting to note the relatively high number of caprines in comparison to the cattle remains. In looking over the caprine category, there are some goats mixed in with the sheep remains. This provides several implications to consider. The ratio of goats to sheep is the type of husbandry strategy used to convert a mosaic sedge/birch plant cover to a grass community. This ratio may also reflect the poor quality of the pasture around the Adalbol farm, where few cattle and horses can be kept. What becomes even more intriguing, is that the poor pasture quality in the Adalbol area occurs during the Late Norse period, a time when other regions in Iceland were not as marginal. This

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could also suggest that a generalized shift of plant communities occurred first in the higher elevation valleys such as Hrafnkelsdalur, before the lower elevation coastal areas. Whether this change is brought about by the nature of keeping caprines in such a marginal low arctic area and/or the numerous shifts in climate at this time is still subject to debate (cf. Buckland, Amorosi, Barlow, Dugmore, Mayewski, McGovern, Ogilvie, Sadler and Skidmore 1996; Parry 1978; Parry, Carter & Konijn 1988; Ogilvie 1981, 1984a &b, 1986, 1991, 1992).

Although aging studies of the major Icelandic collections are still underway, an age profile for the caprine category can be estimated. This profile is based upon the dental eruption and wear rates observed on the mandibles and maxillae in the Adalbol collection. A total of 59% (42 specimens) can be aged within 6 months, 19% (14 specimens) within 18 months, and 16% (16 specimens) within 24 months. The high juvenile mortality rate is consistent with Icelandic practices whereby farmers cull the "first summer" olds in order to keep enough fodder for the rest of the herd in late winter and early spring (cf. Amorosi 1992a; Ingimundarson 1995).

It is unlikely that the Adalbol assemblage is the debris left from a high elevation sheep farm or saeter since there

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are also a small number of cattle, horse, bird and fish remains. Such a mix of animals indicates the presence of a farmstead rather than a shieling site. The low goat to sheep ratio is consistent with many of the other Icelandic collections (i.e. Bessastadir, Granastadir, Svalbard and Videy), but is in strong contrast to the materials from Norse Greenland. The Norse Greenlandic farms from this time period have an almost equal representation of sheep to goats (McGovern 1992b; McGovern, Bigelow, Amorosi, Woollett and Perdikaris 1993).

The cattle remains are composed of adult and juvenile animals. The juvenile remains can be aged within 6+/- months at the time of death, indicating a culling pattern consistent with the caprine pattern noted above. A more refined butchery study is also presently being conducted, but the presence of butchered horn core fragments and "natural-polled" frontal bones are evident in these materials.

The other animal categories are also of interest. The avain component consists of fragmentary geese remains, that can be assigned to ***Anser sp.***. Most likely these remains belong to the Graylag Goose (***Anser anser***) and not the rarer Pink-footed Goose (***Anser brachyrhynchus***). The presence of geese further indicates that grass-like plant communities

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were available within the Adalbol farmstead area (cf. McElroy 1974). The recovery of cod and fragmentary fish remains (assigned to the class level) further suggest that the Adalbol farm was not totally isolated from marine resources.

5.2.4 Caprine Metapodial Butchery Pattern

The distribution and dating of a bi-perforated caprine metapodial (described in Bigelow 1993) as a diagnostic artifact type has puzzled zooarchaeologists for some time. Currently this artifact type is known only from Late Norse sites (AD. 1100-1400) in Iceland, Shetland (Bigelow 1993), Faroe (G.F. Bigelow personal communication 1996, Arge 1995) and Anglo-Saxon sites in the United Kingdom (Bigelow 1993). Curiously, the Adalbol "pit" assemblage has both this bi-perforated artifact type (on 6 metacarpals, 9 metatarsals, or 15% of the metapodial sample) and the earlier pattern of longitudinally split metapodials (on 49 metacarpals and 37 metatarsals, or 85% of the metapodial sample) more often observed in Viking/ Early Norse aged deposits. It is tempting to speculate that this tradition of bi-perforation had just reached the Hrafnkelsdalur where a mix of traditions can be observed. This might even place a starting

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date of this tradition in eastern Iceland during the early part of the late 11th - early 12th centuries (the dating of this "pit-like" feature ranges between the eruption of Hekla in 1104 or 1158).

5.2.5 Conclusions

Although a small and arguably a localized deposit, the Adalbol "pit-like" feature does provide some potentially valuable views of the economy of this inland valley in the early 10th century. When compared with the other small collections (the materials from Hakonarstadir, Melholar described in chapters 3 and 4), each exhibits similar patterns reflecting a heavy emphasis on caprine husbandry. The recovery of bi-perforated sheep metapodials and marine fish remains also suggests that the Hrafnkelsdalur farms were not isolated from coastal settlements. Clearly, if additional well controlled excavated samples could be recovered from this region, a better view of this eastern, high elevation inland economy would be seen.

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5.3 THE HERJOLFSDALUR SITE, ISLAND OF HEIMAEY, VESTMANNAEYJAR

The Vestmannaeyjar or the Westmann Islands can be seen from the south coast of Iceland. This island group consists of 15 large islands with 30 smaller sea stacks, and includes the newly created island of Surtsey, formed between the eruptions of 1963-1967. The Herjolfsdalur site is located on the island of Heimaey, the largest of this island group (see Figure 5.3).

Herjolfsdalur was excavated by Dr. Margret Hermanns-Audardottir in the summers of 1979-1983. The turf foundations that were exposed by Hermanns-Audardottir, totaled 1,100 square meters in area (see Figure 5.4). This site has yielded one of the potentially oldest set of turf ruins in Iceland (Hallsdottir 1983; Hermanns-Audardottir 1986, 1987, 1989, 1991a, 1992). Although, the dating has been hotly contested by numerous North Atlantic Scholars (Crawford 1991; Hermanns-Audardottir 1991b; Kaland 1991; Mahler 1991; Morris 1991; Sigurdsson 1991; Vilhjalmsson 1990, 1991). Essentially, Hermanns-Audardottir claims that the first occupation at Herjolfsdalur started in the Merovingian period (AD. 600-700), while most other scholars

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feel that the dates are too old and argue for a more traditional Landnam date (AD. 870s). Since there are detailed published accounts of the excavation, its finds and the discussion of contested dates, this section will only deal with the recovered archaeofauna.

The identification of the Herjolfsdalur archaeofauna was done in 1985 by Ms. Pirjo Lathipera of the Zoological Museum in Bergen, Norway. Lathipera's 1985 data tables are reproduced (Hermanns-Audardottir 1989:121-126) in Hermanns-Audardottir's monograph of this site, but there is no discussion of recovery methods. In the tables, Lathipera was able to breakdown the archaeofauna into "older" and "younger" depositional phases as well as listing those materials with "no associations" (see Hermanns-Audardottir 1989:123, Table 6.2). However, discussion here will only follow Lathipera's total assemblage listing because of the problems of dating the site and the phasing of the bone materials is unclear.

The archaeofauna is relatively large, with a assemblage total of 1,842 fragments. This figure can be further broken down with 1,135 fragments identified to the Class, Genera and Species levels (see Table 5.2). Figure 5.5 illustrates the relative percentage relationship of the major animal taxa, while Figures 5.6 and 5.7 chart out the relative

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percentages of the domestic mammals and the major mammalian species within the Herjolfsdalur collection. It is interesting to note that the cattle to caprine ratio is almost equal and there is a very high number of avian remains. This pattern is very similar to other Icelandic settlement or "Landnam" archaeofauna (see the Tjarnargata 4 assemblage described below). The assumption is that the wild-fauna, such as the bird and marine mammals, were heavily exploited, while the mix of domestic mammals species were experimentally balanced by the Herjolfsdalur farmers.

Hermanns-Audardottir (1989:121-126) made the observation that the relative number of cattle declines over time (from her "Older" to "Younger" Phases). She attributes this to a decline in fertility of the island's pastures, as a result of the island's volcanism. Although similar shifts have been noted elsewhere in Iceland from the Viking to Late Norse period (within th archaeofauna), the lack of locational information and discussion of recovery methods makes this observation impossible to verify.

It is also interesting to note the mix of seabird species in relation to the recovered fish species. This mix would suggest that the farmers at Herjolfsdalur were well equipped to exploit the Vestmannaeyjar's littoral zone full of shoals and rip-tides and adds further credence to the idea that

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the first farmers at Herjolfsdalur exploited their natural resources while establishing their domestic herds on Heimaey.

5.4 THE TJARNARGATA 4 SITE, REYKJAVIK

5.4.1 Site Background History

According to the excavators, Grimsson and Einarsson (1969), the area around the Tjarnargata 4 site was thought to be where the first settlement of Iceland was established by Ingolur Arnarson in AD. 874. The area first received attention in the spring of 1944 when a number of archaeological animal remains and site features were encountered while digging a house foundation. A "fire-box" pit lined with flat stone slabs was also discovered (Figure 5.8). In the early 1960s the general area was subjected to a series of corings (see Figure 5.9). This was followed by an excavation conducted in 1974, the year Iceland celebrated

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its 1,100 year anniversary. The 1974 excavations represents a generalized [21] site recovery where samples were taken.

Grimsson and Einarsson (1969:96-97) were able to reconstruct a generalized site stratigraphy and identified the stratigraphic position where the 1944 archaeofauna were found:

> "203-90 cm (from above [below the 1974 ground surface]): disturbed soil with remains of buildings of later centuries [materials most likely dating to the Early Modern period]. 3-4 mm thick "floor layer", 90-22 cm: peat layer, rich in wooden fragments and bones. 22-0 cm: brownish mud layer. 0 cm: gravel. On top of it was a 2-3 mm thick layer of bog iron [iron pan?]."

The peat layer (some 90.4 to 203.4 cm 1974 BGL) is particularly interesting, in that two radiocarbon dates were performed on larch (*Larix decidua*) and Birch (*Betula sp.*) samples. The larch sample was thought to be of European origin. The reported uncalibrated dates are 1140+/-70 BP (U-2082) for the larch sample, and 1190 +/-90 BP (U-2167) for the Betula sample (also see chapter 2). The 1st sigma calibrated dates for sample U-2082 are AD. 778-984 and for sample U-2167, AD. 689-978 (see chapter 2). Grimsson and Einarson felt that based upon these dates, and the

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21. Although the excavators do not make this distinction, one gets the impression that their term "pit" refers to a house foundation excavation done with a backhoe.

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archaeological materials, an early settlement was indicated. The authors also think that the peat layer was part of a midden that was dumped into an peat bog at the time of occupation. [22]

Grimsson and Einarson had performed an earlier set of tests in the same area during 1962. These test cores were dug along the southern part of the street known as Adalstraeti (numbers 16-18). The excavators also described these finds in the same 1969 article. Generally, they encountered burnt peat ash and remnants of turf buildings. Grimsson and Einarsson thought that there were two foci of early settlement activity, that around the area of Tjarnargata 4 and the other at Adalstraeti 16-18. Charcoal fragments taken from a floor layer from a deep test at Adalstraeti 18, yielded an uncalibrated date of 1340+/- 100 BP (K-940). This early date corresponded to some degree with the discovery of tephra layer VIIa & b (synonyms with Vo˜900 or the Landnam Layer, dated AD. 850-900 -- Hallsdottir 1987:12; the GISP2 ice core data from Greenland

---

22. The excavators do not offer any descriptions of the later occupational materials encountered at Tjarnargata 4. It is unknown at the time of writing this section whether Grimsson and Einarson had worked with the later materials. Clearly the focus of their 1969 article was a description of the nature and extent of the oldest part of this site.

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dates the Landnam ash to AD. 898 -- Paul Buckland, personal commuincation 1996). The pollen sample also taken from this deep test indicated a very early "historical spectrum" according to Bent Fredskild (Grimsson and Einarson 1969:97).

The archaeofauna that was collected from the 1944 season was discussed by Magnus Degerbol in a series of letters (dated between the years of 1951-1954) to Finnur Gudmundsson at the Icelandic Museum of Natural History [23]. Although there is no discussion of any recovery methods in these letters, a concept only rarely discussed in the 1940s, the assemblage was most likely collected by careful "*in situ*" hand picked samples. This is made evident by the small bone fragments in the archaeofauna, such as the Phalanx I of a great auk.

In these letters Degerbol had clearly identified the remains of 12 species in the Tjarnargata 4 assemblage. These species include domestic cattle (Degerbol assigned the linnean name ***Bos taurus domesticus***), domestic sheep (***Ovis aries***), domestic horse (***Equus caballus***), domestic pig (***Sus scrofa***), the walrus (***Odobenus rosmarus***) and a possible assignment to the mysticetes whale species (***Balaeoptera***

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23. The correspondence between Degerbol and Gudmundsson was kindly made available to the author by Aevar Petersen of the Icelandic Museum of Natural History.

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borealis or sei whale). Degerbol also noted the presence of a number of sea and shore birds. The avian remains were assigned to a swan species (*Cygnus sp.*), the great auk (*Pinguinus impennis*), the guillemot or common murre (*Uria aalge*), the Atlantic Puffin (*Fratercula arctica*) and a herring gull (*Larus argentatus*). Degerbol also notes the presence of the North Atlantic cod as well (*Gadus gadus*). Grimsson and Einarson, in their 1969 article, focus on the unusual remains, the large male domestic pig mandible with tusks (Figure 5.10) and a sentence or two concerning the walrus and the great auk remains.

5.4.2 Analysis of the Tjarnargata 4 Archaeofauna

In the following tables a re-analysis of the Tjarnargata 4 assemblage is presented. In looking over Tables 5.3 and 5.4, there is a discrepancy between Degerbol's species list and the author's. Missing from the author's re-analysis is the swan species, but not mentioned by Degerbol are the molluscan remains. Clearly, Degerbol and the author had analyzed two somewhat different parts of the same collection. It would also appear that some of the Tjarnargata 4 collection remained at the Zoological Museum in Copenhagen, where Degerbol had done his work. Meldgaard

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(1988:164) mentions that there are three great auk bones from this assemblage (a humerus, radius and ulna) that are now curated at the Zoological Museum in Copenhagen, Denmark.

It is also interesting to note that although there is this minor discrepancy in the NISP numbers (Number of Identified Specimens per taxon), the resulting analysis is basically the same. Figures 5.11 and 5.12 illustrate both Degerbol's analysis and the author's. It should be noted that Degerbol and the author were trained in different disciplines (Degerbol in zoology and the author in anthropology/archaeology) and that the analyses were separated by some thirty years in time. Examples such as this are important to note given the methodological pessimism of the "post-post processualists" in current archaeology.

The materials that Degerbol reported to Gudmundsson (see Table 5.3) represent only a NISP count. Degerbol was not concerned with fragment counts. Nonetheless, the re-analysis of the Tjarnargata 4 archaeofauna are represented by 828 remains, with an NISP count of 643 and a TNF (Total Number of Fragments) count of 185 (see Table 5.4). Table 5.4 taxonomic assignments are further broken down in Tables 5.5 and 5.6, where Table 5.5 breaks down the mammalian component, and Table 5.6 the avian component.

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Figure 5.12 and 5.13 graphically illustrates the relative percentages of the major taxa for the Tjarnargata 4 archaeofauna. In looking over this figure, the ratio of cattle and caprines approximates an almost 2 to 1 relationship, in favor of cattle. This pattern is somewhat odd in that the pattern for Viking/Norse and Early Medieval Icelandic cattle to caprine ratios are usually closer to a 1 to 1 relationship. One could speculate that this ratio reflects a "settler" pattern (in the same sense as used in the Historical Ecological literature, cf. Amorosi, Buckland, Dugmore Ingimundarson and McGovern in press), of a farmer who had not yet balanced his critical animal resource to its appropriate temporal landscape.

Among the other mammalian species to note are the presence of horse remains. These are more typical of the Viking/Norse period archaeofaunas in Iceland and the North Atlantic. The relatively high proportion of pig remains also reflects a "settler" pattern. Because of the pig's destructive nature (it was often used by farmers to up-root vegetation and turn soils), this animal might have been used to up-root patches of birch forest around the local site area. Combining the destructive nature of the pig and the use of the cattle and horses, would help to promote more

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grassland or pasture communities over time (cf. Guthie 1990).

Another interesting pattern to note is the relatively high proportion of birds within this collection (see Figure 5.13). Although the Tjarnargata 4 site is situated near a sea/shore bird rich area of the Reykjavik bay, this pattern can not wholly be explained by the site's location. In looking over Figure 5.14, what becomes immediately obvious is that the great majority of the bird remains are from species that would only inhabit the outer-most portion of the Reykjavik embayment (Nettleship and Birkhead 1985 and personal observations made in the outer Reykjavik bay area in 1995) by some 5-10 km out to sea. The great auk remains are even more problematic, since this species was only known to occupy the outer most coastal skerries, and more often than not, usually found out at sea (Bardarson 1986; Bengtson 1984; Bourne 1993; Meldgaard 1988; Petersen 1995). Currently the only known areas where this species would breed was on the Geirfuglasker, Geirfugladrangur (both skerries have disappeared after a volcanic eruption in 1830) and the Eldey sea stacks, some 12-25 km from the Reykjanes peninsula (which is an approximate 70-90 km from the Tjarnargata 4 site (see Figure 5.15). Therefore, the presence of these species would indicate that the

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Tjarnargata inhabitants were exploiting a wide ranging site catchment area. The presence of the seal and cod (8-12+ year age classes) remains would also point to the Tjarnargata farmers exploiting the outer edges of the Faxafloi (the Reykjavik bay area is part of this) embayment. The presence of these species might also reflect the decision of the Tjarnaragata 4 inhabitants not to cull their livestock in the early years of settlement. Decisions such as this are entirely consistent with "settler" patterns in island colonization situations (personal communication P. Kirsch, 1994).

5.4.3 Avian Skeletal Element Frequencies

Throughout this chapter and those subsequently dealing with the large Icelandic archaeofauna, little or no discussion will be offered concerning skeletal element frequencies. Part of this discussion will be reserved for the thesis summation on the taphonomy of the various Icelandic archaeofauna, while the rest will be reserved for future work. However, there are some intriguing patterns that can be observed within the avian component of the Tjarnargata 4 collection.

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In Figures 5.16-5.18, the distribution of the skeletal elements are portrayed for the auk (Alcidae) species. What is interesting to note are the relatively large number of wing elements or units (coracoid, humerus, radius, ulna, carpometacarpus and phalanx I). This most likely reflects a taphonomic indicator of very dense bone preserving very well in this site's archaeological context, as well as being visible in excavated earth.

The cranial elements also offer an interesting pattern. It has been the author's experience that farmers usually kill auks on or in near proximity to the breeding skerry. Auks are killed by having their neck "wrung" and, in most cases with the Atlantic Puffin (*Fratercula arctica*, the head is removed on the skerry. Farmers returning home with whole birds carcasses were usually forced off the skerry by an approaching storm and did not have the time to process their catch. It is also interesting to note that farmers will take a random sample of juvenile to senile adults individuals, with catch size vary from 30-100+ birds.

The cranial frequencies in Figures 5.16 and 5.18 (great auk and murre, respectively) do not reflect this pattern. Although the great auk pattern is small (2.91% seen on Table 5.7), the murre pattern is quite high (41.87% seen on Table 5.8). This might indicate that a small group of great auks

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and murres were taken on some outer skerry in the Faxafloi embayment, or even a long trip to the Geirfuglasker colonies off the SW tip of the Reykjanes penisula.

5.4.4 Tjarnargata 4's Great Auk remains

There are four localities where skeletal remains of the Great Auk have been noted in Iceland. Three are from non-archaeological contexts and are not described here (cf. Petersen 1995). These include the sub-fossil localities of the Westman Islands, Hafnir on the Reykjanes Peninsula near Kirkjuvogur and Byjarsker (Petersen 1995:65). The only archaeological context where Great Auk remains have been recovered is from the Tjarnargata 4 assemblage. The Westmann Island remain(s) were not available for study but are curated by the Icelandic Museum of Natural History. The location of the specimens from the Hafnir and Byjarsker remains are unknown.

However, in Bardarson's account (1986:18-26) of the last hunt for great auks (which occurred on 3 June 1844 on the Eldey sea stack), it is mentioned that two British naturalists collected skeletal materials from the Kirkjuvogur area (the Hafnir location) in 1858:

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> "It is thanks first and foremost to 2 Englishmen, John Wolley and Professor Alfred Newton of Cambridge, that so much is known about the history and final extinction of the great auk. The 2 men visited Iceland from 21 May to 14 July 1858 and stayed at Kirkjuvogur on the Reykjanes peninsula. They intended to visit Eldey, but unfortunately weather conditions never permitted this. They still made great use of their time before returning to England by collecting and recording information about the history of the great auk in Iceland, including the taking of statements from everyone who took part in the 1844 expedition - [the last known Great Auk Hunt to take place in Iceland and in the North Atlantic] - (apart from 2 members who were by then deceased). They also collected a great number of great auk bones which they found in kitchen middens from parts of the coastline which had suffered erosion. Professor Newton published his research in *Ibis*, the journal of the British Ornithologist's Union - [Newton, A., 1861, Abstract of Mr. J. Wolley's researches in Iceland respecting the Gare-fowl or Great Auk (*Alca impennis L.*, *Ibis*, 3 (42): 374-399.) - (Bardarson 1986:26)."

The Tjarnargata 4 great auk remains are represented by a small sample of 78 bones (75 are curated by the Icelandic Museum of Natural History and have a field number of Pi 1-Pi 75 assigned to them by the author, and 3 by the Zoological Museum in Copenhagen, Denmark). Tables 5.9 to 5.37 list the element and osteometric data for these materials.

The largest sub-sample of the Tjarnaragata 4 great auks, the humerus with 18 specimens, (see Table 5.16) was chosen for comparison with other known great auk skeletal materials from the Western North Atlantic. The Western North Atlantic is thought to constitute the NW foci of the great auk

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population. The known breeding colonies were Funk Island, off the NE tip of Newfoundland, Canada and the Geirfuglasker islands in SW Iceland. There are some doubts that a breeding colony was ever present in Western Greenland. Currently many researchers see a western winter migration of great auks from Iceland to Greenland, although a smaller migration from Funk Island might have been possible (Meldgaard 1988:163). No attempt has been made to compare osteometic data from the eastern part of the North Atlantic. The Norwegian data can be found in Hufthammer's doctoral thesis (1982). The comparative materials used here consists of:

1. - The Funk Island colony, known to exist off the NE coast of Newfoundland, Canada. There are two samples represented here. The one described by Meldgaard (1988:164) was a surface collection made in 1887 and is now curated by the National Museum of Natural History (NMNH) at the Smithsonian Institution in Washington D.C.. The second sample was collected in the 1936 as a "grab bag" surface sample by F.A. Lucas and E.T. Gilliard (Gilliard 1961). These materials are curated by the department of Ornithology, at the American Museum of Natural History (AMNH) in New York (these materials were kindly made available for study

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by Mary LeCoy and Allison Anders). The NMNH sample consists of 58 specimens, the AMNH sample consists of 860 specimens.

2. - The Ormond, Florida sample consists of a single humerus, and is curated at the department of Ornithology, American Museum of Natural History.

3. - The known great auk materials that have been recovered from archaeological contexts in West Greenland (Meldgaard 1988). This sample consists of 14 specimens.

Tables 5.17 and 5.18 present the summary statistics for the Funk Island, Ormond and West Greenlandic materials. Although Hufthamer (1982) notes that there is a regional stature variation in the Norwegian materials, there does not appear to be a similar variation evident in the Western North Atlantic materials. Figure 5.19 charts out the Greatest Length (GL) for the humerus of the AMNH Funk Island sample (569 observations) to those of the Tjarnargata 4 sub-sample (5 observations). The Tjarnargata 4 materials tend to fall within the upper half of the variation seen in the Funk Island materials. This also indicates that the Icelandic population is not all that different from the Funk Island population. It also draws attention to the fact that

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the Tjarnargata 4 great auks are only represented by mature to senile adult individuals. The lower half of this graph for the Funk Island great auks would indicate juveniles and young adults (assuming lengths fall below 104 mm. are younger animals, also see Meldgaard's description (1988:151-152)).

Clearly more work needs to be done with the osteometrics of the great auk (currently underway by the author and in discussion with the NABO Zooarchaeology Working Group). What is interesting to note from this rather simplistic statistical manipulation is the size uniformity (stature) of this population since the Viking period until the mid AD. 1800s when this bird was hunted to extinction. This has important ramifications in Global Change studies, where changing climatic conditions seen throughout much of the Western North Atlantic (as reflected in the GISP2 and GRIP Ice Cores) had what seems to be little effect on the stature of this population. The more obvious impact to the great auk population was the changing habitat ecology that made this specialized species so vulernable to human exploitation.

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5.4.5 Conclusions

Altough the Tjarnargata 4 collection is small and somewhat problematic in the manner it was recovered, there are a number of patterns that provide some clue as to how the first settlers attempted to colonize Iceland. Perhaps central to this glimpse of first occupation are the patterns that can be observed from the alcid remains.

There are no juvenile auk and especially great auk remains in the Tjarnargata 4 collection, which imply:

1. - The site of Tjarnargata 4 is not close to the great auk breeding skerries such as the known Reykjanes skerries of "Geirfuglasker" or the island stack of Eldey (Bengton 1984; Petersen 1995:65).

2. - The fact that the Tjarnargata remains are only from adult individuals suggest that the Tjarnargata inhabitants were exploring the SW coastline of Iceland, and certainly a good distance from the in-shore waters. This is supported by a number of Greenlandic Inuit hunting legends and Otto Fabricius observation made in the 18th century (Meldgaard 1988),

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where the great auk was encountered while kayak hunting at sea.

3. - The skeletal element frequency charts for the great auk are different from the atlantic puffin, but similar to the murre charts in that cranial remains were recovered. This is unlike the more usual pattern of atlantic puffin butchering, where the heads are removed close to the site of capture (usually on the breeding skerry, this pattern was noted by the author along the south coast and the eastern island of Papey). This might suggest that the small group of great auks and murres were encountered at sea, collected and later butchered on site at Tjarnargata.

4. - An alternative explanation might be due to the "known" seasonality of the great auk. Meldgaard (1988:155-157) has noted that during the 17th and 18th Centuries, from September to January, adult great auks were seen infrequently off the coastline of southwest Greenland. Usually this bird was rare, but in "...some winters they turned up in larger numbers. They were encountered only among the outer islands and skerries, never close to the mainland or on shore (Meldgaard 1988:157, Meldgaard paraphrasing Otto

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Fabricius observations in the 18th century)". If a similar behavior occurred in Iceland, the auk (great auk and atlantic puffin) remains at Tjarnargata 4 might represent a winter's capture or even an "auk wreck" (birds killed in a storm and washed ashore) where the whole carcass was taken back to the farmstead. Supporting this view is the lack of juvenile specimens in the Tjarnargata 4 bird materials (implication being that chicks hatch in late Spring of Summer date and mature by Winter, Meldgaard 1988; Nettleship & Birkhead 1985).

The interpretation of seasonality from these remains (cf. Amorosi 1984; Grayson 1983, 1984) is difficult to assess, but the above observations are hard to ignore. Based upon the site photographs, profile description of the bone materials coming out of one stratum and other downtown excavations in this same area (Einarsson 1994; Hallgrimsdottir 1987; Nordahl 1988; Skia 1993), the Tjarnargata 4 deposits seem to be primary in nature. This implies that there was a quick deposition and little disturbance of the deposit until excavation (a situation often seen with many Icelandic sites). Therefore an attempt at seasonality

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of "capture" (not occupation) can be offered for at least the great auk remains.

There are other clues from Tjarnargata's terrestrial economy that help to establish a "settler" pattern for the Viking period in Iceland. The cattle to caprine ratio seems to be "off-balanced", as if the mix of animals was established for a more farmed portion of the boreal North Atlantic (the eastern tier islands of the U.K. or mainland Scandinavia). The use of pigs in conjunction with cattle and horse to promote grassland or pasture communities would seem well justified if the claims made in the Landnama Bok (Book of Settlement) are correct about "the forest stretching from the mountains to the sea".

It is also interesting to note that there is a heavy reliance on natural resources (such as whales, seals and sea birds) in combination with domestic livestock. Although this is more impressionistic, it would seem that the first set of resources to be exploited are those natural ones or, as the Icelandic expression goes, the "Gifts of God". In this manner, the farmer, with his more vulnernable domestic livestock, would be given time to adjust to a set of changing environmental and landscape parameters. This adjustment would then supply the time needed for a "settler"

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to cross a critical threshold and become an "established colonist".

5.5 THE HJALLHOLL SITE, BOGARFJORD-EYSTRI, BOGARFJARDARHREPPUR, NORDUR-MULASYSLA

5.5.1 Site Backgraound History

The Hjallholl site first came to the attention of the National Museum in the early 1980s when an advocational archaeologist, Helgi Eyjolfsson, discovered the remains of a possible Viking period site. The section that drew Eyjolfsson's eye was an erosion face cut into the side of a farm mound (the western erosion face) which lay near the edge of a fish processing plant. Eyjolfsson collected two "hog-back" style, single sided composite bone combs and a small collection of animal bones and sent them to the museum for curation. In was in 1986 that the author had the opportunity to detail these remains. The combs are illustrated in Figure 5.20 and can be tentatively dated between the 12th and 13th centuries. The animal remains

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recovered from this erosion face are detailed in Tables 5.38 and 5.39. Based upon these materials and the request from the National Museum, it was decided in 1987 that a site visit was necessary in order to determine the nature of the archaeological deposits.

A visit to Eyolfsson's home was paid upon arrival at the town of Bakkigerdi. Eyolfsson, by that time, had recovered four other Medieval artifacts from the western erosion face at Hjallholl. These included a fragmentary stone spindal whorl, a "lugged" steatite bowl, a whale bone knife (used as a loom shuttle and two whetstones. Eyolfsson kindly agreed to hand these artifacts over to the National Museum for curation and the discovery of these item raised expectations of excavating a relatively old Medieval or Norse period site.

The site of Hjallholl is located in the town of Bakkagerdi which is situated on the northwestern side of Bogarfjord-eystri in northeast Iceland. The site of Hjallholl was situated, with the western edge of the farm mound adjacent to a fish processing plant ("Frystihus" as seen on Figure 5.21). The farm mound had been further disturbed by two large oil storage containers on the southern edge of the mound. Hjallholl's western edge also

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has a two story concrete house with a foundation, and this also disturbed this part of the farm mound.

Work began by clearing the western erosion face (see Figure 5.22) and a systematic set of soil cores were made atop the farm mound. The results of these cores are listed Table 5.40 and the core's position is illustrated in Figure 5.23. These soil cores indicated extensive disturbance by modern building activities, but, more importantly, the presence of well-to-moderately preserved animal bone and other organic remains. There were also concentrations of fire-cracked rock and worked whale bone which would characterize Medieval occupations.

When the surface of the Hjallholl farm mound was mapped, (Figure 5.23) a structural turf mound was noted. This mound contained two shallow depressions, suggestive of collapsed rooms. Based upon the results cores, the finds from the western erosion face and the position of the turf ruin, a 2.00 X 3.00 meter test unit was placed closer to the western erosion face. This was done in order to avoid encountering the lower phases of the "slumped" surface turf ruin [24].

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24. Icelandic archaeological research permits aree rather narrowly defined, often placing many constraints upon the archaeologist. The conditions of the 1987 research permit did not allow for the excavation of obvious architectural remains. Hence, the focus of this work

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This test unit was designated as Test Cut #1. A grid system was established to parallel the western erosion face in the hopes that the profile could be related to the test unit. Unfortunately, the western erosion face was badly disturbed and rather unstable due to the construction of the fish plant foundation. Work was stopped along this erosion face and moved to the top the farm mound. The grid system was divided by meter squares and given an alpha-numeric code, the letter codes of F and G and the numeric codes of 8-10, starting from the southern end of the test cut. Starting the grid designations in this manner would add a measure of flexibility and not complicate the grid designations should the focus of the excavation have to shift.

The recovery of organic remains received a strict three stage program. As large bone materials and artifacts (horse to caprine sized bones) were exposed, they were recovered, *"in situ"* bagged, located to their associated grid meter unit and level. The second stage was completed by placing all excavated soils through a dry screen of 4mm. wire mesh. If a "hot spot" of densely packed organic remains was noticed while excavating, the recovered soil was placed

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was to locate and define the nature of Hjallholl's midden deposits.

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through a 1mm. wire mesh. Screen finds and organics were bagged to their respective grid unit and level. Artifactual materials were kept separate from the animal bone materials. In this way a even flow of excavation and screening was maintained on site, with the bagged remains being shipped back to the National Museum for further analysis.

The 2 X 3 meter test cut recovered a largely intact stratigraphic sequence. Table 5.41 describes the Stratigraphic Units (SU) encountered in this test. These SUs were collapsed into four larger Analytic Units (AU). The AUs were defined by the nature of the change in bedding angles and the superposition of turf walls as seen in Figure 5.24. The AU 1 designation collapses the first four stratigraphic units (SU 1-4). Below these modern turf accumulation were four densely packed burnt peat ash strata. These layers contained numerous animal bones, organics such as charcoal fragments and fire-cracked rock. These deposits can be described as horizontal dumps of burnt peat ash used to level the ground surface over AU 2, a turf wall. Figure 5.25, illustrates the plan view of the test cut once the modern turf was removed. Evident in this plan is the first phase of structural stone as SU 1-4, peat ash was packed around and leveled over the turf wall. Figures 5.26-5.27 illustrate the interface of the strata of AU 1 with AU 2's

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turf wall slump. Figure 5.28 illustrates the first wall course that was situated between AU 1 and AU 2.

Numerous quantities of fish remains were recovered from this strata and identified in the field as belonging to the Gadids (or codfish family). Also recovered were some domestic mammals, whale bone, seal and bird materials. The only artifact of note was a worn copper coin-alloy coin. The coin resembled several examples of late-Medieval types that date between AD. 1100-1400 (Gudrun Sveinbjarnardottir, personal communication 1987).

AU 2 was composed of the strata, SU 5-8, which were a well defined turf and stone wall. A stone line or net sinker was found on the southern side of the unit. The location of the stone line sinker is illustrated in Figure 5.29, which would suggest an exterior side of the turf structure. This is further supported by the recovery of another wall course at the approximate depth 86-96 cm. below the 1987 ground surface (BGS -- see Figure 5.30). This second wall course ran at a right angle (roughly in a north-south direction) to the first (which ran in a rough east-west direction). By the approximate depth of 90-120 cm. (BGS), the bottom of both these walls were encountered. Below these strata was the next analytic unit, AU 3.

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The strata that comprised AU 3, SU 9-10, were a series of pinkish burnt peat ash tucked within the last course of AU 2's turf and stone wall. These layers were substantial in relation to the strata thus far encountered. Cut into these two strata was a hearth (see Figures 5.31 and 5.32). This hearth was filled with burnt peat ash, wood charcoal and numerous burnt animal remains (mostly of fish). The hearth extended outside the northwestern wall of Unit A, and most likely represents an early Norse or Viking period "long fire" hearth. Such hearths often ran along the center of the central hall as can be seen in Icelandic turf ruins as Hofstadir in Myvatnssveit (see Figure 5.33).

Finally, AU 4 was represented by one cultural stratum, SU 13. This consisted of a pair of large, well rounded cobbles (see Figure 5.24). This represents the first cultural deposit on the western side of the Hjallholl farm mound, and is probably a remnant of Hjallholl's first building phase. At a depth of 1.60+ meters, SUs 11 and 12 were encountered. These strata represent a natural stratigraphy, composed of stone "fist" sized cobbles and large "thumb" sized gravel, that is interpreted as part of a Holocene river terrace leading into the fjord.

Clearly, the test cut at Hjallholl indicates a disturbed farm mound along its edge. The mound center however, still

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contains an undisturbed sequence of deposits with good organic preservation. Although the area coverage for this test trench is small, the turf remains seen at Hjallholl do indicate at least three episodes of turf construction, the first being the visible surface depressions and followed by AU 2 and 4. The juxtaposition of the burnt peat ash layers of AU 1 indicates a grading event as the Hjallholl's turf structure "snaked" around its farm mound [25]. It is also clear that AU 1 lacks the characteristic concentration of 18th-19th ceramic and glass thus dating this phase to the Late Medieval period. The basal hearth seen in AU 3 has the distinctive character suggestive of either an Early Norse or Late Viking period deposit.

5.5.2 Site Survey Results

Limited site survey work was also conducted at this time in the Bakkagerdi area. Two other turf ruins were visited; Bakki, a saga-mentioned site, and the site of Os. The site area of Bakki was used in 1987 as a sheep holding pen (see

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25. The superpositioning of one turf structure over another has been described as a "snake-like" movement as the accumulation of deposits form a tell or knoll, commonly referred to as a farm mound (cf. Amorosi 1992).

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Figure 5.34). This pen sat atop a farm mound. Preliminary core tests indicate that there were several organic strata along with a high degree of modern disturbance. Local folk tradition claims that the site of Os was the site of a Hanseatic trading booth (see Figure 5.35), but a test pit did not indicate any presence of organic remains or cultural layers.

5.5.3 Summary of the Zooarchaeological Results

The analysis of the Hjallholl archaeofauna is ongoing. Thus far the analysis of the Hjallholl fauna is represented by 3,399 remains [26]. Analyses yet to be finished are:

1. - The species identification of the avian and fish remains.

2. - The osteometrics, aging, skeletal element frequency and paleopathological parameters of the archaeofauna.

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26. A total of 3,379 were collected from the excavation of Test Cut #1 in 1987, the remaining 20 remains were collected by Eyjolfsson.

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3. - Funds have now been obtained for radiocarbon and C13/C12 ratio assey. These results will be reported by the author in the near future.

Although these data are preliminary in nature, general site trends can now be discussed.

In Table 5.42 and in Figure 5.36-5.38, the relative percentage of the major taxa for the entire Hjallholl assemblage is illustrated. There are two rather odd patterns to note. The first is the relatively low number of bird remains in this collection. This is rather uncharacteristic of Early Norse and Viking bone samples within Iceland. Usually, the pattern is reversed in that the fauna has a sizable number of bird (usually sea and shore birds) remains (Amorosi 1991a). This becomes even more uncharacteristic when considering the local avian ecology of Bogarfjord-eystri. This fjord has several large auk and gull colonies situated at the mouth of the fjord, some 8 km. distant. The other odd pattern is the relatively high cattle to caprine ratio (almost 1 cow to 20 caprines). This ratio is high for both the Norse and Viking periods in that the cattle to caprine ratio is usually closer to 1 cow to 6 caprines. Perhaps this strange pattern can be tied to the problem of limited area coverage yielded by the 1987 test cut.

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Nonetheless, the 1987 sample is mostly composed of gadids (the cod family). The horse relative percentage is also high, but consistent with Icelandic Medieval and Viking samples. The whale remains are fragmentary and the distinction between great and small whale is not possible. These remains are most likely the result of artifact manufacture debris but the function of the finished object(s) is impossible to determine at this time. It is interesting to note the presence of pigs in trace percentages within this collection, given the arctic nature of Borgarfjord-eystri's marginal pasture land. Pigs are normally a destructive animal to pasture and these animals might have been kept on the small islands or peninsula within the fjord, a practice not uncommon within the North Atlantic. Phocids are also represented in small numbers within this assemblage.

The Hjallholl assemblage is further broken down by its Analytic Units in Tables 5.43-5.45 and in Figures 5.39-5.47. In looking at Figures 5.39, 5.41 and 5.44, a certain similarity can be seen in these charts. The fish remains are composed of gadids and predominate each of the Analytic Units. The other very noticeable class are the caprines, especially in AU 2.

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There are some notable shifts in the relative percentages over time. There is a increase in cattle from AU 3 to AU 1. Likewise there is also an increase of the relative percentage of caprines. This cattle/ caprine shift is more comprehensible when examining the cattle to caprine ratios in Figure 5.48. Similar to other Icelandic archaeofauna, (Amorosi 1989a, 1991a) the trend toward keeping more caprines in the Late Medieval period can also be documented for Hjallholl. There is also a high proportion of horse remains in AU 3. This might reflect the "pre-christian or pagan" Viking practice of eating horse flesh.

Another noticeable shift is in the increase in the whale remains from AU 3 to AU 1. As mentioned above these remains are debris from the artifact manufacture. These remains might also be a very subtle archaeological signature as well. As a maritime byproduct, these fragmentary remains demonstrate a growing connection with the exploitation of near shore resources. This might also document the growing interest in cod fishing as the stock fish trade grows in Iceland, starting in the Late Medieval period.

If the major taxa charts are grouped together as in Figure 5.49, it is interesting to note that fishing activities at Hjallholl are important from the Viking/Early Norse period. Although Icelanders are later tied to this

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resource as a "staple finance" (a term first coined by Earle (1991)) in the Late Medieval period, the antecedents of this trade seem to start much earlier. A similar pattern can be noted for the sites of Akurvik, Gjogur (see below, in this chapter) and Granastadir (see chapter 7).

5.5.4 Possible Taphonomic and Sampling Error Problems

Although there are clearly economic trends within the Hjallholl data, there is a strong indication that the Hjallholl assemblage also suffers from some taphonomic and sampling error problems. The sample size for AU 2 is small in comparison to the other two Analytic Units. This in itself may not be an issue, but when the animal categories are examined a bit more closely there seems to be a size sorting of bone materials. The materials are composed of caprines, birds and fish, bone materials that are small enough to be compacted into a turf and stone wall setting. Also, when Figure 5.50 is viewed, AU 2 has a noticeable jump in caprine remains, yet the relative percentage of cattle does not make a similar jump. This is even further evident in the cattle to caprine ratio charted in Figure 5.48. This all suggests that the fauna grouped into AU 2 is biased as a

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result of size sorting due to the turf and stone wall found in AU 2.

Although great care was taken to recover this archaeofauna, there remains the question of how representative was the test cut in relation to the rest of the Hjallholl farm mound. Clearly, there are a number of architectural phases at Hjallholl and the test cut came down on one particular order. Would the interpretation of these architecture features change if the test cut was moved several meters in any one direction? Clearly a larger open area and in phase excavation should be done. Nonetheless, Hjallholl represents a first glimpse into the Viking/ Late Norse economy of this unknown area. Many of the economic trends noted above are consistent with the pattern seen in other Icelandic archaeofauna.

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5.6 THE MIDBAER SITE (SITE NO. 4505-1), FLATEYJARHREPPUR, AUSTUR-BARDASTRANDARSYSLA

5.6.1 Site Background History

Breidafjordur (or the broad fjord) is a wide expanse of relatively protected water, generally less than 50 meters deep, dotted by over 200 islands and rocky skerries. The fjord is bounded on the south by the rugged Snaesfellsnes peninsula and to the north and east by the equally steep mountains of Bardastrandasysla (see Figure 5.51). Breidafjordur offers relatively little pasture land for domestic livestock and the major farms are situated on the larger islands. One of the largest of the fjord's many islands is the island of Flatey, which is approximately 3 X 0.5 km in extent (see Figures 5.52 and 5.53). Flatey is thought to be settled during the initial settlement period (ca. AD. 870-930). The island has gently shelving waters and its scattered smaller satellite islands support rich inshore communities of seals, sea birds, which include the economically valuable species of auks and ducks, fish, mollusks and seaweed. Flatey also has comparatively

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sheltered waters and many landing spots for small craft up to 20 feet. This makes the exploitation of these marine resources a good deal less hazardous than other areas in Iceland.

In many other regions in Iceland, wealth and status was marked by the number of cattle and the extent of pasture land a farm had. Breidafjordur's documentary record suggests a break with this general Icelandic pattern. The marine resources exploited on Breidafjordur's many islands became more than a reserve backup to the domestic livestock economy. Many of the Sagas note the powerful chieftains of this district that were able to finance feasts and feuds. In later periods, the region retained its prosperity with one of the major monasteries located on the island of Flatey. During the 16th and 17th centuries, when famine and disease reduced Iceland's population, Breidafjordur remained fully occupied. By the late 18th century, the people of Flatey had set up a library and many farmers were buying and reading foreign language books. While the settled population of Breidafjordur was limited by the amount of land available, approximately 500 people inhabited the islands of Flateyhreppur by the Early Modern period and the district had an enviable reputation as a place where "none starved".

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5.6.2 The 1989 Column Sample collected from Flatey

Little is known about the basic economy of this region from the documentary sources and the opportunity to investigate the area archaeologically began in June of 1989. Flatey is a low lying island marked by two gentle ridges, one on the northern end and the other on the south side, both running along its main east-west axis. It is possible that these ridges were once smaller islands in the early Holocene, similar to Flatey's present satellite islands. The island of Flatey might have been formed when a series of winter storms surged over the area and silted over these ridges forming, an outlet near the western pond area.

Flatey has a small modern settlement with two active farms, a fish processing plant and numerous small summer houses that occupy the western end of the island. Approximately 200 meters south of the modern village and directly on the southern mid-line ridge is a churchyard with a wooden church built in the 18th or, more likely, 19th centuries. Next to the churchyard lies a ruin of a turf house and associated structures with an extensive mound running down hill toward the meadow (center of the island, see Figure 5.53). This site was traditionally called

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Midbaer and was thought to date to the initial settlement of the island. It was abandoned prior to the writing of the 18th century land register known as the Jardabok and a description of the Midbaer site does not appear in this census. The Midbaer site does appear as a turf ruin on a 1906 map drawn by Samuel Eggertsson (see Figure 5.54). The site's location near a churchyard suggested both considerable age and relatively high status. The structure had been damaged by tractor trails and the local farmers have also discussed the complete flattening of the site. However, because a "scientific interest" was shown for the investigation of this site, the farmers decided not to destroy the Midbaer ruins.

A subsequent 1995 visit saw the further destruction of the site. A large outdoor billboard had been anchored into the Midbaer ruin's southern wall, anchored into small concrete blocks dug into the ground by some 50-100 cm. This has caused further disturbance of the 18-19th century deposits. The irony is that the billboard details the local 19th century cultural history of the island of Flatey.

The 1989 damage from the tractor paths produced two kaolin pipe bowls typologically datable to the mid 18th century (see Figure 5.55). During the 1920s, local farmers had dug a *surhey* pit, approximately 2 X 2 meters, into what

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appeared on the surface as a midden deposit (This is designated as "a." on the site plan map, see Figure 5.56). The sons of these farmers claimed that they had hit nearly 3 meters of midden-like deposits. The fill from this pit contained quite a few animal bone fragments when the author arrived in 1989. Work began with mapping the 1989 surface and the clearing of the 1920s *surhey* pit feature. Exposed from this clearing was a 1.5 meter strip of the former *surhey* pit clay-lined wall. Behind the clay liner was an extremely rich and clearly stratified deposit. The profile was cleared down to approximately 2.10 meters before encountering the island's water table (see Figure 5.57). Soil cores were used to determine how much further this deposit went down but water suction and mud made it impossible to get a true depth reading. Although subsoil was not reached, the total depth of the deposit was estimated to be between 3 to 3.5 meters.

The deposit sampled was one of the richest midden deposits encountered in both the author's and Tom McGovern's working experience in Iceland. The midden contained numerous strata that was so packed with animal bone that little soil remained between the bones! Given the time constraints for the 1989 season, it was decided that a column sample (or a stratigraphic bulk sample) of this

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deposit would be the best method to extract these materials. The column sample's dimensions were 0.50 X 0.25 X 2.10 meters, taken on the cleared profile. This sample recovered approximately 90 kg of animal bone materials (for a point of comparison, the 1987 test cut from the rich midden of Svalbard only recovered 45 kg of animal bone, and a much larger volume was excavated, 2 X 1 X 2 meters). Diagnostic artifacts were, unfortunately, rare though a woolen cloth and a preserved wooden barrel stave were recovered. Significantly, the absence of 18th and 19th century ceramics and bottle glass was noted.

Four other shovel test were performed between the *surhey* pit ("a.") and the mound northeast of the pit (designated as "b." on the site plan map, see Figure 5.56). This was done in order to delineate the extent of the midden deposits. The stratigraphic descriptions can be found in Table 5.47. Shovel Tests # 1 & 2 indicated a deposit of fire crack rock, situated between 40-50 cm. below the ground surface. Midden deposits were also encountered downhill toward the central meadow area of Flatey as seen in Shovel Tests # 3 and 4.

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5.6.3 Stratigraphic Assignments and Radiocarbon Dates

Once the *surhey* pit's clay-liner was removed, each stratum was identified with a Stratigraphic Unit number (SU). The ground surface started the stratigraphic sequence and the limit of excavation received the assignment of SU-33. The Stratigraphic Units are listed in Table 5.46 and the profile from the *surhey* pit is illustrated in Figure 5.57.

Two samples were sent to Beta Analytic labs for radiocarbon assey. Cattle remains from SU 25 and 26 were designated as Midbaer radiocarbon sample #1. These remains consisted of a neonatal radius, an adult frontal bone fragment and distal femur. SU 25 and 26 represent the first change in bedding angle in the Midbaer profile. Similarly, cattle remains were selected from SU 32 and 33 and designated as Midbaer radiocarbon sample #2. The sample consisted of a neonatal humerus, an adult nasal bone, a mandibular fragment, distal metacarpus and phalanx I. SU 32 and 33 represents the lowest possible strata within the Midbaer profile (the actual bottom of the cultural strata was not encountered since the water table flooded the surhey pit). The reason for using a combination of two strata was

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to guarantee enough material to perform the AMS dates and the C13/C12 dietary ratio.

The results for these dates were rather satisfying. The Midbaer radiocarbon sample #2 yielded a calibrated midpoint date of AD. 1283 and a 1st sigma value of AD. 1277-1388. The second radiocarbon sample yielded a calibrated date of AD. 1443 with a 1st sigma value of AD. 1421-1619. For further information concerning these dates, see Chapter 2, "Temporal sequencing of the Collections".

The C13/C12 ratio results are also particularly interesting, especially considering that Flatey is a relatively small island with a limited pasture. If one believes the d C13 ‰ values (see Chapter 2 for the C13/C12 ratio data table, Midbaer #1 has a value of -24.4 and Midbaer #2 has the value of -27.3), then these values would indicate that cattle were consuming terrestrial types of fodder with little or no marine supplements. This is somewhat surprising in that seaweed is often used in Iceland as a supplement for bovid fodders. It is also tempting to speculate that there is a decrease in the amount of terrestrial pathways as time passes. However, such an argument will require many further samples from this midden before such an assessment could be made.

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Based upon the AMS dates the artifactual, documentary evidence and changes in the stratigraphic bedding plane, the SU were collapsed into Analytic Units (AU). These AUs consisted of the top strata, that is SU 1-15 (AU 3), with a date of ca. AD. 1600-1700. The middle strata SU 16-28 and 31 (AU 2), dating ca. AD. 1400-1600. Finally the lower strata 29-33 (AU 1), dating ca. AD. 1250-1400.

5.6.4 Site Survey Results on Flatey

Although time was extremely limited (4 days), some site survey was also performed on Flatey and the far island of Oddbjarnarsker (mentioned previously in Chapter 3). The site of Midbaer was mapped and designated as 4505-1. An Elf Rock alignment (large boulders assumed to be the homes of Elves) was recorded west of the Midbaer site on the other side of the graveyard atop the southern ridge near on the property of the Laknishus farm (see Figures 5.53 and 5.56). The alignment received the site registration number 4505-2 (see Figure 5.53 and 5.58).

It is a standard practice of the National Museum site register program not only to record turf ruins but to also record local folklore that is part of a cultural landscape. Not much is know about this alignment and the tradition of

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these rocks being "Elf Houses" goes back to 1906 (Aevar Petersen, personal communication 1989). A subsequent visit to the site area in 1995 saw the loss of the three most southern rocks.

The site area for the Medieval monastery and the "Cloister stone" were assigned the registration number 4505-3 and 3a. These areas were not mapped due to time constraints. Local folk tradition claims that the Cloister "stone", a hollowed out basaltic flat rock, was part of the Medieval monastery that once stood on Flatey.

5.6.5 Preliminary Summary of the Archaeofauna

Although the analysis of this archaeofauna has not yet reached completion, the materials appear to be are strongly patterned. It should be noted that these data are preliminary in that:

1. - The Bird sp. category in all of the tables incorporates all the avian materials and lists them under this general term. Species identifications are still in progress but slowing this process is the identification of the sea bird materials. Unlike most mammal identifications and some anseriformes (water

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birds), sea birds are extremely similar in gross morphological aspects and age-size variation. Although there are large and well documented avian osteologiocal collections available for comparison, none includes a set of materials that can account for regional and age specific ranges of variation, which is often the key to separating out one species from the next. The author has been slowly building such a collection and will complete this work in the near future.

2. - With the completion of all the species identifications, osteometric analyses can also begin. Only the osteometric for the Atlantic Cod are presented in Table 5.49 and graphed in Figure 5.59.

3. - Age, skeletal element frequency and paleopathological parameters of the archaeofauna are nearing completion and will be reported in the near future.

4. - The shovel test materials will also be completed in the near future. Priority was given to completion of the surhey pit samples.

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Despite these factors, strong patterns are evident in these materials and a preliminary discussion of these patterns can be made.

The assemblage size of this collection is rather large for one derived from a small column sample. In all, 10,803 remains were identified with a very high NISP count of 8,961 and a low TNF count of 1,842. Table 5.49 presents the taxonomic assignments for the entire collection. Tables 5.50-5.52 breakdown the assemblage by their Analytic Units.

Looking at Table 5.49 and Figure 5.60, the major taxa found within this assemblage are dominated by avian and fish species. If the domestic mammal component is further broken down, cattle and caprines make up the major relative percentages (cattle with 50%, caprines with 46.9%) of this category (see Figure 5.61). It is also interesting to note that a small number of pig remains (NISP= 2, RF= 3.13%) can be found in this assemblage. This is unusual, especially given that these animals are destructive in uprooting pasture land and Flatey has little farm land that could be lost to this animal. However, if only the major mammal groups are compared, seals have the highest relative percentage (70.5%), the bovids (cattle with 15.2% and caprines with 14.3%) almost equal percentages (see Figure 5.62), and pigs a trace amount (3.13%).

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In Tables 5.50-5.52 the assemblage is broken down into its three Analytic Units (AU1) already described. AU1 has the lowest NISP count (701, with additional TNF= 455), AU2 the next (2,770, TNF= 1,246) and finally AU 3 the highest of the categories (5,232, TNF= 361). The fauna recovered from AU1 is predominantly marked by avian and gadid fish species. It is interesting to note that the bird component is somewhat greater in numbers than the fish remains (see Figure 5.63). In other earlier Viking period faunas such the Tjarnargata 4 or Herjolfsdalur collections, the exploitation of sea and shore birds is quite common. If the domestic mammal component is examined, cattle and caprines are equally represented (see Figure 5.64). However, when this component is placed into a larger mammal grouping, Phocids comprise almost 73% of this category (see Figure 5.65).

The avian and Gadid fish component found in AU2 dominate this period's fauna. However, there is a reduction of the avian remains (see Figure 5.66). The domestic mammal graph seen in Figure 5.67 portrays an even greater percentage of cattle in comparison to the caprines. It is also interesting to note the introduction of pigs in this period. Yet, when the domestic mammals are placed into the larger context of identified mammals, the phocids are predominate

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(see Figure 5.68). The reduction of caprines becomes even clearer in this pie graph.

The fauna from AU3 is strongly marked by fish species and there is a drastic reduction of avian species (see Figure 5.69). The fish component is comprised of the gadids, in particular the atlantic cod. When the domestic mammal component is graphed, cattle exhibit a reduction in numbers while the caprine category expands. Once again, pigs are present in trace amounts (see Figure 5.70). When the larger mammalian component is examined, Phocids have dropped in numbers while the Bovid categories have grown (see Figure 5.71).

In looking over results from the AU analysis of the archaeofauna, one can't help to wonder if AU 1 and 2 are a bit more artificial in composition. The TNB counts for AU 1 are low in comparison to the other two AUs and might not be a representative sub-sample. In addition the cattle and caprine percentages look to be forced. In Table 5.53, AU 1 and 2 are combined for sake of comparison and to see if the economic trends in the lower period fauna are strongly different from AU3. When AU 1 and 2 are combined, the pattern differences noted above still hold true. The avian component of AU 1 and 2 is relatively larger than in AU3. The gadid fish component of AU 1 nd 2 is smaller by at least

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half (see Figure 5.72). This does suggest that fishing became ecomonically more viable in the 1600-1700s. Likewise, there is a reduction in birding between the Medieval and early Modern periods.

When looking over the relative percentages of the domestic mammals for AU 1 and 2, cattle predominate, followed by caprines and a trace percentage of pigs (see Figure 5.73). When this graph is compared to the domestic mammal percentages seen in AU3 (see Figure 5.70) cattle numbers have clearly fallen while the number of caprines have risen. Looking at the larger grouping of mammals for both AU 1 and 2, seals are the most numerous, followed by cattle and then caprines (see Figure 5.74). Clearly, there is a reduction of seals in comparison with AU3, while bovids have grown in economic importance (see Figure 5.71 for comparison with Figure 5.74).

These relationships can also be seen if graphed differently and the original AU designations are kept (see Figure 5.75 and 5.76). Seals became less economically important in the 1600-1700s. Likewise caprines have grown economically more important to the people of Flatey. Perhaps what is driving this pattern is the ever growing importance of fishing as seen in Figure 5.76. Similarly, there is a reduction of birding over time and the collection

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of mollusks falls as well. What also becomes clear in Figure 5.76 is the complete reduction of a domestic mammal component in favor of a marine resource base.

Why this would occur will certainly require more work with the Midbaer and other Breidafjordur sites, however part of the answer might lie with Figure 5.77. This graph charts out the mortality of neonates within the three major mammalian taxa. There is a sharp increase of seal and cattle neonates within the 1600-1700s archaeofauna. Although the farmers at Midbaer might be selecting for young seal pups, the high cattle neonate percentage is significant, in the sense that these animals are being culled early and not allowed to grow to maturity. In the Icelandic system of animal husbandry, wealth and legal status is measured in terms of the number of cattle kept. To restrict the number of cattle newborns would suggest a problem in acquiring enough animal fodder to carry these juvenile through winter. This in turn would suggest a problem in pasture production. But attempting to unravel a signature of obtaining enough labor to acquire the winter fodder for cattle from the problem of pasture productivity would require further research. It should also be pointed out that the rise of fishing on Flatey might have caused a labor shortage or at least a scheduling problem of labor on

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the farm. It is also interesting to note the flat line of the caprines within this same period. It very well might reflect the nature of Flatey's pasture becoming poorer in quality, but not enough so as to preclude the use of cattle. Caprines do not require the same high quality pasture and fodder as cattle.

If there is indeed a decrease in the quality of pasture on Flatey it is not seen with any size reduction in the cod landed on Flatey. The GISP2 ice core data has demonstrated an increase in sea storms (the Na curve) in the 1400-1500s (Paul Mayewski personal communication 1994) which could be a direct measure of cod abundance in the western North Atlantic (Lough, Smith, Loder, Lynch, Page, Sinclair, and Werner 1993; MaKenzie and Kirboe 1993). More frequent storms can help to kill [27] the 1-3 year age classes which would reduce the size of the landed cod and should show as a size discrepancy in the cod regression graph (Figure 5.59 and Table 5.48). The size of the fish remains relatively constant in the Midbaer samples from the 1400s to the 1700s. It is also interesting to note the size curve of the cod, the regressed size of the landed cod generally being between

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27. Either by washing ashore the young fry or forcing the younger age classes into deeper water where they would fall prey to the older cannibalistic age classes.

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422-1,025 mm. This might also suggest a size limit that is selected for the European stock fish trade.

Although the Midbaer fauna is diachronically patterned, some caution should also be applied to these data. There is still a question of how representative the column sample is. Did it run through the thick and most dense part of the midden? As a column sampled archaeofauna, it is one of the most dense deposits that the author has worked with in the arctic. If this sample was not from the most dense part of the midden, will the above patterns change? Was the area coverage of this small amount of excavated earth representative of this site and island economy? Questions such as these are central in interpreting the value of such samples and the patterns observed above. Although a column sample does open a window into the past, the question of its view must also be raised. Certainly this is a first step toward the investigation of the Breidafjordur's past economy and the Midbaer sample has served its purpose. The Midbaer sample allows a first glimpse which must be followed with future work at Midbaer and the general Breidafjordur area.

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5.6.6 Subsequent Archaeological Research on Flatey

The main harbor on the north side of Flatey was investigated for an underwater Dutch ship wreck, the *Melckmeyt* in July of 1993 (Einarsson 1992, 1993b; Olafsson 1992). In 1659, a the Dutch ship was charted by a Danish merchant to trade with the farmers of Breidafjordur. The ship safely arrived in Flatey's harbor which is shielded by a tiny island, (an extinct volcanic crater) with the place name of Hofn (see Figure 5.78). A storm broke and wrecked the ship near the southwestern end of Hofn. The 17th century annal, *Ballararannall*, records this event noting that 15 of the crew survived the wreck and overwintered on Flatey. Parts of the ship were salvaged and a smaller craft was built and successfully sailed back to Holland.

The excavators were able to determine the exact site of the wreck and the extent of what remains (see Figure 5.79). Atop the Dutch wreck was a second and later ship that sunk in 1882. The ship was determined to be a 19th century Danish schooner, the *Charlotte*. Once the 19th century ship was removed, access to the Dutch ship was possible. The excavators recovered large quantities of Dutch ceramics such as Delft and fragments of an iron cannons.

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Currently there is much discussion about making the Breidafjordur area, including the island of Flatey, an Icelandic National Park and entering the fjord system into the list World Wildlife Refuges. A part of this effort would entail a much more complete archaeological survey and excavation program. Several preliminary site surveys have already been conducted on Flatey, identifying the turf ruins (Georgsson 1990) and describing the many historic houses and structures on the island (Magnusdottir 1993; Snaesdottir 1992). Georgsson reports the finding of 20 additional turf structures on Flatey, most dating to the late 19th or early 20th century.

Based upon these studies plans are now developing for the construction of an international field station either on the island of Flatey or in the town of Stykkisholmur on the southern mainland. The purpose of this station will be to conduct a systematic study, not only of the archaeology but the natural sciences as well. In the months ahead, the author (as the NABO representative) along with members of PALE, INSTAAR and the Icelandic archaeological and science community hope to finalize plans and start a much more intensive and co-operative research effort for the study of this fjord system.

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5.7 THE NESSTOFA (NES) SITE, SELTJARNARNES, KJOSARSYSLA

5.7.1 Site Background History

Nesstofa receives its name from the point of land that forms the "tip" of the long Seltjarnarnes peninsula which stretches out into the Faxafloi forming Reykjavik's Harbor (see Figure 5.80). Icelandic folk tradition claims that this point (or Nes) was the site of the 9th century settlement of Ingolfur Arnarsson's sons. [28] Unlike many of the large Viking period farmsteads in Iceland, Nesstofa does not appear in the documentary sources until AD. 1200. A church register written by Bishop Pall described Nesstofa as a church located on the point or peninsula known as Nes. This document also mentions that the church is dedicated to Saint Nicolas. Although undated (this document would be

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28. According to the Icelandic sagas, Ingolfur Arnarsson is considered to be the first Norseman to settle in Iceland. Based upon what is known about the regional spacing of Icelandic Viking period farmsteads in the Western North Atlantic, it is not implausible that Nesstofa, situated at the end of the Seltjarnarnes peninsula, could have been one of Reykjavik's two most southerly neighbors. The other settlement might very well be the site of Bessastadir.

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contemporary with the church register) there is another description of the church and its holdings. This second document mentions that the church was rich with three stained glass windows. Bishop Arni's Saga also confirms this observation. In Arni's description, the church was said to be very rich and the houses much better than those of common farmers. Other documents mention the names of those in residence at Nesstofa in 1280. A man by the name of Hafurbjorn Styrkarsson lived at Nesstofa with his wife Gudrun Thorlaksdottir. It was said that Hafurbjorn was the descendant of Ingolfur Arnarsson and hosted a representative of the King of Norway in 1280-81 [29]. Apparently the Nesstofa holdings remained in Hafurbjorn's family at least until 1341. At this time, Hafurbjorn's sons Gissur and Styrkar managed the farmstead and we know of the death of Styrkar. After the mid 14th century, records for the Nesstofa site become scarce until the 18th century (Chirstian Magnusson, personnal communication 1994).

The Nesstofa church experienced its last phases of turf and wooden construction in the 18th century. This was thought to occur in 1785, and this structure stood for 14

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29. In the Viking and Medieval periods it was a common practice to provide food and lodging for traders and royal agents spending the winter in Iceland.

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years until a winter storm surged onto the Nes peninsula and destroyed the church on January 9, 1799. The Nesstofa church and farmstead became part of the holdings for the southern episcopal see of Skalholt and the seat of many prominent Icelanders and Danish officials. The years of 1761-1763 are particularly interesting from an archaeological point of view. The architecture of the major residence switched from turf and wooden structure to a stone built house similar to those seen in Denmark. This stone house was built for the first Director of Health in Iceland, Bjarni Palsson. Palsson was the first and only medically trained doctor in Iceland at this time. Bjarni remained at Nesstofa until his death in 1779. The Nesstofa stone building remained a doctor's residence until 1834, when the office and drug store was moved into downtown Reykjavik. The stone structure and adjoining farmstead was sold into private hands and remained so well into the 1960s when the National Museum of Iceland purchased the site as a national landmark.

There are numerous traveler's accounts that describe visits to the site of Nesstofa in the 17th-19th centuries (cf. Boucher 1989). For the most part travelers were introduced to Nesstofa as one of the three Danish colonial centers. Nesstofa served as the physician-general's office

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(which all inbound travelers were required to visit) and a place were a ship's pilot could be found to navigate a ship into Reykjavik harbor further to the north by some 5-10 kilometers.

Archaeological investigations began at the Nesstofa site early in 1985, when Gudmundur Olafsson investigated a plumber's trench in the basement of the 18th century building. Olafsson was able to recover some 18th and 19th century ceramics and animal bone. The animal bones were detailed in Tables 5.54 and 5.55 (and in Amorosi 1986, 1989). This established that archaeological deposits were still intact and that any further alterations to the building or grounds would have to be further investigated.

In the summer of 1989, the driveways and paths around the house were scheduled for a regarding and the stairs leading down into the 18th century structure needed repair. Because of the previous work within the 18th century structure, a small-scale investigation was required. The goal was to ascertain whether the archaeological deposits would be threatened by the road grading work and step repair. The operation was directed by Vilhajlmur Orn Vilhjalmsson and assisted by Tom McGovern and the author. Several test units were placed in front of the 18th century stone building designated as units NA and NB (see Figure 5.81). The units

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are on the landward side of the 18th century building and reveal a series of multi-phased structures. Currently it is thought that these structures date to the early modern period (Vilhjalmsson 1989).

A deep test was dug with a backhoe on the seaward side of the 18th century building. This unit was desgniated as NC, measuring 3.5 meters X 1 meter in area. The unit demonstrated that cultural deposits were surprisingly deep and well stratified. The test measured 2.55 meters below the present ground surface and also revealed rich midden deposits that included animal bone, macro-plant and insect remains (Amorosi, Buckland, Magnusson, Sadler and McGovern 1994; also see Figure 5.81 and 5.82).

The animal bone materials described here were collected from a column sample measuring 0.25 deep X 2.5 meters in width. The sample was taken from the southeast profile face of the NC unit (see Figure 5.82). The stratigraphy was nicely horizontal, containing 12 layers of burnt peat ash and humified organic deposits. The basal deposits (Vilhjalmsson designation NCN, or the author's designation of SU 10-12, and Vilhjalmsson profile designations J, M, N) were darker in color and more compact. These strata contained significant amounts of compressed birch-willow species twigs and tree roots. Historic artifacts dating to

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the 17th to 19th centuries (i.e. glass and ceramics) were confined to the uppermost quarter of the deposit (approximately: Vilhjalmsson NCA to NCE, or SU 1-4, Vilhjalmsson profile A to E).

Similar to the recovery strategy described for the Hjallholl test cut, a two stage program of "in situ" and screened soils (through 4mm. wire mesh) was instituted. Also, while the column sample was excavated, a duplicate column soil sample was taken. These samples were picked clean of animal bone materials, leaving behind other organics such as the macro-plant and insect remains in the soil. (these are detailed in Amorosi, Buckland, Magnusson, Sadler and McGovern 1994). Bone preservation was variable, ranging from good to excellent throughout the profile. There was a notable concentration of fish bones in the upper 25-30 cm.

The considerable depth of test unit NC suggested that a substantial portion of the mound now topped by the 18th century house could be anthropogenic [30]. An attempt was made to trace the midden's depth and perimeter away from the test unit NC using hand-held soil cores. The first core

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30. Not an unusual situation with Viking to Early Modern period farm mounds was that the mound is formed by accretational dumps of kitchen debris and burnt peat ash.

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(designated as core 1) was taken next to the modern barb wire fence at the Northwest edge of the farm mound. The linear distance from the 18th century structure was approximately 20 meters. Core # 1 penetrated 1.48 meters of cultural deposits before striking a sterile subsoil.

The second core (core #2) was attempted along the same northwest axis, but 10 meters closer (or uphill) toward the 18th century building. Core #2 encountered 1.17 meters of cultural deposit before it was stopped by a large field stone. A third core, designated as core #3, was placed next to core #2 and successfully reached sterile subsoil. Core #3's depth was 2.55 meters below modern ground surface.

In the following year, 1990, a backhoe excavated a pipe and electric trench that ran down hill to the southeast toward the 20th century barn. This trench was extremely shallow, approximately 30cm in depth, but it turbated the mound's stratigraphy preventing any detailed observation. Nonetheless, a substantial amount of disturbed 19th century ceramic and animal bone was recovered from the backhoe's spoil heap. This confirmed the observations made with the soil cores. Nesstofa's farm mound is anthropogenic, and extends at least 20 meters seaward and downhill from the 18th century building.

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Thus the archaeological investigation and the accidental backhoe pass have helped to confirm an extremely rich and well stratified farm mound sitting below the 18th century structure. Based upon aerial photography, the mound seems to cover an area of 20 x 40 meters with several turf structures located at the mound's western base. Based upon the deep test NC and the soil cores (#1-3), the midden has an approximate depth of 2.5 to 3 meters.

In 1995 another test trench, situated on an east-west axis, was placed near the northern corner of the property line of Nestrod 7. This trench is situated on the landward side of the Nesstofa structure, approximately 50 meters to the west of the house. Four 18th or 19th century graves were encountered at the bottom and eastern side of this trench. The topmost grave was badly disturbed and overlaid three other wooden coffins. The excavators did not continue the excavation on this end of the trench and directed efforts towards the western side of the test (see Figure 5.83). The eastern side of this trench yielded several stone and structural turf walls. Although it is too early in the analysis of these findings, the various walls seen in Figure 5.84 might relate to the structures that Vilhjalmsson reported (1989a -- Adolf Fridriksson and Orri Vesteinsson personal communication 1995).

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5.7.2 Nesstofa Zooarchaeological Patterning

The analysis of the Nesstofa archaeofauna is still far from complete. Presently the Nesstofa assemblage is represented by 9,596 remains, of which 9,290 are identified to a species level, and 306 to the more generic fragment classes. The analyses still to be performed are:

1. - The species identification of the avian (see the Midbaer section for problems in the identification of sea bird materials) and fish remains.

2. - The osteometrics, aging, skeletal element frequency and paleopathological parameters of the archaeofauna.

3. - Funds are now available for the radiocarbon and C13/C12 ratio assay.

While these analyses are nearing completion, the reporting of general site trends can be discussed.

The 1985 interior materials are listed in Table 5.54 and 5.56. Connected with the advent of Danish-style stone architecture in Iceland is the establishment of colonies of Norway Rats. It was not until the 18th century that the conditions of dry, warm stone architecture existed and large

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stores of imported grains came to Iceland. Residences such as Nesstofa (also at the site of Bessastadir described in chapter 6) allowed a secure resource base for this species to establish a foot-hold in this sub-arctic country.

Tables 5.56-5.65 and the corresponding Figures 5.85-5.94 detail the Nesstofa archaeofauna by their Stratigraphic Unit designations. Tables 5.66-5.67 and Figures 5.95-5.96 presents the Analytic Unit analysis of the Nesstofa archaeofauna from the exterior deep test NC. This was done in order to account for the "stochastic view" that the Stratigraphic Unit data presents. The Nesstofa assemblage has a relatively small absolute number of mammal and bird remains recovered in each of the Stratigraphic Units, which can lead to an illusory precision when comparing one stratum to the next. In Figure 5.95 this problem of variable sample size can be easily seen. Nonetheless, when the deposits from the deep test NC are collapsed into the Analytic Units seen in Figure 5.96, a preliminary patterning becomes evident. As both Figure 5.95 and 5.96 makes clear, fish bones are by far the most numerous component in the Nesstofa archaeofauna. The remainder of the assemblage is made up of domestic mammals, mollusks and birds.

Figure 5.96 preliminary aggregation of layers into three major phases was based upon field observations and the

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presence/absence of 18th-19th century ceramics. The upper phase (Vilhjalmsson's layers A-E, the author's field SU destinations 1-4) includes all deposits that contained 18th and 19th century glass or ceramics and can be broadly dated to the Early Modern Period of the 17th-19th centuries. The Middle phase (Vilhjalmsson's F-G, the author's field SU destination 5) lacks glass and ceramic and may reflect Later Medieval to Early Modern periods. The lower layers (Vilhjalmsson I-N, the author's field SU designations 7-12) date to the Middle Ages with little or no admixture of later materials. Note that the Middle phase primarily has the function of securely separating the lower and upper layers and there is no implication of detailed chronology appropriate here. It is also important to note that the NC collections do not contain the lowest layers on the site, as these were below the limits of the 1989 excavation [31].

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31. It was decided in the field, that the depth of the deep test NC was the furthest one could dig without shoring the excavation walls and having several backhoes on site for rescue in case the walls collapsed. Soil cores indicated a further 20-50cm of cultural deposit but, since the bottom layers were water saturated, no detailed stratigraphic observations could be obtained from the cores. The water saturated soils also indicated that a slurry of the bottom layers would present a dangerous "grave" situation for such a narrow test.

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Thus this three phase division offers a crude device to discuss a general comparison of the Nesstofa archaeofauna from the upper, middle and lower portions of the deposit. It should also be stated that a more detailed chronology will only be possible when a larger and more complete excavation becomes possible. However, this crude approach will allow for a realistic inspection of long term trends at Nesstofa and the southwestern areas immediately south of Reykjavik.

5.7.3 Domestic Mammals

Figures 5.95-5.96 presents the changing percentages of the major domestic mammals (cattle, caprines and pigs). Although the small sample size of the domestic mammal component makes certain conclusions difficult, the Early Modern period associated with the Danish residence seems to be marked by a increase in the relative number of cattle remains. Nesstofa's residents were both Danish officials and Icelandic servants. Thus, Nesstofa never served solely as a Danish residence, nor as its midden debris the result of solely Danish activities. Currently it is almost impossible to separate the admixture of Danish and Icelandic artifactual materials.

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5.7.4 Fish and Molluscan Remains

Figure 5.96 graphs out the relative percentages of fish and molluscan remains from the column sample taken at Nesstofa. It is interesting to note an inverse pattern between these two suites of taxa. Although the fish remains increase in the Early Modern period, the molluscan remains show a noticeable drop. This would suggest that the collection of mollusks were not for bait preparation in a time when the Stockfish trade becomes firmly established in Iceland (Amorosi 1991a). It has been suggested by a number of farmers that the collection of mollusks was either as a starvation food or used to supplement animal fodders. The high percentage of molluscan materials would further argue in support of a seaweed fodder.

Contained with the Medieval phase were marine mollusk materials are a number of species such as small gastropods and limpets and a few bivalves. These small mollusks species, by themselves, would contribute very little to any dietary supplement. However, the ecology of these species is such that they are encountered in the littoral zone, living among various seaweed and kelp beds. The use of seaweed as a fodder supplement is practiced across much of

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the North Atlantic (Kristjansson 1983, Paul Buckland personal communication 1991), and seaweed is still being used today in Iceland as a summer fodder supplement on the coast of Arneshreppur in Strandasysla. A soil sample from the lowest level was saved and analyzed by Paul Buckland and Jon Sadler. Contained within the sample were numerous burnt seaweeds, small burnt gastropods and Hydrophilid and Staphylinid insects, common to the littoral zone species. Not only could this material have been used as a fodder supplement but perhaps as a source of fuel.

5.7.5 Ratio Measures

Another means used to investigate an individual archaeofauna is to create a series of ratio scale statistical comparisons as can be viewed in Figure 5.96 (see the quantification discussion in Chapter 2). Based upon prior experience with Icelandic archaeofauna (Amorosi 1989, 1991, 1992a) several ratios are worth tracking in assemblages. The Nesstofa materials includes:

1. - The ratio of cattle to caprine bones.

2. - The ratio of Fish to Mollucsa remains.

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3. - The ratio of Fish to Domestic Mammal remains.

The most dramatic ratio in Tables 5.66 and 5.67 is the ratio of fish to domestic mammals. The very noticeable increase of fish suggest that Nesstofa was tied to the Stockfish trade by the early 15th-16th centuries. The ratio has indicates a farmstead that was changing its labor investment in animal husbandry and fishing. Similarly, the increase of fish to mollusks would argue a growing importance of fishing in the Nesstofa household economy. The relative drop in the cattle to caprine ratios would suggest that caprines lessened in importance in relationship to cattle. The last pattern contrasts with that observed in other sites in the region and deserves further investigation.

5.7.6 Summary of the Invertebrate Remains

A number of bulk soil samples were also recovered and analyzed by Paul Buckland and Jon Sadler. Since the details of their analysis are reported elsewhere (Amorosi, Buckland, Magnusson, Sadler and McGovern 1994), only a brief summary will be offered here. Ectoparasites of both caprines and humans were recovered in the basal and subsoil interface

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samples. These are represented by lice, *Pediculus humanus*, the human head or body louse. Also the species, *Melophagus ovinus* and *Damalinia ovis* were recovered indicating that wool processing activities occurred at Nesstofa (cf. Buckland and Perry 1989). The Nesstofa midden allowed for the breeding of a number of insect species that is consistent with the decay of accumulated human debris (both plant and animal). Included in these materials are some Staphylinids, several of the Aleocharines and the Spider Beetle (*Epauloecus unicolor*. The presence of these animals could indicate a dry decaying residue consistent with living quarters debris. It is interesting to note in the Nesstofa samples the low occurrence of spoiled hay insects. Among the materials recovered from SU11 and the basal birch layer (SU L), were a total of three charred barley seeds.

5.7.7 Concluding Thoughts

Despite the limitations of sample size and the distinct possibility that this column sample is atypical of the deposit as a whole, the data presented above has some important implications. These materials highlight a strong maritime supplement to Nesstofa's land-base resources. The utilization of seaweed is particularly interesting and most

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likely relates to the limited nature of Nesstofa's hayfields. Still much work remains to be done with the Nesstofa archaeofauna. Similar to the Midbaer materials, the identification of the avian and fish remains are nearing completion. Also, funds have been obtained for radiocarbon assay and the C13/C12 diet ratio comparisons for the 1989 samples. Once these analyses are complete, a more detailed picture of the faunal assemblage can be presented in future work. Plans to return to Nesstofa are also in progress, and hopefully a more representative sample will be obtained.

5.8 ARNESHREPPUR, STRANDASYSLA

5.8.1 Introduction

The 1990 field season, carried out in the Arneshreppur region of Strandasysla, located along the eastern side of Iceland's northwestern arm, produced a host of archaeological, zooarchaeological and paleoecological materials. However, in 1990, the antiquity laws of Iceland were revised and an internal political feud arose between two newly established archaeological committees. This feud

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severely limited archaeological and bio-archaeological research in Iceland for the last five years. None of the 1990 Arneshreppur bioarchaeological materials were allowed to leave the country, nor could they be analyzed by the author. Therefore the reporting below will not include any systematic analysis of the zooarchaeological assemblages. However, there is a bright postscript to add here; in 1995 the author received information from the National Museum of Iceland that the release of these materials might soon be possible.

5.8.2 Akurvik 4901-1

5.8.2.1 Site Location

The site of Akurvik is in a small embayment located less than 50 meters from the end of the modern airstrip at Gjogur and is on the approximate boundary between the lands of the Gjogur farm and the neighboring farm of Reykjarnes (see Figure 5.97) [32]. It is between several active potato gardens which provide the modern place name. These same

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32. Local tradition claims that the Reykjarnes farm was abandoned in the early 1960s.

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gardens have removed a portion of the site in the recent past. The small embayment has several hot springs providing a steady supply of warm water until mid August and the stream passing by the site tends to be warm to the touch. The soil is shell sand, close in texture and shell content to a Scottish machair [33], but far darker in color due to the volcanic origin of its mineral component. The sod-covered portion of the site is marked by luxuriant grass growth due to the organic archaeological debris and local farmers clearly selected this location for potato raising because of the combination of volcanically warmed soil and the enrichment of the archaeological remains.

Local residents today do not attempt to land small craft through the offshore skerries at Akurvik and the site is accessible either by walking from the air strip or more practically, by a four wheel drive vehicle. There is no farm place name associated with the locality and no farm or other structures were noted in the 1703 Jardabok or land register. In fact, neither the place name Akurvik nor any mention of fishing booths at this local is found in this register.

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33. A machair is a sandy soil deposit that has a high marine mollusk component mixed in the soil.

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5.8.2.2 1988 Investigations

The site of Akurvik is steadily eroding due to winter storm wave action and the grazing of sheep and horses. The spread of animal bone and dark organic soils from the deposits have been evident for some time. In 1988, a survey team consisting of Dr. Haukur Johannesson, Jon Haukur Ingimundarson and the author investigated the area as part of a long term cooperative survey project sponsored by the National Museum of Iceland, the Icelandic Museum of Natural History, and the Bioarchaeological Laboratory at Hunter College. An invasive testing and preliminary mapping program was conducted and the results were entered into the National Museum of Iceland's site survey archive.

The Akurvik site appears to consist of either a cluster of small rooms associated with an unknown farm building or to represent a series of small, single room structures showing some superposition and overlap (see Figure 5.98, the Akurvik site plan). A channel approximately 14 meters long had been cut into the turf-covered bank by winter storms and this provided a series of profiles for observations and recording. The survey team noted a series of dark colored organic layers separated by varied thicknesses of shell

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sand, and isolated two major archaeological horizons that ran most of the length of the profiles [34].

Conditions of organic preservation were excellent and large amounts of well-preserved fish, mammal and bird bone were observed in the beach scatter and in situ in the exposed profiles. Soil acidity was measured with a portable soil pH meter and found to vary between 6.5 to 7.0. This indicated that the deposits were weakly acidic to almost neutral, ideal conditions for animal bone preservation. Most Icelandic volcanic-sand beaches show a higher acidic soil condition of pH 5.0 to 4.5 and thin sites in these regions have little or no organic preservation. No 17th to 19th century artifacts [35] were observed in the erosion area. Based on paucity of historical documents and no Early Modern artifactual materials, the Akurvik site appears to be early. This site demonstrates exceptional organic preservation and is endangered by marine and livestock types of erosion. This lead the 1988 team to strongly recommend that the National Museum further investigate this site before it was lost to the archaeological record.

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34. In 1990 these deposits were designated as SU7 and SU 22.

35. These materials would include glass, ceramic and kaolin tobacco pipe fragments.

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5.8.2.3 1990 Investigations

Upon returning to the Akurvik site in 1990, four major objectives had to be achieved. These objectives were:

1. - determining the nature of the Akurvik site and whether the structure observed in 1988 (4901-5) was the farm-like building associated with the complex of "booth" structures.

2. - collecting a useful amount of bone and other bioarchaeological material from the site's stratified contexts.

3. - collecting a useful zooarchaeological sample along with other bioarchaeological materials from the site.

4. - attempting to conserve the deposits in order to slow the destruction of the site by marine and grazing animals.

Though the 1990 field season was unfortunately truncated by delays in receiving a research permit in Reykjavik, a good deal was learned in the period available. The site had suffered additional storm surge damage since the 1988 visit

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and bones and organic material were scattered widely over the beach area.

It was discovered that the erosion channel carved out by wave action had totally destroyed the archaeological deposits down into the sterile subsoil. Intact deposits were thus confined to the north and south sides of this erosion channel. The erosion channel's south side abutted an active potato garden. This gardening had disturbed much of the southern deposits and it seemed likely that this area had a limited potential for further investigation.

The north side of the channel (towards the surviving structures) provided a long profile where the lowest levels were found to be intact. However, these same levels were badly endangered by further marine erosion. These deposits extended 1 to 1.5 meters into the center of the erosion channel. The excavation strategy clearly involved the careful cutting back of the long north profile and the documentation of its layers and structures. In the upper half of the profile, this cutting back amounted to only 5 to 10 cm. This was enough to clear and straighten the profile wall so that it could be effectively observed and drawn. The lower half of the profile allowed for more extensive excavation, as a "bench" of drift sand and undisturbed archaeological deposit formed a consolidated strip along the

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base of the north erosion face. When the loose drift sand was removed up to 1.25 meters of deposit extended from the lower profile. Most of the excavation effort in 1990 involved systemically excavating this lower "bench" deposit and documenting the emerging remains.

5.8.2.4 Site Conservation

Based upon prior experience with the excavation of fragile archaeological deposits, excavator traffic had to be kept to a minimum in order to excavate the "bench" area. Otherwise, many of the site features could easily be trampled and lost before being accurately recorded. The erosion channel's northern end was used as a work area in order to protect the "bench" area. This also allowed for the use of an existing exposure instead of opening a fresh break in the turf by beginning a horizontal area excavation. The work began by clearing and bagging the drift sand to allow better access to the profiles. This minimized turf removal and prevented destabilization of the sand matrix.

Only light, flat bottom, running shoes were allowed on site, and board walkways and sandbag steps were used to prevent unintended disturbance. Excavated areas were covered with weighted polythene sheets and back dirt (spoil)

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was bagged in recycled feed sacks to provide windbreaks and prevent drifting. A site shelter, similar to the one used at the Gjogur site, was considered for the Akurvik site. Fortunately, a stretch of good weather at the beginning of the excavation allowed the 1990 team to complete critical cleaning and photography without the use of the shelter. If future work is to be conducted at this site, a site shelter is strongly recommended since the Akurvik site is exposed to north-easterly storms.

During the excavation small orange flags and brightly colored nylon flagging were strung around the excavation units. These moved and made noise in the wind, serving to keep free ranging horses and sheep away from the open units. It was not possible to place fencing around the site area in 1990 as this area serves as summer pasture for horses.

The Akurvik site was completely backfilled at the end of excavation. Polythene sheets were pegged against the cleaned profiles. A series of sandbags were staked into the ground against this sheeting in hopes that further marine storm surges would not remove them and further destabilize the site's profiles. In the site's feature areas, such as Structure F, sandbags were set in two interlocking courses and placed to the height of the turf exposure. Although the site was definitely left better protected than when we

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arrived, it will certainly be subjected to ongoing marine, wind and animal erosion.

5.8.2.5 Recording and Site Documentation

The Akurvik site was horizontally and vertically controlled by setting up a grid system which covered the site area. This was accomplished by the use of an optical transit and verified by use of an EDM (laser transit). The site area was later fully contour mapped using an EDM and the program "SURVEY" and illustrated in Figure 5.99 [36]. Since the total site area was small, an alpha-numeric grid system was used [37]. The grid squares used in 1990 were Q89 to S 105, with the grid datum established at R 112, located just outside the excavation area. The grid orientation was along the line of the erosion face, which ran approximately east-west [38]. All measurements were taken from the southwest corner of each square. The long profile and clear

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36. Developed by David Ingram and Paul Buckland at the University of Birmingham, U.K..

37. Prior experience has shown that the combination of numbers and letters reduces the possibility of recording error.

38. Letters work on the N-S axis, numbers are situated along the E-W axis.

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stratigraphy allowed consistent stratigraphic excavation and all finds can be related directly to natural stratigraphic layers. All artifacts were located to the nearest centimeter, bones and other ecofacts were bagged by the meter square layer.

Location information was recorded on inert aluminum tags. These tags were chosen for the metal's ability to resist decay from water and mold. All materials were bagged in 2-3 mm. plastic bags. A finds register was regularly kept on both notebook and portable laptop computer. This information was entered on a Borland Company product known as the "Quattro-Pro" series. This program and backup computer disks were left on file at the National Museum of Iceland. Both color and black & white 35mm photography were regularly used with each frame entered into a photo log. Horizontal plans (plan registration numbers 49 & 50, Figures 5.100 & 5.101) were drawn and individual Stratigraphic Unit Forms were filled out for each natural layer, lens or other deposit (see Table 5.69).

5.8.2.6 Recovery

Numerous authors (Payne 1972a and b; Thomas 1969, 1972) have demonstrated the importance of systematic sieving for

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the recovery of unbiased samples of bones and small artifacts. At Akurvik a 100% sieved sample was possible since the site's finds were contained in a loose sandy matrix. A further subdivision of this sample, of 10% was screened through a 1 mm wire mesh. Bulk whole-soil samples were also taken for macro/micro fauna and flora. Although lacking in organic materials (micro-faunal samples such as insects) the resulting samples are of a high quality and are similar to other high quality collections in the Eastern North Atlantic.

5.8.2.7 Structures

As excavation proceeded along the north profile (grid coordinates Q90 to S100), it became apparent that the deposit was made up of bands of cultural debris of variable width separated by bands of largely sterile drift sand of variable width (see Figure 5.102-5.104, profile #11 and sketches of the same profile). The room depressions visible on the turfed area above the north erosion face proved to represent at least five separate, small and probably single room structures. These averaged approximately 1.00 to 5.00 meters by an approximate 2.00 to 2.75 meters long and corresponded closely in form and general appearance to small

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"fishing booth" structures encountered in many parts of Iceland. These structures were designated from West to East as rooms "A, B, C and D". Structure B is superposed over structure C and cuts into its west side. Other structures may be present but were not visible without excavation (see Figures 5.98 and 5.99). No attempt was made to excavate the structure discovered on the grassy knoll above the northern profile (structures A, B, C, D, E). Structures G and F were only partially investigated when portions of these turf structures were encountered in profile.

5.8.2.8 Structure "F"

Within the first week of excavation it became apparent that the end of one such small structure was protruding from the north profile (occurring in S96 to S100 area) near the base of the cultural deposit at a depth of 80 to 100cm below current ground surface. The southwest corner of the structure had been caught by a North/South mini-baulk that had been placed at S96, which allowed for a clear view of the low turf wall corner. Profile #10 (see Figure 5.103-5.105) shows the horizontal and vertical extent of the wall corner. The compacted turf wall was quite thin, usually less than 30 cm in thickness, but showed

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characteristic banding of turf layers laid down diagonally. The turf included some small lenses of sand at the base of each fragment, suggesting that the structural turf had been cut from the sodded beach sand dunes nearby and not from the plateau further inland. A substantial slab of whale bone (possibly a rib fragment of an animal the size of a bow head whale) was placed beneath the corner of the structure, close to grid point R96. Apparently, this rib was set to provide support for the foundation of this low turf construction. Little or no stone was used in the construction the walls, neither on the interior nor exterior, and there were no foundation trenches (builder's trenches) or footings apart from the whale bone slab. It would appear that the walls of Structure F were never designed to support a heavy roof-like structure. Outcrops of stone and loose shingle from the beach were readily available within a 100 meter radius of the site so that the low content of stone in Structure F does not reflect a shortage of building materials.

The south edge of Structure F was evidently temporarily stabilizing the erosion face in this area and fortunately did not wash out to sea during the winter storms. The surface of the structure was carefully cleaned, photographed and planned horizontally. The outer wall of structure F was sectioned and drawn at the R through S 97 grid line but was

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otherwise left intact and sandbagged to aid site conservation.

The turf wall of the end of Structure F, with the turf wall to exposed and some separate collapsed turf blocks scattered to the East (R99 to R100 area) can be seen in Figure 5.105. Further horizontal cleaning in the exposed interior portion of Structure F revealed two superposed floor layers separated by a thin layer of drift sand (see Figure 5.100 and 5.101, horizontal plan #50, and Figure 5.102 and 5.106, profile #12), vertical profile of a temporary baulk left in the center of the floor deposit. The floors were made up of patches of compacted peat ash, wood charcoal [both fire-cracked and natural cobbles], and fragments of whale bone (with several showing cut marks) which were all covered by a later midden deposit (designated as SU 22) that collected in the vacant structure. These floor layers [39] were hard and compact, had a noticeable concentration of charcoal on their surfaces and were evidently walked upon and formed working surfaces. A

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39. The first floor was designated as SU 30, the second floor is designated as SU 29 and the sand lens between the two floors is designated as SU 31.

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preliminary field impression is that the majority of the worked whalebone fragments [40] came from these floors.

At the base of the lowest floor, a simple pit hearth extended into sterile subsoil, apparently being later infilled and sealed by the SU 30 deposit. This pit hearth was scooped out of the beach sand and the fire built directly in the unlined pit, as the sand at the SU32/ subsoil interface was partially oxidized and fused by heat. The stone cobbles that were recovered from this area do not seem to have been used to make a liner for the pit hearth.

In summary, there appears to have been three brief phases of occupation as evident from structure F. Profile #10 (see Figure 5.105) demonstrates that structure F was not the first human habitation in the immediate site area. Midden debris (designated as SU 24) were sealed beneath the first layer of the turf wall. The stratigraphic bedding angles of deposits in the lower third of the S99 to S 103 area of the North Profile (see Figure 5.102, profile #11) suggests that Structure F was constructed in the lee of a low sand dune (designated as SU 27 and 35) and this may have provided some support and wind protection on the seaward side.

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40. The recovered materials all appear to be craft waste.

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When structure F was abandoned, it was partly demolished, with some chunks of structural turf kicked down hill toward the beachhead. The walls of the small structure then collapsed both outwards and inwards, "melting" downward in the characteristic pattern of turf wall collapse. Structure F then served as a convenient dump for refuse, filling rapidly with a mix of fish bone, whale bone fragments, and fire-cracked rock (designated as SU 26,. This fill episode was quick as evidenced by little or no sterile sand drifted into a separate wall fall from the first refuse deposit. Before a great deal more time had passed, the ruin of Structure F and its immediate fill were buried beneath another, more widespread midden deposit labelled SU 22. The SU 22 layer effectively leveled the mound left by Structure F and the older dune formation and resulted in a change in bedding angle evident in profile #11 (see Figure 5.102).

5.8.2.9 Structure G

Once the extensive SU 22 deposit was traced toward the West from the Structure F area, the corner of another small turf structure in the grid line S89 to S91 was encountered (see Figure 5.102, profile #11). This structure was designated as "G". Structure G also appeared to have a wall

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made of banded turf, again with sand lenses suggesting collection of construction turf from the immediate beach dune area. The turf wall (SU 39) was preserved to a thickness of approximately 30 cm and included little or no stone in its construction. Beneath the turf wall corner was found a shallow pit holding a virtually complete vertebra of a great whale species. The large vertebra was buried as a footing to the corner of Structure G in a similar manner as the whale rib recovered beneath Structure F.

Stratigraphically speaking, Structure G was the likely source of the extensive midden deposit already described as SU 22 which covered over Structure F and 3.5 meters further east along the North Profile. Just outside Structure G and directly on top of the SU 22 deposit was a compact dump of wood charcoal, peat ash and a mass of fire-cracked rock (SU 23). This did not appear to be an in situ hearth but rather the remains of a cleaning from a hearth.

Structure G also underlines Structure A, a depression that is visible from the current ground surface. These structures are separated stratigraphically by a sterile layer of sand (designated as SU 41). Since only a corner of Structure G was exposed and documented, little more cam be said described at this time.

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5.8.2.10 Post-Molds

The molds of two separate post-like intrusions were documented in the immediate vicinity of Structure F. One post-mold appeared in the North Profile near grid reference S99. It extended from SU7 down to the SU33 layer. This post-mold included two stones in its fill and a dark organic smear, suggesting that the post had decayed in place and had been braced by some stones in the fill, as one would expect in a loose sandy substrate. The second post-mold, SU 46, was detected in plan view (see Figures 5.100 and 5.104) and extended into Structure F from above. It may have been contemporary with the post-mold from SU7 but this cannot be demonstrated stratigraphically. The mold is a good deal later than Structure F and penetrates it from above. Both posts were around 10-12 cm in diameter.

5.8.2.11 Midden Deposits

The North Profile's length allowed extensive documentation of spreads of midden refuse generated by the set of superimposed small turf structures at Akurvik. These midden deposits tended to be relatively thin, ranging from 20-30 cm in thickness but were extremely rich in bone

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debris, especially in fish bone. The darker ash and organic midden matrix contrasted sharply with the lighter shell sand natural deposit and allowed extensive tracing of the cultural deposits. It is clear that the Akurvik middens built up as a series of intensive episodes separated by periods of natural sand accumulation. This pattern is most clearly seen in the upper half of the long North Profile (see Figure 5.102, profile #11) where thin bands of dark organic bone and shell (e.g. SU7) are separated by bands of sterile wind-deposited beach sand (e.g. SU 13). The beach dune complex was probably significantly larger in the past and certainly seems to have undergone repeated phases of sand accumulation, stabilized by grass-sedge communities. The midden layers and other cultural debris seem to have helped to stabilize the active dune formation and the cluster of structures at the side of the small hot spring and may have acted to anchor this end of the beach. Thus the pattern of midden accumulation at Akurvik is radically different from that of farm mound sites elsewhere in Iceland. At Akurvik, periods of human garbage dumping were clearly punctuated by periods of natural accumulation, strongly suggesting a periodic, rather than continuous human occupation.

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Akurvik's midden is a mixture of fish, sea mammal, land mammal, bird bones, shellfish fragments, fire-cracked rock, wood charcoal, burnt peat ash and very few artifacts. The deposits do not seem to have been extensively re-worked after initial deposition, as many delicate bone elements are well preserved and occasionally found articulated. Conditions of organic preservation were excellent and fish otoliths and other acid-vulnerable fragments were preserved in quantity.

5.8.2.12 Tephra and Uplift

Three possible tephra horizons were observed during the excavation. These have been examined by Dr. Haukur Johannesson of the Icelandic Museum of Natural History. Johannesson has identified the lowest of the tephra (Tephra Layer #1) as a "late prehistoric" pumice dated to ca. 1750 BP. [41]. This pumice was derived from Snaesfellsjokull. Tephra layers #2 and #3 have been identified as eolian sand with rounded grains of various rock types (Haukur Johannesson, personal communication 1992.)

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41. The term "late prehistoric" is usually reserved by Icelandic archaeologist and geologists to refer to late Holocene and pre-Landnam (just prior to the AD. 870s) periods.

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The "Tephra Layers" #2 and #3 were encountered in a geological trench dug from the north profile at S104 to S105 (see Figure 5.102). "Tephra Layer" #2 (designated as SU 36) is a thin band of dark sand and could hardly be followed in the geological trench profile. This dark sand layer could not be traced to any of the known structures or midden deposits but it appeared to rum some 35 to 40 cm below the SU22 midden deposit. "Tephra Layer" #3 was observed to lie 2- to 25 cm deeper and appears as a band of grey-green sand. This sand was also difficult to trace and may represent a buried land surface. Again, "Tephra Layer" #3 was not in close stratigraphic association with any cultural material.

Akurvik also seems to have suffered isostatic rebound, as evidenced by a marked series of raised Holocene beach terraces along the tip of the Reykjarnes peninsula. These raised beach terraces can be clearly observed on the Icelandic air photo series and suggested a relatively quick rate of uplift. The presence of what appears to be a fishing station in a bay now substantially closed to small boats may reflect an inshore landscape altered by geological uplift (Haukur Johannesson, personal communication 1990).

The association of this site appearing on top of a prehistoric tephra and the absence of place names identified to the late AD. 1690s, coupled with a lack of ceramic

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materials and the possibility of uplift terminating the usefulness of the Akurvik embayment for boat launch and recovery suggest a comparatively early historic date for the site. The preliminary artifact analysis suggest a date in the late 14th to early 15th centuries AD..

5.8.2.13 Recovered Artifacts

The 1990 excavation produced only 16 artifacts despite the program of systematic screening. Table 5.69 and 5.70 lists these finds stratigraphically and reproduces the field finds registry. The majority (approximately 60%) of the finds were small iron fragments, appearing to be boat nail and rove fragments. Copper/Bronze objects were the next most frequent find and were for the most part represented as metal sheets. The two worked bone fragments are represented by a cut segment of caprine tibia with both ends removed (see Figures 5.107-5.108, field designation as A16). The bone artifact was a more elaborately modified fragment, which is a whalebone disk (see Figure 5.108, field designation A15). This fragment appears to have been saw-cut via a center-stabilized rotary cutter bow-drill from a larger piece of whalebone. Although it is always hard to determine the exact function of such an artifact, it is

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worth noting that the size and shape of this object is correct for a gaming or chess piece. Also worth noting is a jasper flake, struck from a "strike-a-light" (A6, see Figure 5.107).

5.8.2.14 Ecofacts

A large vertebrate archaeofauna was recovered from the midden deposits. This comprised 98% of the total site recovered materials by weight. This material is still pending loan status with the National Museum of Iceland (see McGovern and Amorosi 1993 for details of the political problems faced by the two investigators). Floral remains are still being analyzed at this time and cannot be detailed here [42]. Nonetheless, based upon the 1988 sample and the 1990 field notes some observations are possible.

The 1990 excavations made clear that the majority of the vertebrate materials were represented by fish. The most numerous species would seem to be the atlantic cod (Gadus morhua), and, to a much more infrequent basis, the ling (

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42. The floral materials are being analyzed by Cindy Zutter of the Department of Anthropology, at the University of Edomonton, in Alberta, Canada. The insect samples have been processed, but yielded no remains (Paul Buckland and Jon Sadler, personnal communication 1996).

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Molva molva). There also seemed to be a very large number of large sized cranial elements consistent with reference specimens of at least a 1.00 to 1.30 meters in length. However, caution must be applied here until a proper metrical analyses can be carried out.

It is also interesting to note the near absence of basking shark remains in the archaeofauna since this species was of great importance to the local "Northwest Arm"'s economy. The absence of shark remains can be explained easily as a preservation problem; cartilagious skeletal materials do not easily preserve.

Other species that are present are seals, including both the common or harbor seal, (Phoca vitulina) and the newly born harp seal pups, (Phoca groenlandicus). The harp seal materials are an unexpected find since these animals normally pup much further north on the permanent pack ice. This would suggest that the drift ice was much more frequent in the Arneshrpeppur area during the late Medieval period and correlate to what scholars are now thinking would indicate "Little Ice Age" conditions in Iceland (cf. Amorosi 1992, Ogilvie 1991).

Whale bone was also recovered in some numbers. The larger fragments and complete vertebrae are suggestive of the bow head whale (Balaena mysticetus). There were also

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several large barnacles recovered in the excavation which superficially resemble the genus Coronula, usually restricted to whale's skin. If this preliminary identification is correct, then this is evidence of whale carcass being present on the site rather than the collection of fleshless bone for the construction of turf structures or craft items such as the whale-bone disk.

Bird remains were also recovered in some quantity. Field identifications suggest that the majority of these remains were alcids (mainly Uria sp.), but a proper laboratory analyses is required to identify effectively any of these species.

5.8.2.15 Akurvik Interpreted

Akurvik would appear to represent a series of small-scale occupations rather than a single continuous farmstead through time. These small structures are clustered in space but separated by time. They seem to represent regular re-use of the same portion of the beach, perhaps on a seasonal basis.

The structures were not heavily built and were apparently rapid and fairly casual constructions not intended to last a long while. The small number of artifacts and their

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simplicity also suggest a small resident population consistent with cottagers/fishermen. Within structure F, there is definite evidence of two and probably three phases of occupation, separated by a brief period of sand accumulation. If this pattern is repeated in the other structures it is possible that they were each used by a few people for 2-4 seasons and then abandoned.

A depositional model for Akurvik is presented in Figure 5.109. In the bottom of the profile SU 24 (Medieval period) was encountered, its origin remains unknown. Next Structure F would seem to be the oldest of the observed fishing booths. Structure G is the original of SU22 which in-fills Structure F. Later on (perhaps within the earlier part of the Early Modern period) Structures E, A and D might be contemporary with each other. Structure A is the origin of SU 7 upon which Structure B was built. Finally, Structure B seems to have in-filled Structure C.

The concentrations of fishbone and fire-cracked rock suggest that fishing and fish processing were important activities at Akurvik. This is a familiar pattern seen from early fishing stations in Shetland, Orkney and Caithness. The presence of seal, bird and whale remains may suggest that a more broad-spectrum exploitation of marine resources may also have taken place from Akurvik. Perhaps one might

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even speculate that Akurvik was a central fishery for the southern part of the hreppur, later replaced by the Gjogur site area in the Late Medieval and Early Modern periods. The location, at the tip of the long Reykjarnes peninsula would have provided proximity to offshore resources of many sorts and many marine species are represented in the archaeofauna.

The most plausible explanation for the site is that this small bay was the site of seasonal fishing "booths" such as those widely documented in the historical record. The excellent organic preservation and the clear stratigraphy have allowed direct correlation of short term midden deposits with short term structural occupation. If the geological evidence of tephra and isostatic uplift and the lack of "historic ceramics" characteristic of Early Modern occupation in Iceland provide a correct impression of the period of occupation, Akurvik may well date to the Late Medieval period.

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5.8.3 Gjogur 4909-7

5.8.3.1 Site Background History

The site of Gjogur is located along the southern edge of the Reykjarnes Peninsula (see Figure 5.97, 65 59' N, 21 21' W), directly off Route 643 and visible from the road. The present farm consists of a complex of two farm houses and several byres and sheds. The farm mound can be found behind the current summer homes of the farmers at Gjogur and approximately 100 meters North from the Reykjarfjordur (see Figure 5.110). The Akurvik site (4901-1) is situated to the NE of the Gjogur and approximately 2 km distant. The two sites are now separated by the large runway serviced by Icelandair.

The current farmstead sits upon a raised early Holocene beach terrace overlooking the Reykjarnes fjord. A series of at least three beach terraces run parallel to the present shoreline. The modern farm sits on the second terrace immediately in front of an older terrace where the archaeological site was placed. Coring indicates that these terraces are composed of fist-sized rounded cobbles and small pebble-like rounded gravel, suggesting that these old

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beach fronts were the result of high intensity wave action not presently seen along this edge of the Reykjarnes peninsula. This would further support the notion that the isostatic rebound for this region was rapid during the early Holocene and gradually slowed. Perhaps the last event(s) were the Medieval rise so evident at the Akurvik (4901-1) and Pollavik (4901-2,3,4) site areas.

Gjogur was the center for the shark oil fishery in the northwestern Hunafloi during the late 19th Century and into the early part of this century. Maps dating to the early 1900s (now in the possession of Dr. Haukur Johannesson) show an approximately 100-150 structures spread across the Gjogur area. Most of these structures were small, temporary buildings related to the shark oil fishery and were pulled down after the collapse of this industry in the 1920s. Neither the 1988 nor the 1990 survey teams could find many traces of these structures. Local farmers however, did mention that these temporary buildings provided a source of building materials for the present dock and byre complex now in use at Gjogur. Currently the farmstead consists of a complex of two houses and several shed/byre buildings. These cement structures were built in the early 1920s. The dock at Gjogurstangi moors only one 8-10 meter vessel (used for fishing in the Reykjarfjord and transport in the

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hreppur) and several skiffs (used as small "run about" boats).

Gjogur is not as active a farm as it had been in the past. Most of the family who formerly resided at Gjogur now live in Reykjavik and the farmstead has only one year round farmer [43]. Through discussions with these farmers it was learned that the present family came to Gjogur in the 1860s. It was at this time that the old farm mound was abandoned as a living structure and the current farm location was used. Consistent with the re-use of old building materials, the farm/byre complex was dismembered and moved to the current site. The midden area of the farm mound was used as a "freeze-dryer" or *Surheygryfja* until the early 1960s. The farmers reported to the National Museum of Iceland and later to Dr. Haukur Johannesson that archaeological materials were encountered while this *Surhey* pit was in use.

5.8.3.2 1988 Investigations

Although a preliminary record of the *Surhey* pit finds were placed in the National Museum's archives, the shortage

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43. This farmer has recently passed away as of the writing this section. There is some discussion now as to whether to close down the farm and use it as a summer residence or to abandon it to the Icelandic state.

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of archaeological manpower prevented any further investigation of the Gjogur site until 1988. It was at this time that a survey party was sent to test the *Surhey* pit deposits and to determine if any of the original deposits were still intact. Other questions concerning the dates and depth of these deposits and whether organic remains could be recovered were taken into consideration.

Upon arriving at Gjogur the survey team was told that the farmer intended to bulldoze the farm mound soon after the testing was done. When asked why this was necessary, the farmer mentioned that the winter snow drifts from atop the farm mound were becoming a major hazard to livestock. Apparently snow drifts were making their way into the byre and preventing access. Also the "gully" formed between the farm mound and modern houses filled with snow and took a longer time to melt in late Spring. This "gully" also serves as a major access road to the pastures still in use by the Gjogur farm which are just below the airport and the Reykjarnes lighthouse.

Realizing that the planned 1988 test was too small [44] to

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44. It was negotiated with the National Museum of Iceland that only the *Surhey* pit fill could be removed and a very restricted column sample could be taken. No

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adequately test the entire farm mound, the 1988 team managed to get the farmer to postpone his bulldozing activities until a more extensive test excavation of the midden could be performed in 1989 or 1990. In the meantime only part of the *Surhey* pit was re-excavated. Great care was taken to isolate disturbed fill from intact midden deposits. It was soon discovered that a clay-like liner and wood planks separated the midden from the Surhey pit fill. Once this interface was clearly seen, the clay-like liner was peeled back. A column sample going down the NE side of the Surhey pit was dug to the bottom, the profile was straightened and mapped and organic samples of bone and soil taken. This sample was an approximate 0.70 X 1.20 X 1.80 meters (see Figures 5.111 and 5.112).

The column sample was stopped at this depth since no shoring materials were available. Additionally, because this column sample was starting to resemble a telephone booth, allowing little natural light to observe stratigraphy past one meter, problems in intrepreting the natural stratigraphy arose. A hand held soil core was used to determine the nature and the depth of the cultural deposits. Core #6 reach an additional depth of 1.17 (2.97 meters below

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intensive program of column sampling could be carried out at that time.

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the ground surface) before hitting the culturally sterile raised Holocene beach terrace. Core #7 could only reached an additional total of 0.66 cm. (2.46 meters below the ground surface). Core #7's limit was due to the core hitting a large rock but clearly the cultural stratigraphy still continued (see Table 5.71). A number of low laying turf walls were noted on the west side of the farm mound (see Figure 5.113). Five other core tests were performed between the turf walls and the west side of the *Surhey* pit. The results of these cores indicated that the pit was situated near buried structural turf (see Table 5.71).

It was noticed in the excavation of the column sample, that no Early Modern period artifacts were recovered. This supported the farmer's claim that the farm mound was abandoned in the 1860s. Most Icelandic archaeological sites which date to the mid 1800s usually have a high percentage of ceramic and glass materials. The depth of the midden indicated an accumulation, well over 2 meters, of well stratified deposits that could possibly extend back into the Medieval period.

The organic remains were well preserved and seem to reflect both Gjogur's farming and maritime economies. Numerous bones from cattle, caprines and other livestock were recovered. Codfish bones were also present in large

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numbers with the size of the codfish indicating individuals whose live length were in excess of 1.20 meters. Based upon these preliminary findings the 1988 team strongly recommended returning to this site for a more extensive look in 1990.

5.8.3.3 1990 Excavation Plan

In order to compensate for lost time due to political problems in Reykjavik, the site was mapped with a laser transit. While the mapping was being conducted, a meter grid system was established over the midden area. Once the contour map had been plotted, several features became apparent:

1. - The farm mound was approximately 3 meters above the last raised early Holocene beach head. This confirmed the 1988 core tests and, therefore, the excavators could expect to encounter 2.50 to 3.00 meters of cultural deposit.

2. - The *Surhey* pit had occupied most of the area atop the midden. This meant that most of the disturbed deposits would be encountered moving downhill toward the northeast. A recent tractor path running up the

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mound in this same area meant that further subsurface disturbance could be expected.

3. - The area of the farm mound where the *Surhey* pit was encountered was most likely to be a midden area. The pit occupies the northeastern edge of the mound. The western portion of the mound has barely visible decayed turf structures. However, with the aid of the EDM contour map, the turf structures become more readable. The western position of the midden has several turf walls running in an East to West fashion. It was decided at this point to avoid the Western portion of the mound as it was likely to encounter architectural remains [45].

Based upon these observations and time constraints of two weeks, a revised excavation strategy was developed. This strategy required the *Surhey* pit to be emptied of disturbed fill deposits. This would ease the task of connecting the 1990 excavation with the 1988 test. The SE wall of the Surhey pit was stripped of its clay liner. One meter

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45. The 1990 research permit did not call for the excavation of archaeological structures. It was felt that the complexity of a turf structure or structures would slow the excavation test and to properly excavate such a situation would require several field seasons. Such an obligation could not be met at that time.

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excavation units then connected the 1988 test to the 1990 unit squares.

In order to compensate for the rather steep bedding angles of the Eastern edge of the farm mound, an "L" shaped set of four, one meter units were orientated East/West. These units are designated as K20, K19, K18 and K17. Since the *Surhey* pit is an oblong feature, these four East/West units were set back approximately .50 meters, creating two smaller half meter units. These are designated as J18 and J17. In order to make sure that some control could be maintained in a North/South bedding angle direction and to ease site shelter logistics, one last unit was placed south but adjacent to K20 and is designated as L20. The site datum was then placed 1 meter further to the East in line with K20's Northeastern edge (see Figure 5.114 and 5.115).

A site shelter was constructed atop the open pit and the proposed excavation squares. Since the farm mound at Gjogur is exposed to strong SE winds, protection of the crew and the stratigraphy became important. The site shelter allowed a relatively warm and dry place to work in what turned out to be the coldest and rainiest part of the 1990 season.

In order to speed the excavation great care was taken in the pealing back of the pit liner. This was followed by a careful profile straightening and mapping of all visible

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stratigraphy (see Figures 5.116). The natural stratigraphic units were each assigned a number and traced out to the stratum's full extent. This careful mapping allowed the excavators to link up the 1988 test to the 1990 observed stratigraphic units (or noted as SU in later parts of this text).

A disturbed wall feature was encountered along the NW part of the Surhey pit profile. This feature was composed of four large and well rounded cobbles with turf packed around the stones. Apparently the farmers who originally created the *Surhey* pit had dug into a turf structure and removed most of it. When the Surhey pit was cleaned of its disturbed debris, many large, well rounded cobbles were encountered. It can only be surmised that these stones were once part of this wall structure. After a flattening of surface grasses around the pit's NW edge, a low turf wall was noticed. The wall seemed to have a East/West orientation with bend extending back toward the Western side of the mound. This indicated that the midden deposits were directly outside a turf structure and the proposed excavation would not disturb any other architectural features [46].

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46. In SU 38 and 39, another cobble stone feature was encountered and thought to be part of the base of this

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A number of artifacts were encountered in this profile cleaning, two of which confirmed the idea that the midden deposits could date into the early Medieval period. The first is a composite bone comb side-plate that stylistically dates to ca. 1150-1250, and was encountered in SU 43 (see artifact number G21 in Figure 5.121). A similar comb fragment was recovered from the Svalbard site (6706-60), Svalbardhreppur in the Nordhur-Thingjarsysla (cf. Amorosi 1992). The side-plate is a rather simple affair; it is made of bone with two engraved lines running down the length of the plates and two small rivet holes (presumably for copper rivets). The side-plate ends with a square chisel shape.

Further down in SU 60 a steatite vessel was recovered (see artifact number G51 in Figure 5.123). Apparently the plate was broken in use as is evident from the two conjoinable fragments. The base of the shard has an oblong square-ish angle which could date the vessel within an early Norse context!

It is also interesting to note that no characteristic late 19th century artifacts were encountered. This supports

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wall. It is interesting to note that these stones were disturbed and that no turf was packed around them as apart of the normal building sequence. This does suggest that this turf wall was disturbed at an even earlier time than the creation of the *Surhey* pit.

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the idea that the farm mound was abandoned somewhere in the 1860s. After the 1860s, ceramic materials become a widely affordable commodity throughout the North Atlantic (G. Miller, personal communication 1990) and farms such as Gjogur would probably begin major purchases then.

5.8.3.4 Excavation Methods

The excavation methods were generally similar to those for the Akurvik site operations. All phases of excavation and backfilling were photo-documented using a 35 mm Color and Black & White format. However, the deeper Gjogur excavation used a stratigraphic bedding angle approach in which a bedding string was placed to match the natural contour of the farm mound. Excavators dug through strata by 5 cm increments as measured off this string using the natural stratum. All units were kept in phase and horizontal as well as vertical relationships were documented. As the excavators dug down into the strata, SU assignment could be given as based upon the *Surhey* pit profile. This gave the excavation control over a potentially difficult temporal phasing.

All excavated earth (a 100% sample) was screened through a 4 mm wire screen mesh. Any <u>in situ</u> finds were given a

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three point plot (x, y and z) as measured off the site's sub-datum which in turn is tied to the site datum and EDM generated contour plan. Inert Aluminum tags were used to record the in situ find or screened materials provenience. If any deposits were very rich in organic remains, such as bird and fish bone, the sample was then removed as a bulk sample to be treated later in the laboratory. Two column samples were collected for paleoentomological and paleo-botanical research [47].

The time constraints and lack of man power even further reduced the test at Gjogur. In order to acquire a sample of materials that would verify the 1988 test and reach the bottom of the midden deposits, a new strategy had to be developed. All units were taken down to what appeared as the first change in the stratigraphic bedding angle. This change in the bedding angle would reasonably guarantee the first cultural break in Gjogur's long sequence and a reasonable sample of the terminal phase of the so-called "Little Ice Age" strata. Practically, this would bring the excavator down atop SU's 13, 14 15 and 17 (see Figures 5.126 and 5.127). The units L20, K20 and K19 were closed at this

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47. The paleoentomological samples were sent to Paul Buckland at the University of Sheffield, U.K.; the paleo-botanical remains were shipped to Cindy Zutter at the University of Edmonton, Alberta, Canada.

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point. Only four units were then to be taken to the bottom of the midden deposits, K18, K17, J18 and J17 (see Figure 5.128). From this point onwards the excavation moved quickly with the experienced excavators in the units and the less experienced working the screens.

These four units were quickly brought down to the bottom within a period of 4 days (see Figures 5.126 and 5.127). The last stratigraphic Units encountered were SU 60 & 61, approximately 2.20 meters below site datum surface. This deposit was a 10 cm black organic layer full of bird and fish bone which was bulk sampled. Under this layer another stratum of peat ash was encountered. Because of the extreme wetness of the deposits all excavation was stopped. Unfortunately, the four excavation units had taken on the nature of a telephone booth with an almost jelly-like base. In order to avoid a soil collapse two soil cores were sunk to the bottom of the cultural units. The K18 core was able to pass down another 80 cm to what resembled the Holocene beach gravels substrate. Although the soil cores were compressed and wet, the bottom layers of the midden contained little organic material, but much burnt peat ash. The stratigraphic nature of the peat ash could only be surmised because of the wetness of the deposits obscuring any detail.

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5.8.3.5 Site Conservation

Final documentation of the excavation was completed as SU 60 & 61 were excavated. This involved accurate mapping of all exposed profiles within the *Surhey* pit test. Stratigraphic Unit sheets were filled out and soil pH readings were measured a final time. The closing phases of the excavation were photographed and the test was prepared for backfilling.

In order to distinguish where the 1990 excavation had stopped, all bedding strings were anchored and left in place. All SU assignment tags were also left in place. Atop these was placed a damaged site shelter skin of white polyethene plastic, smaller sheets of plastic and strips of red surveyor's flagging tape. All removed earth was carefully placed atop this with the final layers consisting of removed cobble stones, earth and live turf. This strategy was decided upon after numerous discussions with landscapers in the United States. The cobbles would provide adequate drainage for the live turf and prevent further erosion.

While substantial artifactual and ecofactual collections were recovered from stratified deposits at Gjogur, the 1990 operations only provide a small sample of the site's midden

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deposits. A more extensive operation is needed at Gjogur in order to better understand the site's economy and temporal phasing.

5.8.3.6 General Observations of the Gjogur Midden Deposits

There are a number of field observations that can be made about the midden deposits. Three rather obvious stratigraphic breaks can be determined. Stratigraphic Units 1 through 9 contained the Early Modern Deposits. Late Medieval deposits were most likely encountered in SU's 10-38. The earlier Medieval and possibly settlement layers are encountered in SU's 38-61.

Su's 1-9 were mostly composed of a turfy brown set of peat ashes. These deposits were almost horizontal in deposition and contained numerous large sized codfish (individuals whose live length were nearing 1.50 to 2.00 meters) and seal remains. Very few livestock or bird remains were encountered at this level. One characteristic artifact for this period is a perforated caprine metapodial. The metapodial is perforated on the bone's proximal and posterior plantar surfaces (cf. Amorosi 1991 and 1992, Bigelow 1993). Such materials was encountered at the

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interface of SU's 2 and 3, and loose materials were recovered into SU 9.

The later Medieval deposits exhibited a change in the bedding angle. The strata tended to dip to the NW and NE sides of the excavation units and contained much more burnt reddish-brown peat/wood ashes. Numerous fire-cracked rock was encountered in these strata, starting in SU 13-14, increasing in the middle SUs and finally showing a noticeable decrease by SU 38 (which was the base or footing of the turf wall structure).

Great pains were made in the field to distinguish between the fire-cracked rock and the broken cobbles left after the turf wall was pulled apart. This distinction was rather easy to make. For the most part the wall cobbles were between three to five times the size of the fire cracked rock. The more difficult pieces could still be distinguished by their taphonomic signatures. Most of the fire-cracked rock had clear cut signs of burning and fire cracking and grazing. The broken wall cobbles had showed signs of breakage with a hammer and bar.

The faunal remains from the Late Norse materials exhibited a different pattern than those in the Early Modern Deposits. Although codfish were as numerous as the above layers, the actual length of individuals decreased in size

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(closer to the length of modern codfish, approximately 0.50-0.70 meters). Seals seemed to have vanished from these deposits while domestic livestock (mostly caprines) were recovered. It is interesting to note that bird remains are completely absent in these layers and by SU 38 the perforated metapodials vanish.

The early Medieval deposits represent the third cultural break in this series of strata. The strata are a mix of brown turf, peat ash, wood ash and decaying wood. The bedding angle has made a much deeper dip in the NW and SE corners of the units. The SU's in these layers get more progressively wet as you near the bottom. Likewise, the bone preservation also become worse towards the bottom of the midden.

The faunal materials also make a change over with this new bedding angle. Large numbers of bird materials are recovered with large sized codfish, seal and domestic livestock. This type of signature is completely consistent with Medieval Icelandic archaeofauna (Amorosi 1991). Also of interest are the caprine metapodials. Below SU 38 caprine metapodials are not perforated. Instead, these cannon bones are longitudinally split. This pattern has been noticed for most early Medieval sites in Greenland and the Northern United Kingdom.

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A final change in bedding angles was observed below SU 61. The dip in angle tends to move off toward the SE portion of the excavation units. This change in bedding angle occurs after the last organic deposit was encountered. This would represent the earliest deposits of organic remains and possibly be the first peat ash midden dumps at Gjogur.

5.8.3.7 Gjogur 1990 Artifactual Finds

A total number of 145 small finds were recovered from the test excavation (see Tables 5.72 and 5.73 for the Gjogur find statistics and finds register). The majority of the artifacts are bits of copper alloy (bronze?) sheets. Numerous iron objects were also recovered and, again, the majority are probably related to boat building activities. Most iron objects resemble boat roves and wrought nails. There is also some slag present in these materials. This might indicate that the farmers at Gjogur were smelting bog iron but it may also reflect re-smithing of worn or broken tools. The other categories of small finds can be broken into worked bone, stone wood and fabric.

Much of the worked bone tends to be the result of manufacturing debris. The other organic materials are

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represented by dressed wood fragments and small pieces of cloth, while the stone materials are small whetstones and steatite plate fragments. Although further analysis of these materials stills awaits, most of these materials would seem to relate to the domestic economy of the Gjogur farmstead.

5.8.3.8 Diagnostic Finds

There are a number of diagnostic finds that can be given a preliminary description at this time. These materials are illustrated in Figures 5.117-5.125 and will be broken down by the three major cultural breaks observed in the stratigraphy.

Early Modern Materials: Although the stratigraphic breaks would indicate an Early Modern to Late Norse interface occurring around SU 9, the artifact materials would indicate a later break, perhaps around SU 15. Typical of these materials are the copper alloy sheets and wrought iron nails or rivets. The bronze buckle (register number 4901-7.23 or G23) was most likely used as an article of dress, perhaps for a shoe, and probably imported.

Late Medieval Materials: The Late Medieval materials are only represented by two quasi-diagnostic finds. Although

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these materials occur on a higher frequency in Late Norse levels, these same materials are still being manufactured throughout Scandinavia. However, the worked bone resembles similar bone fragments from other Icelandic Late Medieval collections. The piece was more than likely part of a toggle clamp. The whetstone's mineral composition is of interest as it is an exotic stone not found in the local area. The stone has a grit and color consistent with Norwegian schist commonly used for whetstones and commonly imported in this period to Iceland.

Early Materials: Two of the Medieval finds can provide a rough set of dates at this time. These are the composite bone comb side-plate (G 21, dating ca. AD. 1150-1250) and steatite plate fragments (G47 & G51) already described. The other material represents bone toggle clamps, whetstones, an iron hook and a jasper strike-a-light. These materials are consistent in stratigraphic relationship and relative dates with numerous other Norse finds recovered from Iceland, Greenland and the Northern United Kingdom.

5.8.3.9 Gjogur Site Interpretations and Conclusions

There has been some discussion as to why midden deposits as deep as those found at Gjogur form over time. Brox

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(1965) was the first to speculate that after the rise of the commercial Norwegian fin-fisheries a paucity of male labor resulted. This in turn prevented the spreading of kitchen waste into home fields (a farm's protected pasture) as fertilizer. As a result, the midden waste accumulated into large tells, or farm mounds. While this model has been criticized (Bertelsen 1984) the Icelandic case of farm mound formation can add a new aspect to these arguments.

It would seem that the midden accumulation in Arneshreppur (and elsewhere in Iceland) was used to stabilize the erosion of the farm mound and raise the farm above the ground surface. This had two effects, first to prevent erosion from snow melt and rain, and also to act as drainage for accumulation of surface water. Throughout the Gjogur sequence, bone deposits were separated by strata of burnt peat ash. This would serve to drain the surface of the farm mound of standing water. In fact the lower strata in the midden were wet because of this type of deposition.

Ethnohistorical information from Arneshreppur also points out another problem faced by the farmers, a problem of ice surges from the winter "pack ice" moving on land and crushing anything in their path. This could suggest that the raising of the farm well above sea level became increasingly necessary as sea ice conditions became worse in

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the so-called "Little Ice Age". The farmers in this region still fear massive accumulations of sea ice which can suddenly become unstable and surge across to the relatively flat land areas where farms are located. Several farmers in the Arnes community can recall such surges which carried not only sea ice but large drift timbers caught in the ice.

The midden accumulations at Gjogur would also seem to be a stabilization of the farm mound. The four changes in the bedding angle of the strata are the result of episodic grade leveling of the farm mound's surface. This would also help to increase the living area of the mound while preventing the mound from eroding.

5.8.3.10 Diachronic Patterns

The site is a potentially important site for diachronic patterning and intra/inter-regional comparison. The materials recovered from the midden represent a long span of Icelandic history which is poorly recorded in documentary records. The midden deposits provide another glimpse of the daily life of this region. Locked in the archaeofauna and other bioarchaeological materials are patterns concerning the economy of this household and the economy of the Reykjarnes peninsula. Although the Akurvik site provides a

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look at a Medieval fishing station, it is the site at Gjogur that would have controlled and integrated Akurvik's catches into the larger regional arena of Northern Iceland.

This archaeological data set is complimentary to the historic records. It provides an independent check on the view of reality provided by the documentary sources and allows investigation of long term trends which may not have been apparent to the contemporary actors. The results of climate change, environmental impact by prior landuse decisions and the local effects of the spread of the later Medieval-Early Modern "world system" are all directly reflected in the bioarchaeological record and may be only distantly visible in the documents of the Medieval period.

5.9 CONCLUSIONS

This chapter describes seven archaeofauna with sample sizes large enough to start a discussion of Icelandic economy over time. However, there are a number of biases within these materials. The older collection of Adalbol, Herjolfsdalur and Tjarnargata 4 were recovered at a time when there was no discussion of zooarchaeological recovery standards. For their time, these bone samples were truly large and thought to be representative of their individual

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sites. However, based upon modern recovery standards combined with a program of paleoecological sampling, these collections have small sample sizes when compared with the more recently collected samples mentioned in this chapter.

Likewise, there is a set of problems which bias the modern collection of Hjallholl, Nesstofa, and Midbaer (this might also be evident with the Akurvik and Gjogur samples when analyzed). The problem lies neither with the collection of large sample size assemblages nor in the establishing of a diachronic series of data. Collectively the Hjallholl, Nesstofa and Midbaer assemblages have a sample size of 23,798 identified remains (Hjallholl = 3,399, Midbaer = 9,596 and Nesstofa = 10,803), optimal sample sizes for purposes of quantification. These archaeofauna also demonstrate a clear set of diachronic economic trends. The problem lies with the area coverage of these excavated samples in that it is hard to tell how representative each collection is of its particular site.

The site of Hjallholl, for example, has the largest area excavated with an approximate 2 X 3 X 2 meters test cut (12 cubic meters) but with the smallest sample size of 3,399 remains. The other two column tests of Nesstofa and Midbaer have much smaller cubic volumes excavated (approximately 0.25 X 1.00 X 2.00 meters, or 0.5 cubic meters) yet have

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three times the amount of bone materials. Clearly the area representation of each site is not even. The Nesstofa and Midbaer samples might have recovered the most densely packed or deposited area of their respective sites.

The Hjallholl materials also raise the question of sequential ordering. Could the patterns observed at this site be different if the test cut was placed several meters in any other direction? Likewise, the other column samples beg this same question. Do such styles of excavation allow for the finding of a representative portion of a site (very much akin to the game of "battleship")? Certainly much larger open area excavations are needed for each of these sites.

This bias becomes an even greater problem in attempting to establish archaeological patterns for paleoeconomic reconstruction. This can be clearly seen in attempting to synthesize intra-regional zooarchaeological data in the discussion of how cod fishery became commercialized in the North Atlantic. When questions of "targeting a species" and "the size of fish landed" are being used as archaeological signature of the commercial stock fish trade it is especially important to control the representation of any one site sample.

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While this sounds like a rather gloomy outlook toward this type of collection procedure, this is a valuable recovery method if:

1. - The column sample is a first step toward opening up a larger excavation and "total" recovery of a larger archaeofauna can occur. Granted that this may not possible within the confines of North Atlantic and Arctic Archaeology, where certain situations only permit an available window of opportunity or where the column sample is all that remains of an eroded site.

2. - Column and small test cuts recovery can yield a valuable window for the control of a future larger excavation. The Akurvik and Gjogur tests mentioned within this chapter clearly illustrate this point.

3. - Materials recovered from these types of test are invaluable in order to establishing a diachronic control for chemical (heavy metal, O2 and C13/C12 ratio data), tooth wear and aging parameters within any archaeofauna.

4. - The value of radiocarbon dating animal bone materials from multiple sites is not to be overlooked.

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While such samples will continue to plague faunal analysts, small scale tests done in conjunction with larger open area test will yield critical data for paleoeconomic reconstruction.

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ICELANDIC ZOOARCHAEOLOGY:

NEW DATA APPLIED TO ISSUES OF HISTORICAL ECOLOGY.

PALEOECONOMY AND GLOBAL CHANGE

by

THOMAS AMOROSI

VOLUME II

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Chapter 6

THE 1987–90 ARCHAEOFAUNA RECOVERED FROM THE SITE OF BESSASTADIR

6.1 INTRODUCTION

The excavations at the site of Bessastadir have been ongoing since 1987 when extensive repair of the 18th century governor's mansion and grounds was undertaken by the Icelandic government. The excavations at Bessastadir have been under the direction of Gudmundur Olafsson and Siggi Bergsteinsson who are working for the National Museum of Iceland. Some preliminary findings of the site's major structural contexts and finds have been reported, and a monograph is in preparation. Halldor Baldursson (1990) reported on the finding of two 16th century iron cannons. Gudmundur Olafsson (1988, 1991b & d) has provided the only descriptions of Bessastadir's major structures and contexts and Kevin Smith has made a preliminary report on the 1987

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season's ceramic finds. Likewise, the 1987-1988 organic remains have been discussed (Amorosi, Buckland, Olafsson, Sadler and Skidmore 1992). This publication is currently out of print and inaccessible to the North American audience and in order to rectify this situation, the 1992 publication is included in the appendices [48]. This chapter will also provide some new up-dates on the 1987-1988 material as well as the 1989-1990 material. However, there is little synthetic analysis having due to the excavators re-worked the dating of all the organic samples and site contexts at the time of writing. It would also be unwise to offer a more detailed analysis of the 1987-1990 archaeofauna since the 1991-1995 bone is yet to be analyzed. These materials were not made available for study due to the change in Iceland's antiquity/archaeological laws and to internal politics within the Icelandic archaeological community. [49]

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48. The format of the next five chapters will be different from the last four. In these chapters, 6-10 the large sample size archaeofauna from Bessastadir, Granastadir, Storaborg, Svalbard and Videy will be discussed separately.

49. As a brighter postscript, plans are now underway for the author to analyze the 1991-1995 materials along with the materials which will be recovered in the 1996 season.

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6.2 UP-DATES FOR THE 1987-1988 MATERIALS

While a re-working of the sequencing for the Bessastadir's site contexts have been underway, the 1987-1988 avian materials have been identified and are reported here in Table 6.1. Although there are no rare or vagrant species on this list, it is interesting to note the mix of bird species. There is a relatively greater number of Anseriformes (Ducks and Geese) than sea birds (gulls and auks). Also mixed in with these two general groups of birds are a small number of shore birds such as the Icelandic oystercatcher, ***Haematopus ostralegus*** and terrestrial species such as the rock ptarmigan, ***Lagopus mutus***. This particular mix of species suggests that the local vegetation cover around the Bessastadir site has not changed much since the 18th century (at least according to the datable ceramics recovered from these same deposits).

6.3 THE 1989-1990 MATERIALS

The remains reported in Table 6.2 were analyzed while the author was staying in Reykjavik in 1990. Although the bone materials were identified to a Family/Genus/Species levels,

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none of the aging, osteometric and paleopathology analyses could be done and these still remain in need of analysis. These additional analyses will be performed once work starts on the 1991-1996 materials. Therefore, the total bone count for the 1989-1990 materials is 1,565 (with an NISP count of 1,132 and a TNB count of 433). The assemblage total count for the 1987-1990 materials is 16,557.

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Chapter 7

A VIKING-AGE ARCHAEOFAUNA FROM THE GRANASTADIR SITE IN NORTHERN ICELAND

7.1 INTRODUCTION

The site of Granastadir is located in the Eyjafjordur of northern Iceland. The site itself is situated in an interior valley some 45-50 km south of the modern town of Akureyri. The valley also bears the name of Eyjafjordur (Eyjafjardardalur, located 65 15' N, 18 17' W). It is a long valley, situated in a rough north-south orientation. At the head of the valley are three farmsteads, Holar, [50], Holsgerdi and Tjarnir. The last two farms (Holsgerdi and

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50. This is not the same northern episcopal see/church farm mentioned earlier in chapter 4. The bishopic farm of Holar is located further west in the Skagafjordur area.

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Tjarnir) are situated on a glacial moraine, some 250-300 meters above sea level (asl.). The Granastadir site is about 1 km. south of Tjarnir and the moraine helps to delineate a natural northern border for this farm's catchment. The river Eyjafjardardalsa runs along the valley floor passing just to the west of Granastadir. Granastadir's eastern border is formed by the mountain of Tjarnarfjall and on the west by Torfufell. These mountains flank a hanging valley known as Gleradalur, where a stream (the Glera) has formed an alluvial cone leading down to the Eyjafjardarsa. It is at this confluence of river and stream that Granastadir farm was located (see Figures 7.1, 7.2 and 7.3). Granastadir's catchment area is further confined in the south by narrowing of the valley as it rises to the interior plateau.

The site of Granastadir was excavated from 1987-1989 by Bjarni Einarsson (Einarsson 1994a) who contacted the author to provide the analysis of the recovered archaeofauna. Einarsson exposed a multi-structure farmstead. The major structure is a "turf long house" (see Figure 7.4, structure designated as 9 A-C), with associated turf outbuildings (Figure 7.4, structures 3, 15, 16, 17). These structures seem to be single phased

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according to the tight radiocarbon and tephra dates. Einarsson dates the occupation of this farm to the late 10th century. It would also seem that this farm was occupied for a very short period (perhaps 1 or 2 generations, see Chapter 2 for the dating of this site, also Einarsson 1994a:99-103). After the farm was abandoned, Granastadir was not re-occupied and the site was not disturbed until it was excavated in 1987-1989. It is thus far the earliest tightly dated archaeofauna from this part of Iceland.

The animal remains from the site were carefully collected (mostly by *in situ* hand recovery and some screening through wire mesh) as evident by the numerous fragments 2 cm. long and smaller, including 3 mouse bones. The assemblage has 1,656 fragments identified to family/genus/species level and the entire fauna has a total of 5,495 fragments. Most of the Granastadir bone materials were sent back to Arbaersafn (Reykjavik City Museum) for curation upon completion of the first stage of analysis. While the first stage of analysis has been completed, certain analyses have yet to be completed. These include:

1. - the confirmation of the species assignments of the avian materials. The analysis of the materials is

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almost complete and will be reported in the near future.

2. - age profiles, skeletal element frequency and paleopathology parameters (also need to be confirmed) of the archaeofauna are nearing completion and will also be reported in the near future.

Enough of the work is completed, however, to provide a thorough description of this archaeofauna.

7.2 A COMPARISON OF QUANTITATIVE MEASURES

The Granastadir site offers one of the rare opportunities to compare quantification measures. Unlike many of the Icelandic archaeofauna which were formed by various long term gradual accumulations of midden debris, the Granastadir materials represent a much shorter span of time and accumulation. In fact, the materials that were recovered from structures 9 and 15 seem to be derived from one to several episodes of dumping. The debris had been placed on a relatively clean surface, buried, and remained

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undisturbed till excavation. Because of this, comparison on NISP, MNI and RF counts can be made.

Table 7.1 presents a comparison of the NISP, MNI, and RF measures for the different site contexts at Granastadir for the two most common taxa, cattle and caprines (sheep and goat). Each of these quantification measures can be used to generate comparative statistics. In Figure 7.5 these different zooarchaeological quantification methods are used to generate a ratio of caprine to cattle bones for the different contexts and for the whole site collection. The sample size of identified fragments is noted for each context. As theory would suggest, small sub-samples (samples from areas R3, R9C and Exterior) show a good deal of random variability between measures. In the contexts with the largest sample size (R 15 and the site total), all three measures converge, indicating a probable caprine to cattle ratio of about 2 to 1. This patterning is both an encouraging indication of the quantifiably of the whole Granastadir archaeofauna and a cautionary example of the perils of quantifying bone samples much smaller than 300-500 identified fragments (see Chapter 2 for discussion).

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7.3 TAXA PRESENT

Table 7.2 presents the count of all animal bone fragments recovered from Granastadir, broken down by site context and totaled (at far right) for the site as a whole. Unidentified mammalian fragments (lower rows) were divided into Large (Horse-Cattle sized) and Medium (Sheep-Pig- large Dog sized) terrestrial mammals and totally unidentifiable bone scrap (mainly very small scraps of mammal bone). As in most well-collected archaeofauna, these unidentified fragments make up the majority of the total collection. The fragments that could be assigned to a higher taxonomic level (NISP) include domestic mammals, cetacea (whales and porpoise), birds, fish, and mollusca (shellfish). Figure 7.6 illustrates the relative abundance of the major taxonomic categories.

7.3.1 Domestic Mammals

Domestic Mammals include cattle, ***Bos taurus***, horse, ***Equus caballus***, pig, ***Sus scrofa***, sheep, ***Ovis aries*** and goat, ***Capra hircus***. The "caprine sp." category includes the bones of both sheep and goats, while the "sheep" and "goat" categories are only those fragments securely

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identified to species level. Although dog remains were not recovered at Granastadir, the marks of medium sized carnivore tooth patterns on many of the other animals bones indicate their presence. Figure 7.7 illustrates the relative abundance of domestic mammals. Cattle bones make up about 30 percent of the domesticates, caprines (all sheep, goats, and caprine sp.) about 60 percent, with the remainder split between pig (approximately 7 %) and horse (approx. 4 %). While identified sheep bones outnumber goat bones by approximately seven to one, there are nevertheless more goat bones in the Granastadir archaeofauna than identified from any other site in Iceland. In this respect, the Granastadir caprine mix is more similar to late 10th-11th century archaeofauna from Greenland (McGovern personal communication 1994), all of which have substantial numbers of goats (V51 Sandnes Phase 1 = 5.98 sheep per goat, V48 Phase 1 = 4.5 sheep per goat. Ø 17a lower = 3.01 sheep per goat).

Both dogs and horses are rare or absent from most Icelandic Early Medieval bone collections, even in periods when land-registers document very substantial horse populations (Amorosi 1991a). Horses and dogs in later time periods apparently were not normally eaten nor were their remains disposed of in the same contexts as cattle

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and caprine bones. However the Granastadir horse remains are an exception to this pattern both in their numbers and in the many cut marks and indications of marrow extraction evident and they seem to have been regularly consumed at Granastadir. The occupation date of the farm, the presence of a pre-Christian burial overlooking the site (Einarson 1994a), and the clear evidence for the consumption of horse meat all would appear to suggest that most of the inhabitants of Granastadir followed the old gods. The anthropophilic house mouse, ***Mus musculus***, seems to have been a common pest on Norse farms across the North Atlantic. Substantial numbers of mouse bones have been recovered from several Medieval sites in Greenland (McGovern 1985a, 1992b; McGovern, Buckland, Sveinjarnardottir, Savory, Skidmore and Andreasen 1983).

7.3.2 Cetacea

Only one fragment of whale bone was recovered from Granastadir. This is a cut-marked fragment that could not be identified to skeletal element or family level. This is unfortunately typical of most whale material from North Atlantic sites where the dense bone was extensively used for tool making and craftwork (see Amorosi 1992a and

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Chapter 9). Only rarely do large, identifiable specimens survive in the archaeological record. Large or small, whale bone fragments on a site need not indicate the past presence of masses of whale meat, as it is clearly possible both to butcher a whale without bringing home any bone and to collect useful whalebone from beached whales and bones without gaining any meat.

7.3.3 Fish

Considering its inland location, Granastadir's archaeofauna was fairly rich in fish, producing just over 200 fragments (about 13% of the total identified). The majority of these fish were Atlantic cod, *Gadus morhua*, with a few fragments of salmon (probably Atlantic salmon, *Salmo sp.*, and a single shark tooth fragment (Table 7.3). The presence of a substantial number of salt water fish remains on the site indicates some sort of regular, ongoing connection with marine resources either directly or through an exchange network up and down the fjord.

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7.3.4 Mollusca

The shellfish identified from Granastadir are all clams species belonging to the genus *Mya sp.*, and the unidentifiable shell fragments are probably all from clams as well. In most of Iceland shellfish have been regarded as famine food and the blue mussel, *Mytilus edulis*, is the most common taxon recovered (see Amorosi 1991a). While it is possible that some of these clam shells represent food debris, it is more likely that they were used as spoons and scoops for food preparation and consumption as in later Iceland down to recent times. The concentration of clam shells in structure R9A (hall) and R15 (perhaps a midden-like refuse accumulation), further strengthens this hypotheses.

7.4 TAPHONOMY

Table 7.4 presents a summary of the major taphonomic indicators recorded for the major domesticates, cattle and caprines, broken down by site context. The "teeth as percent of NISP" indicator simply reports the percentage of the taxon's recovered skeleton that is made up of

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teeth. Tooth percent of taxon NISP ranges from 0 to about 5 percent for cattle and from 0 to 5 percent for caprines. For both major domestic taxa, teeth are most common in the R3, R16, and exterior units, and are least common in the R9A, R9C and R15 contexts. Note that this distribution is normalized for sample size: it does not correspond to the simple concentration of fragments (compare Figures 7.8 and 7.10).

Carnivore (presumably dog) chewing marks are present but uncommon in the Granastadir collection (Table 7.4). Less than 1 percent of the identified bones show carnivore tooth marks (and only in bones from the R15 unit) for both cattle and caprines. By contrast, excavated cattle and caprine bones from the Norse site at V51 Sandnes in the Western Settlement in Greenland (midden layers dating to ca. AD. 1000-1350) show substantially more carnivore chewing (caprines range from 4.7 % chewing to 14.38 % chewing, cattle range from 1.23 % to 7.58 % chewing). While attrition from dogs was certainly a factor at Granastadir, it seems to have had a comparatively minor impact.

Bone density has been shown (Binford 1978, Binford & Bertram 1977) to greatly affect the differential destruction of skeleta of different species and of

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different skeletal elements within the same species. Table 7.4 presents a measure of overall bone density (the mean of the element densities normalized for sample size, density measurements approximately following Binford & Bertram 1977). Very dense bones (like teeth and compact elements like the distal humerus) will have high density scores that tend to pull the mean density per taxon upwards while softer bones (like proximal humerus) will have low density scores that tend to pull the mean score downwards. This measure thus provides a crude but serviceable single-number indicator of the relative density of bone elements surviving attrition. As Figure 7.9 indicates, there is a certain variability in density scores in the different site contexts but general similarity in the pattern of cattle and caprine density distributions. Some of the highest concentrations of dense bone for both taxa are in the R 9 A-C and R15 areas while the R3 and exterior units had somewhat less dense bone elements. Figure 7.8 indicates that the distribution of (extremely dense) teeth across the units does not explain the variability in overall bone density scores illustrated by Figure 7.9. Variation in bone density does not seem to be random across the site and both the major

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taxa (together making up about 70 % of the archaeofauna) show parallel patterns.

The available taphonomic indicators thus suggest that:

1. - the Granastadir collection is not strongly ravaged by either carnivore chewing or chemical and mechanical weathering.

2. - these indicators suggest that bone survival of the two major taxa indicate non-random patterning across the site excavation units.

7.5 BUTCHERY AND BONE DEPOSITION PATTERNS

The animal bone fragments at Granastadir were not evenly distributed over the site but, rather, were strongly concentrated in unit R15. Figure 7.10 illustrates the distribution of all identified bone fragments (bar) and the distribution of selected major taxa (lines and symbols). Bones were concentrated in the R15 area and in the hall interior (R9A), with comparatively few bones recovered from the other units. With the exception of mollusca (clam shells), the distribution of major taxa seems to follow the overall

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bone distribution pattern - only mollusca show a disproportionate concentration in room R9A. If we assume that clam shells were in fact eating implements (scoops and spoons) on this inland farm, then their concentration in the hall area becomes logical. They were part of the eating equipment and were lost or discarded were they were most used.

Various workers have attempted to reconstruct the different "meat value" associated with different bone elements and butchery cuts (Lyman 1994; Woollett 1996). All these approaches are inevitably approximations, as reworking of deposits and the tendency of relatively low meat value bones (such as tarsals) to travel as attached "riders" on high meat value bones (such as tibiae) creates a good deal of noise in most excavated samples. While it is not possible to reasonably calculate kilocalories or other direct dietary measures from any but the most unusual archaeofauna, it is often possible to separate concentrations of "high meat value" bones that may be consumption debris from concentrations of "low meat value" bones that may be butchery waste. Although no account of paleocalories will be offered, regular patterns of consumption and discard can be tracked.

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In ungulate skeleta, the major muscle masses are associated with the upper limb bones: the forequarter and especially the hindquarter. While the lower limbs (the metapodials) are marrow-rich, they carry little muscle mass. While feet (phalanges) have some utility as sources of gelatin (and glue), they are otherwise of low food value. Crania (skull) fragments are associated with brains, eyes, and tongue, all of which may be regarded as primary butchery products (not offal). Cranial element discard patterns thus are culturally variable as butchery strategies and food ways change.

In Medieval North Atlantic Scandinavia animal heads clearly reflect valued primary butchery products and cranial fragments and should probably be classed with upper limb bones as indicators of consumption. The traditional Icelandic dish of svid (a sheep cranium split longitudinally) is clearly identifiable in the zooarchaeological record from Medieval Iceland and Greenland (where caribou crania were also split longitudinally, McGovern 1985a). Several sheep crania from Granastadir were definitely prepared as svid.

Table 7.5 presents the distribution of skeletal element groups across the site for both cattle and caprines, presenting both percentage and ratio measures of the

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proportions of cranial, upper limb, and lower limb/foot bones. While there is some evident variability, a clear-cut pattern does not immediately emerge from a simple body-part distribution analysis. However, an analysis focused on meat utility indices produces a clearer pattern of consumption and distribution patterns.

A widely used meat utility measure (Binford 1978) attempts to evaluate the overall "modified general utility index (MGUI)", which provides a numerical score for each bone element (including marrow and sinew values as well as attached muscle meat). While MGUI scores are not precise indicators of amount of associated meat and marrow, they can highlight major differences in the content of bone assemblages. The MGUI scores for cattle and caprines provides a simple single-figure measure (total relative frequency*MGUI/NISP) that is normalized for sample size and element frequency in the skeleton (so that bone-rich contexts do not inevitably have the highest MGUI score regardless of element proportions).

Table 7.5 presents this MGUI summary score for both cattle and caprines across the site contexts. Figure 7.11 graphs this MGUI summary score, indicating the strong similarity in meat value patterning in both cattle and caprines. Regardless of sample size, the highest meat

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value bone elements concentrate in R9A (hall), R9C (door area of the hall), and R15 (midden-like dumping area). It would appear that the hall area was indeed a center of meat consumption and that the highest meat-value cuts were eaten there.

Butchery at Granastadir seems to have followed a pattern common to most other Medieval North Atlantic Scandinavian sites. The animal carcass appears to have been disjointed using a heavy cleaver or axe, with shearing blows by a strong hand cutting across long bones and severing articular ends. Virtually all long bones were then broken open for marrow and some elements show slice marks from lighter knives probably used during the consumption of prepared meals. As noted above, horse bones were treated in the same manner as cattle and caprine bones, showing both heavy axe or cleaver blows and smaller slice marks.

It may be significant that all the caprine metapodials were split lengthwise - none showed the dual perforations common on later medieval collections from Iceland and Shetland. As Bigelow (1993) has demonstrated, this characteristic (and highly efficient) marrow extraction technique practiced all over Iceland down to the present is not a Viking-age survival but seems to have been

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introduced to Iceland sometime around AD. 1050-1100. This marrow extraction method did not spread to Greenland and its widespread adoption in Iceland seems to post-date the mid-10th century occupation of Granastadir.

7.6 OSTEOMETRICAL ANALYSIS

Analysts have measured excavated animal bones in order to reconstruct sex ratios and ancient breeds since the earliest days of zooarchaeology in the middle of the last century. Early efforts were hampered by non-standardized measurement systems and poorly defined osteological measurement points which often lead to sweeping generalizations based upon tiny sample sizes. Basic statistical measures (mean, range, standard deviation) were only sporadically applied and some of the same methodological and theoretical abuses that characterized human anthropometry in the first half of this century are evident in contemporary zooarchaeology.

The central European zooarchaeological tradition has been most deeply involved in metrical analyses and the publication of a generally accepted standard manual defining measurement points and standardizing terminology (von Den Dreisch 1976) has been a major contribution of

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this school. The International Congress of Archaeozoologists (ICAZ) has taken a leading role in improving and standardizing reporting of metrical studies of animal bones, but a daunting amount of variability is still evident in the literature. This report follows the conventions of von Den Dreisch (1976) and the general recommendations of ICAZ.

While standard measurement definitions are a critical step in zooarchaeological metrics, several basic problems affect the use of measurement data:

1. - Sample size is a chronic limitation. The elements most useful for genetic studies (cranium and horn core) seldom survive in measurable condition in any archaeological site. Most Icelandic collections are fragmented so that whole long bones are exceedingly rare and an archaeofauna with a NISP count of several thousand will commonly produce only a few dozen measurable bones of any given species and skeletal element.

2. - Measurement error is a significant problem and is especially prevalent on osteological points classified by von Den Dreisch as "difficult" (von den Driech's "-" measurements). These difficult

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points can produce measurement ranges of over 2.5 mm. Only the "reliable" Von Den Dreisch points are presented here. All measurements are taken with a Mitoyo digital caliper and all measurements are repeated at least 3 times and then averaged (those showing significant variability are repeated by different workers). Such procedures can reduce measurement error but cannot eliminate it.

3. - Equifinality is an even more basic problem in the interpretation of bone measurement studies - the size and shape of bone (like other tissue) is the result of a mix of factors acting on a once-living animal (age, sex, genetic composition, nutritional history, disease, parasite load, and traumatic injury, etc.). Many older studies clearly over-emphasized the genetic component (breed) and underestimated the impact of environmental factors (esp. nutrition) on growth rates. Noddle (1978) discussed this problem, citing a great number of controlled feeding experiments on modern pigs and cattle that have produced dramatically smaller adults from large-bodied breeds by scanting on total fodder or protein content during the growth period. In practice, nutrition and general health during the

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> growth period appears to be capable of producing variability in bone growth that effectively swamps out all but the most marked variability due to genetic composition. Much of the zooarchaeological breed-definition in cattle, caprines, and pigs may be illusory (Clason 1984:10).

Table 7.6 presents the basic statistics for the measurable cattle bones from Granastadir (mean, standard deviation, coefficient of variation, sample size and range). Table 7.7 presents the same data for caprines (both sheep and goat), Table 7.8 presents the same data for horses, and Table 7.9 presents the pig measurements.

7.6.1 Discussion: Size, Genetics and Nutrition

Despite their inherent limitations animal bone measurements can provoke (if not conclusively answer) some significant archaeological and environmental questions. As noted above, the caprine bones at Granastadir contain an unusually large number of very young (neonatal-late fetal) lamb bones and three nearly complete articulated lamb skeleta. In other Icelandic site contexts this pattern has been associated with other indicators

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(archaeological and documentary) of climatic stress during the 17th-18th centuries (the so-called "Little Ice Age", Amorosi 1992a; Ogilvie 1992). If these lamb bones at Granastadir are indeed a signature of stress on the sheep/goat herding economy, was this stress a single dramatic episode (a run of bad weather during lambing season?) or did it have a more prolonged, chronic character?

7.6.2 Sheep Genetic Indicators

Icelandic agricultural scientists describe modern Icelandic sheep as a single, fairly diverse breed with a presumably common ancestry in the Settlement Period and clear connections to the short tailed Finnish Landrace (Adalsteinsson 1991:285-291). Research by Noddle (1978) indicates that a few continuous and discontinuous skeletal traits can be directly linked to genetic inheritance and are not affected by sex or nutrition. The width/breadth (Bp/Dp in Von Den Dreisch terms) ratio of the proximal metacarpal is one such indicator.

Figure 7.13 presents a scatter plot of these two measurements on the available Icelandic zooarchaeological data from Tjarnargata 4 ("T", settlement period,

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Reykjavik), Adalbol ("A", Early Commonwealth period, eastern interior), Videy ("V", 12th-17th century, Reykjavik), and the south coast site of Storaborg ("SL" = Storaborg lower, 1300-1500, "SU"= Storaborg Upper, 1700-1840). Note that the Granastadir specimens ("G") fall near the central tendency of the distribution and, in fact, are all within one standard deviation of the rest of the sample. Note that the metacarpal can normally be securely speciated and that we are comparing only sheep, not goats.

Zooarchaeology thus lends support to the view of Icelandic agricultural science that Icelandic sheep from 870-1840 were of the same general genetic background. The Granastadir sheep were part of the overall Icelandic breed and should have shared the same potential adult size.

7.6.3 Sheep Size Comparisons

Figure 7.14 compares the same Icelandic archaeofauna (same site codes as Figure 7.13) and the same bone element (metacarpal), graphing the relationship between distal width (Bd) and mid-shaft width (medial width, SD). In this scatter plot the Granastadir sheep metacarpals split into two clusters: three specimens near the upper right

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corner (high end) of the distribution and seven specimens at the lower left (low end) of the distribution. Note also that two of the three high end specimens have medial breadths lower than the overall mean, placing them well out on the lower rim of the medial/distal distribution in the medial dimension.

Because of the longitudinal type marrow extraction method used at Granastadir comparatively few sheep metapodials were well enough preserved to allow measurement of the greatest overall length (GL). Figure 7.15 illustrates the distribution of the greatest length (GL) measurement, again comparing Granastadir with Adalbol, Tjarnargata 4, Videy, and Storaborg (upper and lower). While some Granastadir specimens again fall into the mid-range of this distribution, the majority are substantially smaller than the rest of the Icelandic collections.

This relationship is further illustrated by Figure 7.16, a scatter plot graphic the relationship of greatest overall metacarpal length (GL) with mid-shaft width (SD). While three Granastadir specimens reach the mid-range of the distribution, five fall into the low end (lower left corner).

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The overall difference in size and robustness between the metacarpals of the majority of the Granastadir sheep, the other Icelandic archaeological specimens and modern Icelandic sheep can be further quantified but the qualitative relationship may be best illustrated with a comparative photograph (Figure 7.17). The Granastadir sheep metapodials are quite clearly neither as long nor as robust as their counterparts and appear dwarfed by comparison.

Other skeletal elements that can be securely identified as sheep support this general impression. Figure 7.18 presents a comparison of the distribution of the length of the first phalanx (toe bone) in the Granastadir archaeofauna and the phalanges from Adalbol and Videy. While a few specimens reach the mid-upper end of the range, most are below average length.

Figure 7.19 presents the mean and one standard deviation limits of the distal humerus width (Bd) for sheep specimens measured from Granastadir, Videy, and Svalbard (Amorosi 1992a). While the Granastadir distribution just overlaps the lower range of the Videy and Svalbard humerus measurements, note that the Granastadir mean is below the lower one standard deviation limit of both other sites.

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Figure 7.20 presents a scatter plot of the greatest length (GL) and medial width (SD) for the few measurable sheep radii from Granastadir and Videy. While sample size is small, a now-familiar pattern emerges - while one specimen groups with the Videy radii, the majority are substantially shorter and less robust..

Thus for each skeletal element that can be securely speciated and which survives in quantifiable numbers, the Granastadir sheep appear to have included some individuals (rams or wethers?) of near-average size but the majority of animals appear to have been significantly smaller and less sturdy than either modern or other Viking - Medieval period sheep in Iceland. Note that, given fragmentation and diverse finds spots, it is extremely unlikely that this pattern is biased by the preservation and recovery of a few small individuals. In an archaeofauna of this sort it is usually better to assume that each bone fragment probably derives from a different individual unless articulation can be demonstrated. None of the measured Granastadir sheep bones could be shown to articulate.

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7.6.4 Cattle

Cattle bones are less common than sheep bones at Granastadir and most other Icelandic sites and fewer measurable skeletal elements are generally preserved. Figure 7.21 presents a scatter plot comparing the greatest length (GL) and the medial breadth (SD) for cattle metacarpals from Granastadir, Videy, and Tjarnargata 4. In this case, we cannot argue that the Granastadir cattle appear either much larger or much smaller than other Viking-Medieval cattle in Iceland on the basis of the few whole metacarpals.

Figure 7.22 presents the distribution of the length of the first phalanx of cattle from Granastadir, Tjarnargata 4, and Videy. The Granastadir cattle phalanges appear to be at the middle to lower end of the overall distribution. This impression is strengthened by the pattern of a scatter plot of cattle phalanx greatest length and medial breadth (Figure 7.23). While a clear separation of archaeofauna is not visible, note that the Granastadir specimens concentrate in the lower quadrant of the graph. While the Granastadir cattle remains do not present the same set of clear-cut recurring patterns in size

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distribution as the sheep bones, the general impression is that they were in the mid to lower range in size and robustness for Viking-Medieval Iceland.

7.6.5 Size, Nutrition and Fertility

Icelandic agricultural scientists have carried out highly detailed, long-term investigation of the multiple relationships of grazing quantity and quality, winter feeding, multiple lambing frequency, lamb and ewe mortality and morbidity, growth rate and adult body size in Icelandic sheep (see Adalsteinsson 1991, Dyrmundsson & Thorgeirsson 1989 for English-language reviews). Not surprisingly, these factors are interlinked; poorly fed ewes have fewer and less healthy lambs who then grow more slowly and reach adulthood at a smaller stature (Gudmundsson & Dyrmundsson 1989:148-168). Prolonged poor nutrition can produced lowered milk production and reduced fertility in adults. Lower quality pastures and inadequate stall feeding in late winter place especially heavy burdens on pregnant ewes and their foetuses, increasing mortality of both (Thorsteinsson & Thorgeirsson 1989:113-145). In the recent past, after a hard winter, Icelandic farmers were often forced to kill newborn lambs

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to protect their mothers as even a short period of nursing could be fatal to the ewe (Adalsteinsson 1991:289).

Systematic studies (Thorgeirsson & Thorsteinsson 1989:194) have demonstrated that metacarpal length (the zooarchaeologist's GL measure) was the most strongly linked to heredity of all the carcass traits they measured (sample = 1,826 individuals). The same skeletal element can be used to indicate past genetic affiliation (Figure 7.13), confirming that the small stature of Granastadir's sheep was not due to heredity. If the full length of this most-heritable bone element was not regularly attained by the Granastadir sheep then a developmental problem seems the most likely cause.

It would thus seem most likely that the Granastadir sheep, especially the ewes, had grown up during a period of prolonged nutritional stress. From the epiphyseal fusion rates of the long bones measured in this study, we can estimate that this growth-period stress occurred at least 3-3.5 years prior to the death of the animals measured (Amorosi 1989a:85-89). Since most measured elements showed a total obliteration of fusion lines and clearly came from fully mature adults we can probably extend this likely stress period up to 3-6 years prior to the death of the measured sheep. The large numbers of

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newborn lamb bones and the several articulated newborn/late fetal lamb skeleta excavated thus seem to fit into a pattern of perhaps a decade or more of stress on the sheep herding portion of the farm economy.

7.7 CONCLUSIONS

The Granastadir archaeofauna derives from an early, high-status farm and its archaeofauna contains several elements that paleoeconomic researchers are recognizing as "signature profiles" of status and Viking-Age date (Amorosi 1991a, McGovern 1985a):

1. - Relatively high ratio of cattle to caprines: while wool production was a major chiefly concern (Ingimundarsson 1995), chieftains' home farms tended to emphasize cattle production as far as this was possible given local resources. By the later Middle Ages, a clear correlation between site rank and relative percent of cattle bones had been established in several regions.

2. - Pig and horse consumption: pork was a preferred food item throughout NW Europe but in the North Atlantic pig raising became increasingly expensive.

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By the 12th century, pigs (and their bones) become extremely rare in Iceland and Greenland. Both pork and horse flesh had significance in ritual feasts in pre-christian times. Horse sacrifice and horse consumption were both markers of chieftain-priests (godar).

3. - Marine resources on an inland farm: as argued by Durrenberger (1991), the ability to control access to distant resource spaces and their products is one potential trait of chiefly farms during the settlement period. This is a somewhat ambiguous marker as in later times lower status inland sites were sometimes integrated into regional-scale exploitation of marine resources.

Thus artifacts, site size and layout, and archaeofauna all indicate that Granastadir was a chieftain's farm - yet it seems to have been abandoned following some prolonged stock raising difficulties. While any extended speculation about the causes of these agricultural problems and eventual abandonment are beyond the scope of this report, it may be useful to suggest some alternate hypotheses for further investigation.

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Climate impact - though the 10th century is generally thought to be part of the so-called "Medieval Warm Period", some bad seasons were experienced during the Settlement period (Ogilvie 1991). Recent Greenland Ice Sheet Project (GISP2) results and some recent glaciological investigations are now providing some possible indications of a cooling event around AD. 1000 (Paul Mayewski personnel communication 1994; Andrew Dugmore personnel communication 1995). If these indications are confirmed it is possible that the farmer at Granastadir was the victim of a cold spike in an otherwise warm period.

Overstocking- By the time the law code Gragas was composed in the early 12th century Icelandic farmers were well aware of the correlation between overstocking and low lamb and ewe weight and attempts were being made to regulate pasture use. Did this later legal action reflect unhappy experiences of the prior two or three generations of farming? From pollen and macrofloral evidence (Hallsdottir 1987, Zutter 1989) we know that the Icelandic landnam had drastic effects on local vegetation and later upon soils and landforms (Dugmore and Erskine 1994). We should thus imagine that the Eyjafjordur district of ca. AD. 950 was a fluctuating environment, still in transition

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under the impact of humans and their stock. The relation of grazing pressure and pasture productivity may have been both less stable and less well understood than in later centuries. The land-knowledge of the modern Icelandic farmer was bought at a high price and the farmer at Granastadir may have been one who paid it.

Competition- We also know that the later Settlement Period was a time of intense competition among chieftains and would-be chieftains for land, natural resources, followers, wealth, and power (Byock 1988). The perceived destructive effects of such competition was the stated reason for the formation of the Icelandic Commonwealth in AD 930: some of these effects were certainly environmental (McGovern, Bigelow, Amorosi and Russell 1988). While all Norse farmers understood the long-term hazards of overstocking and over-intensification of farm production in the long term, deadly competition in the short term may have regularly caused struggling godar to push their pastures and their animals a bit too hard. Losers may have pushed both over a threshold that could not be recrossed and landscapes as well as lineages may have suffered in a long feud. Lost competition of this sort was part of the mechanism that, a generation later, would propel Icelandic chieftains and their followers further

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west to Greenland. These hypotheses are of course not mutually exclusive and all need to be tested by further inter-disciplinary investigations.

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Chapter 8

THE ARCHAEOFAUNA RECOVERED FROM THE SITE OF STORABORG

8.1 INTRODUCTION

Perhaps the longest ongoing project in Iceland is the excavation and analyses of the Storaborg farm mound. Although there is a farm that now bears the same name, the archaeological site was located on Iceland's south coast in the Eyjafjallasveit in Rangarvallasysla. The original church farm was abandoned in 1834 as a result of continued erosion of the coast, which set the ocean literally at the farm's front door. To make matters worse, the glacial rivers that surrounded Storaborg's home field changed their course and cut into the farm mound. Rescue excavation begun on Storaborg's church yard in 1978 and excavation work has just ended in 1994. Throughout these years Mjoll Snaesdottir directed this project, often with a very limited budget and dealing with foul weather and dangerous river

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erosion and managed to completely excavate this farm mound. Thus, the Storaborg site represents the only farm mound that has been completely excavated in the North Atlantic. Currently the architectural phasing, dating of the stratigraphy, and analyses of the finds and ecofacts are still being investigated.

Major structural contexts and finds have been reported and plans for a site monograph are forthcoming in the North Atlantic Biocultural Organization's (NABO) monograph series. Preliminary findings have already been published in a series of short reports (Snaesdottir 1980, 1987a & b, 1989a & b, 1991a-b & d, 1993; Sveinbjarnardottir 1992b; Sveinbjarnardottir, Buckland and Gerard 1982), a masters thesis has considered the osteometric analysis of bovid metapodials (Russell 1985), and other organic remains have also been studied (Buckland and Perry 1989; Russell, Amorosi and McGovern 1986; Sveinbjarnardottir, Buckland, Gerard, Greig, Perry, Savory and Snaesdottir 1980).

This chapter will only provide an interim report of the Storaborg archaeofauna. The archaeofauna has been under analysis since 1981 when yearly installments were sent to the Bioarchaeological Laboratory at Hunter College. Although the final aggregation of the Storaborg stratigraphy will be completed in early 1997, a summary of the

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archaeofauna is useful at this time. A sample of 37,966 bone fragments have thus far been identified and the last remaining materials should exceed this count by some 10,000-15,000 additional fragments. The present chapter will be restricted to the stratigraphic contexts of Hus (structure) 7, 9, 14, 9/14, 17, 18 and 19 but will give a clear impression of diachronic change at Storaborg. These materials are late Medieval to Early Modern in date with a probable date range of AD. 1450-1834. The other structures still need to be temporally aggregated and will be fully reported in the site monograph. Thus it would seem appropriate to use these data and the patterns they contain, in order draw the comparative materials for later discussion.

8.2 SPECIES COMPOSITION

Table 8.1 lists the identified taxa from the Storaborg contexts of Hus 7, 9, 14, 9/14, 17, 18 and 19. The species list is one of the most diverse of all the Icelandic archaeofauna recovered to date. The mammalian taxa include the full range of European domesticates [51]. The marine

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51. The occurrence of the domestic cat, *Felis catus*, is extremely rare in the Icelandic materials. To date only

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mammal component is also equally diverse with the recovery of two seal species, the common and grey seals. There are numerous whale remains which are represented by whale vertebrae, which was possibly used as a chopping block. One cranial element can also be assigned the species of the northern bottle nose whale, ***Hyperoodon ampullantus***.

The birds are represented by a wide range of sea and shore species (see Table 8.5). The auks are the predominate group represented, followed by gannets, gulls and geese. The one fulmar specimen represents an intrusive element recovered from Hus 7 (the structure or Hus 7, is older and tentatively dated to AD. 1650-1750). The snowy owl remain was also recovered from the uppermost deposits and may have belong to a bird inhabiting the farm structures shortly after abandonment.

The recovered fish remains are a substantial part of the Storaborg archaeofauna. These remains are mostly represented by the Atlantic cod, ***Gadus morhua***. However, in most contexts, the next most numerous species belongs to ***Pollachius sp.***, which in all likelihood belongs to the saithe rather than the pollack. Ling, ***Molva molva***, haddock,

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one collection, Hraun in the Westman Islands, has yielded this species, see chapter 4.

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Melanogrammus aeglefinus and whiting, *Merlangius merlangius* make up the remainder of the fish materials.

Shellfish are relatively rare in the Storaborg assemblage. The species that are present are the common clam, *Mya truncata*, the blue mussel, *Mytilus edulis*, small winkles assigned to *Patella sp.*, and limpets, *Littorina sp.*. However, the majority of the molluscan remains can only be assigned to Mollusca as the materials are too fragmentary. They most likely derive either from the *Mya* or *Mytilus* species.

8.2.1 The Major Taxa

Table 8.2 lists the relative percentage of the major taxa in the Storaborg archaeofauna. These data are aggregated into three major blocks of time (seen in the first left hand column) and then are sub-divided by structural context (Hus, seen in the second left hand column). These data summary provided at the bottom of the table allows for a comparison of descriptive statistics. It is immediately apparent that all the phases listed in this table are dominated by fish remains followed by domestic mammals. The seal, whale, bird and molluscan remains are clearly trace species in this archaeofauna. The very high coefficients of variation

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listed with the taxa suggest their irregular or "noisey" occurrence in the Storaborg deposits.

Table 8.3 lists the relative percentage of the taxa comprising the domestic mammal category. The most common materials among this collection are cattle and caprine remains. The caprine category is particularly interesting since there are both sheep, *Ovis aries* and goat, *Capra hircus* present. The frequency of goat remains in the Icelandic archaeofauna is extremely low unlike the caprine frequencies observed for Norse Greenland (T.H. McGovern, personal communications 1991). The other domestic mammals, horse, dog, and pig, are comparatively rare with only a few specimens being recovered in any structural deposit. The pig remains would seem to be patterned, where the bones become less abundant over time. This might very well confirm the observation that the use of pigs in Iceland became scarce by the 18th century (Ogilvie 1981:247).

The data that are listed in Table 8.3 are presented in Table 8.4 in a ratio format. The cattle to caprine ratio remains remarkably stable throughout the sequence at Storaborg. The cattle to caprine ratio appropriates a figure of 2 caprines to 1 cow. If these data accurately reflect the bovid proportions then there seems to be little indication of any increase in the relative number of

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caprines to the proportion of cattle in the eastern part of the Eyjafjallasveit since the 1450s. This is rather atypical of the Icelandic archaeofauna as this ratio generally shows an increase in use of caprines over time. Table 8.4 also demonstrates the ratio of goats to sheep at Storaborg. It is clear that goats are far less common than sheep with ratio approximating 9 sheep to 1 goat.

Tables 8.6-8.8 present the relative frequency of the fish taxa in the Storaborg sequence. Throughout this sequence the Atlantic cod comprises the vast majority (an approximate 90-94%) of the identified bone fragments. This predominance of cod does not conflict with documentary evidence or the general patterning seen with all the Icelandic archaeofauna (cf. Amorosi 1991). The other taxa listed in these tables, saithe, ling, haddock and whiting are trace species.

8.3 SKELETAL ELEMENT DISTRIBUTIONS

An examination of the relative proportion of different skeletal elements of the different species in the Storaborg archaeofauna reveals an anomalous relationship between the cranial and postcranial elements. Tables 8.6-8.8 show this relationship ("heads to tails") as well as the relative

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percentage of the different fish taxa. In the sixth and seventh rows of these tables, the cranial to vertebral fragments demonstrate an apparent abundance of cranial elements (71-94% of the total fish bones for each context). Although the category of fish crania may seem somewhat "noisy" at first glance (in that the Gadid skull can easily fragment into numerous pieces), the identifiable cod cranial elements are fairly dense and rarely fragment into tiny pieces [52]. When these materials are compared to the vertebral elements the same pattern is apparent.

This imbalance of cranial to vertebral elements has some variation in the Storaborg sequence. Hus 7, 9/14, 14 and 17 show a clear abundance of identifiable cranial elements. Hus 9 (although a small sample size) does not exhibit this imbalance. In fact, the ratio of cranial to vertebral is much closer to a "natural" [53] ratio of a whole fish. Hus 18

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52. Unlike fish remains recovered from Norse contexts in the U.K. and arctic Norway, the Icelandic fish materials are rarely fragmented into small pieces. This lack of fragmentation is mostly due to the nature of midden contexts. Icelandic middens tend to be primary in deposition with little to no reworking of the deposit. Carnivore access is also barely visible in most collections.

53. Since the Gadid vertebral column can be size ranked it is evident that the comparison of identifiable crania to all possible vertebrae is somewhat unrealistic in an archaeological context. Thus a "natural" ratio of identifiable crania to the larger vertebrae sequence (in

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and 19 indicate an observed cranial/post cranial ratio lower than a "natural" ratio, suggesting a greater number of vertebral elements.

The variation seen with the Storaborg structures might give some idea to the function of these structures. The cranial abundance in Hus 7, 9/14, 14 and 17 suggest that these fish crania were the result of butchery for home consumption rather than fish used for the stock fish trade (and storage for the fish heads). By the 18th-19th centuries Icelandic laws commonly restricted the fisherman's share of the catch to small sized fish and the heads of the larger stock fish (often with the pectoral region attached, cf. Kristjansson 1985:382-412).

A test of this explanation's likelihood was done with an examination of the cattle and caprine skeletal element distributions. This test was carried out by first ranking the skeletal elements of these mammals by frequency within their respective context and then comparing the skeletal ranking to Binford's Modified General Utility Index (or MGUI, see Binford 1976) which has generally been accepted as a rough measure of the food value represented by an ungulate

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this case 11 cranial elements to 34 vertebral elements) produces a ratio of 1:3.1 (see the 9th row in Tables 8.6-8.8).

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skeletal element. Low-score (<10.0) MGUI elements are those likely to be discarded during initially butchery, while high-score (>20.0) MGUI elements tend to be associated with major concentrations of meat and marrow. If the Storaborg samples are derived from deposits of primary butchery waste, then the most common mammal bone elements should have low MGUI scores.

Tables 8.9-8.12 present the most common elements of both caprine and cattle remains from Hus 7 and 14. In these contexts the highest concentration of fish crania relative to postcrania can be found. The horizontal line is drawn at the limit of the top quartile (most common 1/4 of the ranked list) and the MGUI scores can be read down the first column on the right [54]. Simple inspection indicates that there are quite a number of high MGUI-score elements in the most common quartile for both bovids. Major meat bearing bones like the femur, tibia, scapula and innominate were clearly being deposited in these contexts in some numbers. The explanation for the missing fish post crania does not seem to lie in intra-site depositional patterning.

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54. Some skeletal parts have no corresponding MGUI scores due to some differences in the manner Binford and the author record elements in the ungulate skeleton.

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8.4 OSTEOMETRIC ANALYSES AND DIACHRONIC CHANGE

8.4.1 Stature

Unfortunately the cattle metapodials sub-sample in the Storaborg assemblage is too small to permit a discussion of diachronic comparisons. However, the caprine metapodial sub-sample is large enough and such a discussion using these remains can be made. The reason for the high survival rate in the Storaborg collection is due to the butchery technique used to extract the marrow from these bone. Once the marrow is extracted the metapodials serve as a multi-purpose tool, therefore the storage and subsequent deposition of these bones is quite different from primary butchery waste, with a lower survivor rate, for a discussion of the bi-perforated technique and functional of the tool type (see Bigelow 1993).

Tables 8.13-8.18 list the osteometric data for the caprine metacarpals and metatarsals (upper context, Hus 7, 9 and 14 & lower Hus 17, 18 and 19 structural contexts are combined into summary presentations). The most salient feature of these data are the remarkable homogeneity across

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the Storaborg sequence displayed in every measurement. Figure 8.2 illustrates one ratio between the minimum medial breath and the total length for both the metcarpals and metatarsals. Because there is considerable variation in range, the mean (the center vertical line) and the standard deviation (the broad horizontal bar) better suggest the degree of similarity.

8.4.2 Breed

Although there are considerable difficulties in securely identifying past breeds of domestic stock from gross morphological non-metric characters, the work by O'Connor (1982) and Noddle (1983) which combines osteometric analyses with non-metric characters still holds promise. The index proposed by O'Connor and Noddle, the ratio of proximal width to breadth, Bp/Bd, is a useful indicator of the degree of "primitiveness" of the breed, with less modified populations exhibiting a ratio close to 1:1. This ratio seems unaffected by sex, age and nutritional status, making it far superior for genetic tracing to most other measurements (cf. Noddle 1983:214).

Table 8.19 lists these data for the measurable Storaborg sheep metacarpals (n=83). As Figure 8.3 indicates, the

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Bp/Bd metacarpal index is tightly clustered about the mean of 1.50. There is no significant change in this pattern through the Storaborg sequence, suggesting that the sheep breed remained fairly uniform over time. Interestingly, the mean metacarpal index is a good deal higher (less "primitive") than those reported by Noddle (1983:229-237) for two Medieval archaeofauna from Loughor Castle in south Wales (mean value 1.41) and Hereford (mean value 1.36). It will clearly be useful to obtain measurements of modern Scandinavian breeds considered ancestral to the modern Icelandic sheep (Adalsteinsson 1981) since comparative work with this index still needs to be further understood.

8.4.3 Cod Osteometrics

Table 8.20-8.22 presents the osteometric data and summary statistics for the cod sample recovered at the Storaborg site (for a review of the methodology see Amorosi, McGovern and Perdikaris 1994). Once again the most striking feature of these data is its homogeneity. There are no statistically significant differences between the measurements throughout the sequence.

The distribution of the measurements about their means is also very similar. Figure 8.4 graphically illustrates the

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distribution of the cod dentary element's measurements (in mm.), showing the clear uni-modal pattern in the Storaborg sequence. Other measurements on the premaxillary and vomer produce similarly consistent graphs. An interesting comparison may be made with the cod osteometrics from the Late Norse site of Sandwick on the island of Unst in the Shetland Islands (data from Bigelow 1984, see bottom graph). Like the Storaborg cod data, the Sandwick data also show a consistent bi-modal pattern of distribution. The Storaborg cod are at the larger end of the Sandwick distribution, and it would seem that only animals at this end of the distribution are being taken.

It is possible to translate these data in reconstructed cod lengths using a linear regression method outlined in Wheeler and Jones (1976) and Bigelow (1984). Tables 8.23-8.24 present this transformed data grouped by 10 cm. intervals with the mean, range and sample size indicated. Consistently, there is a strong pattern through time with the reconstructed length falling from half a meter to over one meter in length (the mean size falling between 80-90 cm.).

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8.4.4 Comparisons to Modern Atlantic Cod

Recent Icelandic fisheries research trawls (Palsson 1983) have provided distribution data for the length of modern cod for 1976-1979. Table 8.24 lists these data in a format comparable to the previous tables presenting the archaeological data. As Figure 8.5 indicates, there is a dramatic difference in the modern and Medieval samples. There might be several factors responsible for these divergent patterns:

1. - The Storaborg fishermen almost certainly used long lines with baited hooks (baited with small fish or mollusca) which were most favored by the larger and older age classes of cod. The trawl nets were selective for a different set of age classes.

2. - The larger and certainly older cod recovered in the Storaborg sample were already over fished by the mid 1970s.

3. - Since Storaborg was a church farm with a higher social status than its neighbors, the inhabitants might have been able to select the larger individuals

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(perhaps as part of a church tithes generally described as "pew" fish -- cf. Kristjansson 1985).

Thus it would certainly be unwise to take the size distribution patterns presented in Figure 8.5 at face value. However, despite the factors that might taphonomically skew these data, the fact remains that large, old cod were present in the offshore waters of Iceland and were caught in some numbers by 15th-19th century fishermen. It cannot wholly be an artifact of deposition and recovery that the reconstructed archaeological mean length falls near the upper extreme of the modern size distribution. It would seem that there are considerably fewer cod fished by modern Icelanders than were in the waters fished by their ancestors (cf Amorosi, McGovern and Perdikaris 1994).

8.5 AGE AT DEATH & HARVEST PROFILES OF THE DOMESTIC MAMMALS

The age of death of domestic mammals has frequently been used to infer past herding strategies. While it is clear that the process of constructing survivorship curves or profiles has many implicit pitfalls (Amorosi 1989b; Rackham 1983), there can be no doubt that patterns in the age of

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death visible in substantial zooarchaeological collections do reflect, at least in part, past stock-management decisions. The Storaborg collections show consistent patterns in several categories of aging data and these do seem to relate to plausible husbandry patterns.

8.5.1 Neonatal Remains

One of the most noticeable patterns in the mortality of the Storaborg domestic mammals is the regular numbers of bones from neonatal cattle and caprines recovered. These are the partly-calcified bones of very young animals (newborn to < 3 months) and their survival is another indication of the good conditions of organic preservation at the site. Table 8.26 presents the neonatal bones' percentage of NISP for the major structural contexts. While there is clearly some variation between contexts, the overall pattern of 12-28% neonatal cattle bone and 1-4% neonatal caprine bone is clear. Calves seem to have died much younger than lambs. Similar proportions of neonatal cattle and sheep bones have been reported from Shetland (Bigelow 1984) and in Norse Greenlandic materials (McGovern 1985a). The consistency of this pattern suggests that it is the result of regularly recurring human decisions and not

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simply the result of random natural mortality of young calves. Such a strategy must have been tied to a dairy economy which lacked any interest in raising cull calves to a more economic meat weight, or which lacked the pasture, milk and fodder reserves to spare on such animals. Stefan Adalsteinsson (personal communication 1986) has suggested that these young calves may have contributed rennet to the production of *skyr* (a yoghurt) and that the rennet quality would have been destroyed by weaning to hay. The much smaller number of lamb bones may reflect a different herding strategy less centered on milk production.

8.5.2 Dental Attrition

An analysis of the state of tooth wear on cattle and caprine mandibles and maxillae has recently been completed and appears in Russell (1985). Table 8.28 and Figure 8.7 present a summary of the tooth wear stages and show a peak in caprine mortality in the 6-24 month categories. This peak in mortality would broadly correspond to a peak in the growth curve, the point at which a meat-orientated strategy plans to cull excess animals. The tooth wear summary for cattle (Tables 8.29 and Figure 8.8) indicates a marked mortality very early in the tooth wear sequence (perhaps at

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the end of the first summer) and no secondary increase closer to the growth-curve peak [55]. This pattern suggests a deliberate and systematic early culling of calves and a less regular culling of older (perhaps infertile or aged cows) animals over successive years.

8.5.3 Aging Summary

The neonatal bone evidence and the tooth wear patterns both seem to indicate contrasting husbandry strategies for cattle and caprines. Cattle seem to have been kept strictly for milk with only a very limited number of calves being raised in order to maintain herd replacement. Beef seems to have been a fairly minor husbandry goal. Caprines apparently were raised both for meat and for secondary products (milk and wool) and a definite pattern of growth-peak culling seems evident.

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55. The Grant MWS stages are a continuous sequence and that there is actually a greater separation of younger and older specimens than Table 8.29 suggest.

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8.6 BONE PATTERNS AND REALITY: MEASURING THE FIT

The analysis of the Storaborg archaeofauna has revealed some very consistent patterning in a number of categories. The relative frequencies of the major taxa seem very stable throughout the Storaborg sequence as does the size of caprines and the indications of a dual herding strategy for cattle and caprines. The steady exploitation of cod is notable as is the consistent pattern in the reconstructed length of the cod. The pattern of intra-specific skeletal element deposition for both domestic mammals and fish shows considerable regularity and does not support a model of highly discrete patterns of bone deposition (which greatly complicate any attempts to generalize from the present sample).

However, it is well to recall that all archaeofauna (and archaeological evidence in general) are subject to many skewing effects caused by non-random factors of deposition, preservation and recovery. While the Storaborg excavators have clearly made a heroic effort to save animal bone under very difficult circumstances (many fragments under 0.5 cm. are included in the samples), the practical limitations of an urgent rescue project on a highly exposed site have

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prevented all but small-scale sieving of deposits and some skewing must be expected for this reason alone. In addition, numerous studies have indicated the extent to which other taphonomic factors affect bone collections before the excavator has any opportunity to recover them. These problems must be addressed, if only in a cautionary fashion.

8.6.1 Taphonomic Factors

Table 8.27 presents some of the taphonomic factors that have proved instructive in the analyses of other Icelandic archaeofauna. In the table's third column, the NISP counts for each of the main structural context are listed. The fourth column presents the percentage of the identified fragments form of the whole collection. The high rates of identification are not quite such good news as they first appear; normally only unsieved sites produce identification rates as high as those seen in this table. The next two columns show the percentage of cattle and caprine bone that exhibited evidence of carnivore gnawing. Caprine bones seem slightly more heavily gnawed than do cattle bones, but both taxa show comparatively little evidence of canine attrition when compared with Norse Greenland collections which

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regularly contain a percentage of 30% gnawed by canines. The taphonomic indicators would thus suggest that canine attrition (and access to midden accumulations) is not a major factor skewing the relative abundance of taxa on this site, but that there will a slight bias against smaller taxa.

8.7 THE 1785 LAND REGISTER

There are a number of historical Icelandic land registers in which the district level and even the farm level livestock census was recorded for a particular year. Perhaps the most useful of these registers are the Arni Magnusson & Pall Vidalin 1702-1712 and Laki 1785 census data. Using the 1785 census, it is possible to check the Storaborg bone data against actual animal counts. Rafnsson's (1984) review of this Icelandic documentary source describes the impact the 1783-1784 eruption of Laki (in southeastern Iceland) had on livestock throughout Iceland. A summary listing provides some interesting comparisons to the Storaborg bone counts:

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	Cattle	Horses	Sheep
District Total for the Rangarvallasysla (where the Storaborg site is located)	2878	1620	7228
Relative %	24.54	13.82	61.64
Rel. % cattle/sheep	28.46	-	71.52
Ratio cattle:sheep	1:2.51		
The late phases at Storaborg			
Mean rel. %	32.78	-	66.67
Mean ratio cattle:sheep	1:2.05		

It would appear that the later phased Storaborg archaeofauna has provided a reasonable approximation of the actual proportions of livestock. The rough 30-70% to 35-65% percentages of cattle to caprine are not too different from the 28-72% percentages present in the census data. If the bone data is viewed as proxy evidence then the patterning in the Storaborg collections seems a likely reflection of past economy.

8.8 SUMMARY

The Storaborg archaeofauna, even at this stage of the analysis, is clearly an important collection for the study of Iceland's past. Perhaps the most striking feature of this assemblage is the continuity of the subsistence strategies used by the Storaborg farmers. Multiple lines of evidence suggest that the successive generations followed

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much the same strategy of animal husbandry, fowling and fishing throughout the time the farm was occupied. The physical attributes of the livestock seem to have little changed and the farmers' efforts at fishing do not seem to have altered much of the scheduling of labor to operate this farmstead.

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Chapter 9

THE ARCHAEOFAUNA RECOVERED FROM THE SITE OF SVALBARD

9.1 INTRODUCTION

The research at the site of Svalbard has been ongoing since the discovery of the midden deposits in 1986. Similar to Bessastadir, details of the site's major structural contexts and finds have been reported and plans for a site monograph are forthcoming in the North Atlantic Biocultural Organization's (NABO) monograph series. Preliminary findings have already appeared as unpublished field reports (Amorosi 1986, 1987; Amorosi and McGovern 1988), a masters thesis concerning the paleo-botanical remains (Zutter 1989), and publications (Amorosi 1992; Zutter 1992). Unfortunately, the published articles are now out of print and inaccessible to a North American audience. Therefore, the article has been included within the appendices.

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Although further work on Svalbard's archaeofauna and artifactual materials has been done, and continues to be conducted, the assessment of the general site patterns has not changed since the 1992 publication. This is especially true of the zooarchaeological and paleoeconomic patterning seen in Svalbard's archaeofauna. Therefore it seems appropriate to use these patterns and draw the comparative discussion from them.

9.2 NEW DATING RESULTS

Further work on the dating of the Svalbard midden materials has been conducted since 1992. The results of radio-carbon dating were reported to the author as the Svalbard article had gone to press. These results are reported in Chapter 2. In 1992, the author had the opportunity to assist in the collection of modern molluscan and sea water samples from the coast (3 km. north of the Svalbard site) in order to establish a modern baseline for O16/O18 isotopic work. These results are reported in a doctoral dissertation by Molloy (1993).

Tephra noted in the 1992 publication (and in Amorosi and McGovern 1988) was further investigated in the field with the very kind help of Dr. Haukur Johannesson of the

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Icelandic Museum of Natural History. Although the back-filled midden could not be re-opened [56], a number of geo-trenches 1 km. distance from the midden were examined in order to verify the reported tephra dates.

The tephra found within these trenches that are:

1. - Hekla 4, dated approximately to 4,000BP.

2. - Hekla 3, dated approximately to 3,000BP.

3. - Hekla AD. 1104/58 was present in small traces

4. - Kverfjoll AD. 1477

5. - Vatnajokull AD. 1717

No trace, however, could be found of the Hekla 1636 north of the Svalbard farm mound (1.5 km. north of the actual site). Subsequently, Zutter has also reported (personal communication 1995) [57] the presence of the first three Hekla ashes.

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56. This work was not approved by the 1992 archaeological/antiquity committee which at that time granted research permits.

57. The tephra in Zutter's geo-trench samples was identified by Andy Dugmore at the Department of Geography and Geophysics, the University of Edinburgh, U.K..

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Based upon these results, Johannesson thought that the Hekla 1636 tephra might actually be the Kverfjoll ash dated to AD. 1477. If this is indeed the case, then there is a cultural break or very slow soil formation and midden accumulation between Analytic Units (AU) 6 and 7. The "burn layer" of Stratigraphic Unit (SU) 8 would then re-start the accumulation of materials in AD. 1717. Two observations argue for this interpretation:

1. - The senior excavators working in 1988 (Amorosi, Bigelow and McGovern) all noted a possible cultural break in the stratigraphic sequence which occurred at SU 8.

2. - The dates of the artifactual materials pattern in a similar manner (as suggested by the composite bone combs Nos. 898, 1176 and 1196) when viewed by their locational co-ordinates, and this alters none of the archaeological and especially zooarchaeological patterning.

   Unfortunately, these observations need to be confirmed by re-opening the midden and taking new column samples to test for the tephra dates [58].

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58. The tephra samples taken in 1988, and mentioned in the 1992 article, were lost at the National Museum in 1990.

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Subsequently, the profile drawings and photographs of the tephra materials were also examined by Andy Dugmore in 1995. Dugmore could not verify the identification of either Hekla 1636 or Kverfjoll 1477 based upon these materials. However, Dugmore was able to identify the faint presence of the Landnam tephra (Vo~900, dated to AD. 900) below the Hekla 1104/58 ash. The Hekla 1104/58 tephra forms the a discontinous layer below the midden accumulation in unit I20. The accumulation between both ashes is minimal suggesting that the first dumps of midden materials occurred in the early 10th century (also confirmed by artifactual dates of the composite bone combs Nos. 666, 863 and bone mounting plate No. 1529).

9.3 ANALYSIS OF THE 1986 CENTRAL EROSION FACE SAMPLES

In 1986 when the Svalbard midden was first discovered, a small surface collection of bone materials were recovered. Table 9.1 lists these materials. It is interesting to note that although these materials were badly turbated by the

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This occurred while the museum was reorganizing its curation facilities.

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midden slumping down into the Svalbardsa (Svalbard's River), the basic relationships seen in the domestic mammals, seals and whales are very similar (see Table 3 in the 1992 article that follows this section).

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Chapter 10

THE 1987-1988 ARCHAEOFAUNA RECOVERED FROM THE SITE OF VIDEY

10.1 INTRODUCTION

This report describes archaeofauna collected from the 1987-1988 archaeological excavations on the island of Videy, just north of the modern harbor of Reykjavik in Southwest Iceland. While this report describes Videy's vertebrate fauna, readers are recommended to consult Snaesdottir (1987c), Hallgrimsdottir (1987a, 1987b, 1989, 1990, 1991, 1992, 1993, 1994) and Kristjansdottir (1995). The vertebrate archaeofauna described in this chapter were generated by excavations directed by Mjoll Snaesdottir, Siggi Bergsteinsson and Margret Hallgrimsdottir for Arbaersafn (Reykjavik Open Air Museum).

The bone collection comprises only the 1987 and 1988 samples from the Videy excavations. This chapter will not

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discuss any of the samples recovered in the 1989-1995 field seasons. These materials were not made available for study.

While most fragments could be tied to a datable context, some bags could not be, and have been excluded from the quantitative tables and graphs. When it is possible to combine the analyses of the 1987-88 materials with 1989-1996 samples a larger and more comprehensive report will be possible. This chapter thus constitutes an extended working report rather than a final and authoritative statement.

10.2 SPECIES PRESENT

The excavators the vast majority of the 1987-88 bones could be phased into late medieval, 18th century, and 18th and early 19th century deposits. Since the whole 18th century collection is rather small and overlaps temporally with the 18th & 19th century materials, it was combined with the 18th & 19th century materials and designated as "Early Modern". This produces a simple and hopefully robust aggregation of the 1987-88 phased collections into two major phases, each represented by an approximate 3,000 identified bone (NISP count) fragments. These two phases will be used for general comparisons. The original site context with NISP counts are presented Tables 10.13 to 10.14. Table 10.1

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presents the two major phases identified specimen counts (NISP) while Table 10.2 presents the same data as relative percentages of the whole archaeofauna. In Figure 10.1 these relative percentages are illustrated.

10.2.1 Domestic Mammals

The domestic mammals are mainly cattle, (*Bos taurus*), sheep, (*Ovis aries*) and goat, (*Capra hircus*), though some pig, (*Sus scrofa*), and horse, (*Equus caballus*) remains were also present (Figure 10.2, Table 10.3). Sheep and cattle dominate the domestic mammals, together comprising between 85-90% of the domestic collection.

10.2.1.1 Cattle

Cattle were of the small medieval type, with large heads and upcurving horns, once common from Norway to Greenland (Russell 1985). Surviving horns and horn cores from Videy are of the type 1, "shorthorn" variety (Armitage 1982) and all those recovered are of female type. Naturally polled (hornless) cattle crania are also present in both the medieval and early modern collections at Videy. This genetic trait was apparently present in the original Viking-

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age stock as it is found in low frequency in archaeofauna from Greenland as well as in early deposits in Iceland (cf. Amorosi 1991a, McGovern 1985a). As yet there is no evidence of larger "improved" breeds (such as Holstiens or Frisians) from the 18th-19th century layers.

A good deal of continuity in stock raising between early modern and medieval phases is suggested by patterning in the age of death of the Videy cattle. Table 10.4 presents the bone counts (NISP) and the percent of species data for "neonatal" cattle and caprine remains in the current collection. The neonatal cattle are animals definitely less than 3 months old and most probably less than one month old (Amorosi 1989a, 1991a). These would be the calves regularly produced by a dairying economy which attempted to keep most cows in lactation (milking) but lacked the fodder resources to raise the resulting young calves to a more economical meat weight. Similar percentages of neonatal calf bones are found in other Icelandic sites (Amorosi 1992a). As Figure 10.3 illustrates there are only minor changes in cattle neonatal percentages between major phases (about 22% in Medieval and about 24% in Early Modern).

Tooth rows also provide evidence for the age at death of most mammals but large samples of nearly-intact rows from mandible or maxilla are needed for a statistically valid

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analysis. At the moment the 1987-88 Videy collections do not contain enough cattle tooth rows for reasonable quantification. However, the general impression is that the Videy cattle are mostly very young (neonatal) or quite old adults (>5 years). This pattern is also consistent with a dairying system that was more concerned with producing milk products than beef.

10.2.1.2 Caprines

Virtually all the caprine bones that could be identified to species level from Videy are sheep, (Ovis aries). As Table 10.3 indicates, only a single definite goat bone is included in the phased 1987-88 collections. This pattern is again consistent with other archaeofauna from Iceland, where sheep are far more common than goats in all levels (Amorosi 1991a, 1992a). In Greenland, goats were far more common down to the end of the settlements ca. AD. 1450, sometimes exceeding the number of sheep on smaller farms (McGovern 1985a). This divergence of ancestrally-related economies is not fully understood but probably relates to the different economic role played by surplus wool products in the two Scandinavian settlements.

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The Videy sheep are closely similar to modern Icelandic sheep and other Icelandic archaeofauna. As noted by Degerbøl (in Roussell 1943); these sheep are large-bodied and of the "goat-horned" type. Similar to today, both sexes carried horns and the majority of the horn cores preserved are female. The ratio of the proximal breadth (Bp) to proximal thickness (Dp) of the sheep metacarpal has been thought to represent a genetic marker in sheep (Noddle 1978). This measurement of the Videy sheep metacarpi suggests considerable genetic homogeneity (Bp/Dp ratio mean 1.3, SD 0.06. variance 4.01, n=43) across both major phases.

The Videy sheep show some interesting variability in their reconstructed age of death. Table 10.4 presents the counts and percentages of caprine neonatals. These are also graphed in Figure 10.3. In this case there is a marked contrast between the caprine neonatal percentages from the medieval contexts (about 11%) and from the early modern period (less than 1 %). Caprine neonatal remains are from very young animals, all less than one month old, and most probably less than two weeks old. These remains are generally interpreted as uncontrolled mortality among new-born lambs. Their presence in large numbers in an archaeofauna is normally interpreted as evidence of some sort of stock raising disaster (freezing rain or snow

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conditions during lambing, disease or malnourishment of ewes) rather than a normal part of a farming strategy. At Svalbard in NE Iceland the frequency of young lamb bones went from around 1-2% in the period 1050-1150 and 1250-1400) to over 17% of the taxa with the onset of the Little Ice Age in the 16th century (Amorosi 1992a:126). A smaller jump to about 5% of the taxa was recorded at Svalbard ca. 1150-1250.

The lamb bones at Svalbard are fairly evenly distributed through the midden deposit sampled. This is not the case at Videy. Table 10.4 reveals that virtually all the caprine neonatal bones from the Medieval phase at Videy derive from the M12 context. This raises a number of questions about this site context:

1. - Did some short-term stockraising disaster strike Videy while the M12 deposit was being created?

2. - If so are the large number of M12 lamb bones the result of a single event (rather than a series of cold springs as at the Svalbard site)?

3. - Conversely could the large numbers of slaughtered M12 lambs be the result of a demand for especially high quality skins (perhaps for the manufacture of parchment for the monastery on Videy?) ?

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Obviously further investigation of this pattern should prove interesting.)

Tooth rows from caprines at Videy are also too few to give a statistically valid picture of herding strategies at present (although this should be possible in the near future). Present data indicate that the sheep at Videy who survived their first summer were killed most commonly in late adolescence (6-9 months) and as very old animals (> 5 years). This pattern suggests a "dual products" economy that produced both secondary products (milk and wool) and meat. Fertile ewes and good wool producers (both ewes and wethers) would be allowed to live as long as possible, while unpromising or barren animals would be culled for meat at a younger age.

10.2.1.3 Horses

Horse bones are far more common in the Medieval than the Early Modern phases and there is a concentration of horse remains in context M12. The horse bones in question could have derived from as few as two animals and do not show extensive marks of butchery. Thus, it is probably unwise to place too much weight upon the changing horse percentages in the total archaeofauna or to assume that horse meat played a

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important role in Medieval diet at Videy. The horse remains are of a small bodied type very similar to modern Icelandic horses.

10.2.1.4 Pigs

Pig bones from Videy include both adults and neonatal piglets, suggesting that pigs were raised locally in small numbers (and not imported exclusively as pork). Pig bones have been found in a number of other Icelandic Medieval contexts (Amorosi 1991a) and are also found in the earlier layers at sites in Greenland. Pig remains become extremely rare on many northern sites in the 17th-18th century and the animal was formally banned from some island groups (Bigelow 1984). It is not impossible that pig bones from early modern layers at Videy and Bessastadir (Amorosi, Buckland, Olafson, Sadler and Skidmore 1992) are derived from animals commonly carried aboard ship in the 16th-19th century and thus relate to the higher status and international contacts of these sites. However, it is particularly hazardous to place too much significance upon patterning in the "trace species" in an archaeofauna. Where a taxon is represented by only a few fragments per phase, a small amount of random taphonomic noise can easily create apparently meaningful

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patterns in the percentage data. The role of pigs in Early Modern phases at Videy remain another interesting topic for further study.

10.2.2 Wild Mammals

Wild mammals in the Videy archaeofauna are restricted to seals and cetacea and a few fragments of arctic fox. It appears that these wild mammals played a very minor role in the local economy.

10.2.2.1 Seals

The seals that could be identified to species level in the phased materials (Tables 10.1 & 10.2, Figure 10.1) were all the common, or harbor seal, *Phoca vitulina*. This is the most common seal in Icelandic waters today, breeding in many parts of the coast. It has been hunted throughout the country since early times, particularly in the northeast of Iceland (Amorosi 1992a). Just over 65% of the seal fragments in the phased collections were from newborn, or neonatal animals. These would have been too young to swim effectively and were probably taken on pupping beaches. While it is tempting to ascribe the decline in seal remains

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between Medieval and Early Modern phases to disturbance of local breeding colonies, the small number of bones involved make this another topic for further investigation. A single tooth from the larger, more pelagic grey seal, (*Halichoerus gryphus*) was identified in the unphased materials.

10.2.2.2 Whales

Whale bone in archaeological contexts presents problems both in identification and in interpretation. While its characteristic vascular texture allows recognition even on small fragments, whale bone is often so cut up and modified in Norse contexts as to make species or even genus level identification impossible. Economic interpretation of whale bone fragments is equally challenging. It is certainly possible both to butcher a great whale without bringing home a single bone and to bring home fleshless bone collected from a long-stranded carcass without gaining any meat. Active, open water pursuit of great whales is probably a Late Medieval innovation in the Scandinavian North Atlantic, but stranded great whales were certainly exploited and small whales and porpoises were almost certainly actively hunted long before the Viking period. The two pieces of porpoise-

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sized toothed whale (both vertebrae) may well derive from drives or net catches of these smaller species.

10.2.2.3 Arctic Fox

The three bones of arctic fox, (*Alopex lagopus*), that were identified in the Medieval phased collections were all cranial, and may relate to bounty heads turned in for payment. Similar remains have been recovered from Bessastadir (Amorosi, Buckland, Olafson, Sadler and Skidmore 1992).

10.2.3 Birds

Currently the bird remains are being identified and only a partial listing can be presented here (Table 10.5). Later reports will include a detailed analysis of the Videy avian fauna and comparisons will be drawn with other Icelandic archaeofauna. This species listing is not unexpected when compared to modern bird sighting data for the island of Videy made in the years 1970-77, 1984 and 1988 (Johannesson, Egilsson and Petersen 1988: 14-20). Examination of the bird sightings indicates that the most numerous species are the Anseriformes, specifically geese and ducks. Perhaps the

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most numerous of these species is the eider duck. In fact, Holland, reporting in 1810 (see Mackenzie 1810 for reference), claims that the island of Videy was known as an eider down/feather producing center. Other common species, in decreasing order of observed frequency of sightings, are the various shorebirds, gulls, terns and auks.

What is interesting at this stage of the analysis is that the auk family is far more numerous that the Anseriformes. Although a matter of speculation, this observed difference might not reflect a change in bay and island ecology. Rather, the numerous auk remains (predominantly atlantic puffins) might have been a dietary preference, where birds such as the eider were used for their down and feathers.

The only odd species to note is the northern gannet which breeds in Iceland but not in the immediate vicinity of Videy. The modern sensitivity study (Johannesson, Egilsson and Petersen 1988:15) does not report this species in the Videy area of Reykjavik harbor. It may have been taken at sea or blown deeper into the fjord by a storm.

10.2.4 Fish

Fish remains are generally more subject to the forces of attrition than are mammal or bird bones (Jones 1986). Large

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collections from well-controlled excavations are needed to establish relative percentages and there is always the probability that very small taxa will be systematically under-represented. However, while the Videy fishbones show some signs of chemical weathering from slightly acid soils (otoliths are very rare), the Videy collections are quite large and well-controlled and should provide a solid basis for comparison of major taxa.

Table 10.6 presents the fish bones identified to species, genus, or family level from the 1987-88 Videy phased contexts. While a range of species are present (including salmon), the great majority of the species-level identifications are of the Atlantic cod, (*Gadus morhua*). The vast majority of the fishbones that could be identified only to the family level were also Gadid (cod family), and it is likely that almost all of these are also from Atlantic cod. As Figure 10.4 illustrates, the overall pattern of species composition does not alter between Medieval and Early Modern phases. The great majority of these cod were fully mature, large individuals, suggesting offshore fishing (probably done with long lines baited with small fish or offal which would tend to select for larger individual cod).

The fish remains from the 1987-1988 samples are represented by relatively few species, as in other Icelandic

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archaeofauna (Amorosi 1989, 1991, 1992). The cod family (Gadidae) and particularly the Atlantic cod, (*Gadus morhua*), are the predominate species in this fauna. The Gadids are also represented by one (1) ling, (*Molva molva*), dentary. Less numerous than the Gadids are the flat fish, Pleunronectidae, which is represented by one species assigned to *Hippoglossus sp.*, or halibut species. Salmon, (*Salmo sp.*), are also represented in low numbers in these samples. Finally, there are two trace species to mention, the wolf fish or "steinbitur", *Annarrhichas lupus*, and a vertebral element assigned to the shark family.

Salmon are an interesting inclusion in the collection and may well have been a more common item of diet than the bone collection suggests. The cranial bones of the salmon family do not preserve well in comparison with the more robust Gadids (cod family), and it is possible that salmon were more commonly taken by the residents of Videy than the bone record indicates.

Although the species diversity is relatively low, these samples comprise the largest ordinal counts of the 1987-1988 samples. When the samples are aggregated to Medieval and Early Modern phasing, the fish remains are represented 34.12% (Medieval) and 56.06% (Early Modern), respectively. Similarly, this trend can be observed in the Gadids (the

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most numerous fish remains in these samples). This jump in percentages or even raw ordinal numbers suggests a general shift toward the commercialization of the stock-fish trade in the Early Modern period. This shift is consistent with all major Icelandic archaeofauna from the Medieval to Early Modern periods (Amorosi 1989a, 1991a).

10.2.5 Mollusca

Table 10.7 presents the molluscan (shellfish) remains from the phased contexts at Videy. Note that molluscan shells (mostly calcium carbonate) dissolve very rapidly under only slightly acidic depositional conditions. A sample of pH readings from Videy soil ranges from pH 6.0-5.5 (pH7 is neutral) indicating a slightly acid depositional matrix. Where this sort of matrix is well aerated and passes through repeated wetting and drying episodes, rapid destruction of molluscan remains is possible. Where deposits remain waterlogged, good preservation of molluscan shells is possible even at more acid levels.

Thus while Table 10.7 probably reflects the overall composition of the molluscan remains from the 1987-88 phased samples, it may be realistic to use some caution in interpreting the numbers too literally. The molluscan

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category is probably subject to significantly more taphonomic noise than the mammals, birds, or fish.

The great majority of molluscan remains surviving are blue mussel, (*Mytilus edulis*), which also probably make up the great majority of the small shell fragments that cannot be identified to species level. The specimens surviving are all large and were probably hand-collected at the tide line (rather than being accidentally included in a mass of seaweed, which would have deposited many smaller individuals). Mussels are also the most common shellfish recovered from other Icelandic sites near rocky foreshores providing suitable habitat (seen with the Svalbard, Midbaer, Bessastadir materials). Mussels are comparatively rare at Storaborg, where clams, *Mya sp.*, predominate in the sandy shelving beaches of the region. Shellfish have usually represented bait or famine food in Iceland and have not been favored items of human diet.

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10.3 TAPHONOMY

10.3.1 Attrition

The indicators for the distribution of skeletal elements for major taxa are found in Tables 10.9 and 10.10. These indicators are very subject to both sample size and sample aggregation problems so at this time the results from two major contexts (M2 and M12) for the two major domestic taxa (cattle and caprines) are presented. Tables 10.8 to 10.11 present the cattle and caprines data for the two sample contexts.

Table 10.12 (upper panel) summarizes four particularly useful indicators for these selected context from Videy and compares them to a later Medieval (late 13th-mid 14th century) context from the Western Settlement of Greenland. Figure 10.5 (upper) illustrates these data. If a collection is mainly made up of dense, enamel rich teeth, then it has probably been subjected to extreme attrition from chemical weathering (acid soils) or repeated re-working of the matrix in which it lies. Pleistocene archaeofauna are often 30-40% teeth. As the table and figure indicate, there is some interesting variability in the frequency of teeth as a % of

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identified fragments (NISP), but none of these samples approach the weathered Pleistocene figures.

Carnivore (probably dog) chewing also differentially affects bone survival (McGovern 1985a, Binford 1978, Jones 1991). Given time and sufficient incentive, dogs can totally destroy any bone of any major European domestic animal. Table 10.12 and Figure 10.5 illustrate the relative amount of carnivore tooth marks present on bones from these contexts. The Greenlandic collections are consistently heavily gnawed, with all archaeofauna showing ca 8-30% tooth marking (the Greenland data was kindly provided by T.H. McGovern).

The last two taphonomic indicators are different ways of applying bone density data derived from Binford (1978) and Binford and Bertram (1977). In both cases lower numbers indicate the survival of less dense bone. Heavily modified collections (from wolf dens or exposed Pleistocene sites) produce mean density figures above one. None of the North Atlantic contexts in these figures approach this level of attrition.

As Figure 10.5 indicates, these different taphonomic indicators produce a fairly consistent pattern. The Greenlandic collection (especially the caribou) seem to have undergone more intense attrition than either context from

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Videy. At Videy, the M2 collection (both cattle and caprine) seems to have undergone somewhat more severe attrition than the M12 context. Further patterns will emerge as more contexts can be entered in a common recording format.

10.3.2 Differential Deposition

These data suggest that the Videy archaeofauna has not been subjected to extremes of attrition from natural forces. However, cultural forces have clearly affected the distribution of bone on site. Numerous studies of butchery and consumption indicate the complex interplay between animal anatomy and meat-cut preferences that result in the transformation of a live creature into a meal (Woollett 1991). Hunters and others faced with a long walk between kill site and consumption site tend to divide carcasses differently from sedentary farmers killing and consuming animals on or near the same site. Richer households may consume larger amounts of higher quality meat in most societies, though specific meal preparation techniques clearly vary widely by ethnicity and time period.

These different possible depositional patterns tend to be somewhat blurred in actual archaeofauna. "High value" bones

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(mainly hindquarter and forequarter) associated with rich meat are often firmly attached to lower value bones (feet and lower limbs) which may be transported from the kill site as "riders". Primary butchery waste may often become mixed with meal preparation debris and table scraps in a common midden. While real collections seldom approach theoretical clarity of patterning, some interesting patterns are visible in the Videy material.

Figures 10.6 to 10.9 illustrate the context of M2 and M12, and are used in the discussion of attritional indicators above. Hindquarter and forequarter elements are disproportionately represented in both species in both contexts, but a substantial number of low "meat utility" (MGUI) elements (especially cranial) are also present in M2 & M12 cattle and M2 caprines.

Table 10.12 (lower) and Figure 10.5 (lower) summarize these data, using Binford's MGUI index and a ratio between high meat value upper limbs and lower meat value lower limbs. The patterns would seem to indicate a mixture of primary butchery waste with a larger volume of high meat value elements presumably representing meal consumption. Again, additional work with the entire collection is needed to further investigate spatial and temporal patterning in element distribution.

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10.4 BUTCHERY AND BONEWORKING PATTERNS

While a full-scale analysis of butchery and bone working at Videy will have to be a future project, a number of qualitative observations can be made in addition to the quantitative ones on element distribution. The majority of the collections from Videy show a consistent pattern of carcass dismemberment and meal preparation from the Medieval through the Early Modern periods. Metal knives and light axes (or heavy cleavers) were used for dismemberment and most bones bear some cut marks. Most long bones were broken for marrow extraction, the most common technique involving a longitudinal split, usually from the proximal end. Some special patterns were evident in the collections that deserve separate mention.

10.4.1 Svid

The traditional Icelandic dish *svid* (split sheep's cranium) leaves a clear zooarchaeological signature and has been identified from all phases at Videy. *Svid* has also been identified in virtually all the other known Icelandic collections including those dating to Settlement and

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Commonwealth periods (870s-1260s). It would appear that *svid* was part of the foodways of the Viking age settlers for it has been also identified in the bone collections from Greenland (where both sheep and caribou heads were prepared this way).

10.4.2 Metapodial Preparation

Another traditional Icelandic foodway has a different spatial and temporal distribution. Icelanders have extracted the rich marrow of the metapodials (cannon bones) of sheep by piercing the proximal end near the center of the articular facet and then piercing a second hole near the distal end on the plantar (lower) surface. This allows one to suck out the marrow while preserving a bone with a most useful shape. Such sheep metapodials have been used as thread winders, harness toggles, needle cases, toys, and for a host of other purposes in Iceland. These perforated metapodials are found all over Iceland and are part of folklore as well as practical tools.

Bigelow (1993) has completed a comparative study of this interesting marrow extraction technique and finds it in Shetlandic sites dating between 1100-1350, in Iceland and Faroe, but nowhere else in the Scandinavian world. The

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technique is absent in Norse Greenland and in both Iron Age and Medieval Norway. This traditional and characteristic technique must have entered Iceland sometime during the Commonwealth period (see Chapter 5, the Adalbol collection and Chapter 9).

10.4.3 "Georgian" meals?

In a seminal early work on structuralist approaches to archaeology, James Deetz (1973) noted a distinct change in meat preparation techniques in colonial America between 1650 and 1800. The earlier pattern, which he called "Medieval", was characterized by large roasts and stews served in common bowls. It produced the sort of bone chunks typical of most Icelandic Medieval and Early Modern bone deposits. The later pattern Deetz called "Georgian" and it was characterized by individual servings of meat (steaks, rib roasts, and chops). These individualized portions (served on matching but separate ceramic or metal plates) produced small, neatly sawed rings and segments of bone. As many other workers have since demonstrated, Deetz's "Georgian" consumption pattern began in the upper classes of the eastern seaboard and only gradually penetrated to rural or frontier sites. Until the mid-19th century, the "Georgian"

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pattern remained most uniformly common in urban and high-status European-ancestry contexts and was less evident in rural and non-European settings. Deetz links the spread of formal individualized place settings and cuts of meat to the spread of "rationalist/ internationalist" elite ideology that de-emphasized older local traditions and stressed a modernizing enlightenment world view. In the United States, at least, this world view was more evident in the Jeffersonian mansions than in the slave quarters.

Videy, in both the 1987 and 1988 collections, has produced a great many bone fragments that could fit into Deetz's "Medieval" pattern. It has also produced a smaller number of fragments that appear to be part of Deetz's "Georgian" pattern. A series of rib segments (all apparently from cattle) appear in the 18th-19th century deposits which have been cut into "Georgian" individual portions. In contemporary Europe or America, this meat cutting would have been done by a saw, but at Videy an axe or heavy knife (the traditional tools) were being used instead. The fragments are rare, even in the 18th-19th century contexts, and it is clear that "Georgian" meat cutting did not displace traditional techniques even at Videy. The only other site producing similar cuts of meat

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(also using traditional cutting tools rather than a meat saw) is the 18th-19th century levels at Bessastadir.

10.5 BONE DISTRIBUTION BY CONTEXT

Table 10.13 presents the distribution of bone fragments (1987-1988 only) by location and phase. In the Medieval phases, the great majority of bone of all species comes from context 34 III. The 18th century deposits are also dominated by context 33 II, though it should be noted that this is largely due to the concentration of fishbones recovered there. The 18th-19th century contexts are dominated by contexts 34 I and 35 I, though again the variable role of fish in the total should be noted. Table 10.14 presents similar data for the fish remains.

Figures 10.10 to 10.12 illustrate some of these depositional patterns. The Medieval phase (1988 only) shows a fairly even distribution of major taxa. Most of the bones come from 34 III, and they appear in similar concentration. This confirms the general impression of great bag-to-bag similarity in overall proportions of species in the Medieval contexts from Videy and other sites in Iceland.

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The 18th century and 18th-19th century contexts (Figures 10.11 & 10.12) illustrate a somewhat different pattern. In both phases, there is a marked discontinuity between the distribution of domestic mammal bone and fish bone. In the Early Modern period, fish bone seems to concentrate in some areas while mammal bone concentrates in others. Present data suggest that different depositional areas (and possibly different activity areas) had been established on the site with the beginning of Early Modern times.

Table 10.15 presents both the 1987 and 1988 data with a single context 57049 (18th-19th century) excavated in 1989. While there is a clear overall trend toward more fish in the Early Modern levels, much of this is the result of a few contexts (esp. M2). Context 57049 illustrates this trend as it is low in mammals and extremely high in fish (if 5049 were added to the 1987-88 Early Modern collection fish would rise to over 90% of the collection). Evidently some sort of specialized fish-processing areas had developed by Early Modern phases and these have a special depositional pattern. A similar concentration of fish remains is evident in the Bessastadir collections.

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10.6 OSTEOMETRIC ANALYSIS

The measurement of animal bone fragments in zooarchaeology attempts to characterize the size and configuration of past populations. Various workers have developed osteometric indices in an attempt to identify females, males, and castrates (oxen and wethers) within a past animal population and to attempt to identify different breeds in antiquity (Noddle 1978). These osteometric studies have often proven difficult to apply rigorously, as it has been demonstrated that nutrition as well as genetics greatly affects bone growth in mammals. Many domestic mammals (including Icelandic sheep and cattle) produce overlapping ranges for both sexes on most bone measurements with the likely presence of large numbers of castrated weathers further complicating the picture. Some of the most useful measurement indices require large numbers of whole bone elements- a rare occurrence in most archaeofauna. At present, few firm statements can be made about sex and breed based on Icelandic zooarchaeological bone measurements.

However, as a larger body of measured bone material is assembled, this situation will change. The work of Maltby (1979) and other urban zooarchaeologists have demonstrated the potential of a good sample of large, well dated

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measurements. In this chapter, the major trends in measured bone elements from the 1987-88 contexts at Videy are presented. No clear temporal trends are evident in this sample, hence the whole archaeofauna is used to provide a larger sample size.

10.6.1 Cattle

In the current sample, the first phalanx is the most commonly preserved measurable cattle bone and is the only element suitable for extended quantitative discussion. Figure 10.13 illustrates the distribution of measurements of the proximal end of the first phalanx (Bp: all measurements follow von den Dreisch 1976). Figure 10.14 illustrates the distribution of the measurement of the length of the first phalanx (GL). There is a suggestion of bimodality in the distribution in both cases, but no clear separation is found. Figure 10.15 compares the range and mean of the length measurement (GL) with the same measurement on some very small cattle remains from late Iron Age Norwegian site of Aaker (near Hammar, Norway, cf. Perdikaris 1990). The Videy sample shows close similarity with the earlier continental sample, suggesting the typically small North Atlantic cattle of the Middle Ages (Russell 1985). Further

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investigation of size patterns in cattle at Videy should be possible as excavations continue.

10.6.2 Caprines

Sheep bones are more abundant than cattle bones and a wider range of elements can be reasonably quantified based on the present sample. Again, nutrition as well as age and sex will pattern any group of bone measurements and results are seldom clear cut. Figure 10.16 and Figure 10.17 present distribution charts of two measurements of the first phalanx of the combined Videy sheep. Both the Bp and GL measures suggest a bimodal or trimodal distribution, possibly including a few immature animals and a larger number of adult ewes and castrate males (wethers). Figure 10.18 presents the distribution of the maximum length of the calcaneus (GL) of the combined Videy sheep. Again a bimodal or trimodal distribution is suggested. Figure 10.19 presents the distribution of the distal tibia width of the combined Videy sheep. This measure probably provides one of our best characters for separating sexes in adults (Maltby 1979) and further work on this element should be interesting. Figure 10.20 presents the distribution of width of distal humerus of the combined Videy sheep. Again

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a suggestion of an over lapping bimodal distribution is evident.

Figure 10.21 compares the distal humerus measures from Videy with other archaeofauna from Iceland, Greenland, and the United Kingdom. Additional data would make this chart more interesting, but it is clear that variability in this measurement at Videy falls within the general range of distal humerus measures from other parts of the North Atlantic. Figures 10.22 and 10.23, as well as Table 10.16, present some comparisons of distal breadth (Bd) for metapodials from Videy and other sites in Iceland and Greenland. The wide range of the Videy metapodials and their strong similarity to the elements from Storaborg are evident. Further investigation of patterning in this element should be very productive, as it is commonly preserved on many Icelandic sites.

10.6.3 Fish

Thanks to recent research (Wheeler & Jones 1989, Colley 1990), it is now possible to estimate the live size of several species of North Atlantic fish from the bone elements often preserved in Icelandic archaeofauna. This provides the potential for bioarchaeological evidence to be

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used for the reconstruction of the age and size parameters of Atlantic cod stocks over time and may eventually represent a significant archaeological contribution to modern fisheries research and related issues of global change (Amorosi 1992a; Amorosi, McGovern and Perdikaris 1994). Attempts to estimate the size of fish from archaeological remains are not new (Casteel 1976:93; Wheeler and Jones 1989:139-148), but only recently have statistically meaningful fish archaeofauna been collected in the North Atlantic.

Figures 10.24, 10.25, & 10.26 present the measurements of cod bones from Videy 1987-88 samples. The Figures 10.24 to 10.26 present the distribution of reconstructed cod length based on the dentary and premaxilla (regression follows Bigelow 1984). The approximate age class of the fish now reaching this size is indicated for reference (Jonsson 1983).

When the entire 1987-88 sample of measurable premaxillae and dentaries is taken as a whole, the length of cod fish appears strongly uni-modal, falling between 450 to 1,300 mm. with a mean around 1,000 mm. (Figure 10.24). This sample represents age classes falling from 2-10+ years at the time of death. The majority of specimens fall into two age classes, the first centering around 900-1,000 mm. in length,

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which represent an 8-10 year age class and the second falling between 1,000 to 1,300 mm. in length suggesting an age class of 10+ years (see Jonsson 1983:248, for the relationship of size to age classes).

When this sample is disaggregated into a Medieval and Early Modern subsets a further difference can be noted. In the Medieval sample (see Figure 10.25), cod size generally falls between 500-1,300 mm. with a spike falling around 750 to 1,100 mm. This would place the age class generally between 3 to 10+ years with the spike falling between 6 to 10+ years. However, the Early Modern Sample has a wider range of sizes falling between 450 and 1,300 mm. with a modal spike appearing around 750-1,300 mm. This suggests that the Early Modern age classes fall between 2-10+ years with the majority at 9-10+ years.

Thus, the majority of the fish caught by Videy's fishermen fall into discrete size and age classes. The Medieval sample is strongly suggestive of a uni-modal age of recruitment [59]. The current thinking among

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59. Modern fisheries biologists use this term to refer a minimum time when a viable population can successfully reproduce itself while being fished. Modern fisherman refer to this term as the "legal limit". In the archaeological sense this term would also refer to the part of the population to which fishermen would target their lines and gear.

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zooarchaeologists suggests that 6 to 10+ year old cod are normally taken in deep, near shore waters. This further implies that the Early Modern fishermen were mainly selecting from two discrete parts of the North Atlantic cod populations, 2-3 years (inshore?) and 10+ years (offshore?). A similar set of cod size and age parameters are seen (Amorosi, Buckland, Olafson, Sadler and Skidmore 1992:171-174) at the Bessastadir site located along the southern end of the Reykjavik harbor. The Bessastadir cod sample is bi-modal with two spikes; the first appearing around 400-600 mm. (2-4.5 years) and the second around 900 mm. (7-8 years). It is also interesting to note the larger cod, 900-1,100 mm., exceeds the average size of modern Icelandic cod by a factor of 400-500 mm.

The smaller codfish were caught during July to September, when fishing among the many numerous islands of the Faxafloi is possible (Amorosi, Buckland, Olafson, Sadler and Skidmore 1992:174; Kristjansson 1982 -- see English translation on 479-480; Bigelow 1984:130-133). The catch would have been primarily used for household consumption and would be caught during these months in order to avoid a scheduling conflict with the harvest of summer grasses used for winter fodder. The larger animals would be caught during the fall (September to December) and winter (January to May) months.

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It is during this time that labor requirements around the farmstead would ease and large row boats could fish off-shore shoals. This simple fact would support arguments of farm labor (male and female) being pooled for fishing in the fall and winter months. The catching of this large animal would require the help of several fishermen and a rowboat with gear capable of handling multiple large cods. This type of labor pool would only become available after the summer harvest and round-up of sheep were done.

10.7 COMPARISON TO OTHER ARCHAEOFAUNA

10.7.1 Medieval to Early Modern Transitions

The transition from Medieval to Early Modern periods in Iceland's history brought a series of changes to economy and settlement, some gradual, others abrupt (Hastrup 1989, 1990, Palsson 1991, 1992). The interaction of climate change, human impact on terrestrial and marine ecosystems, social perceptions and the changing political and economic relations with the outside world were felt with different intensity in different parts of the country (and differently

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by different social strata). It has been somewhat traditional to assume that Icelandic subsistence economy was fairly uniform and rather static from Commonwealth times down to the 15th-16th centuries, with only minor regional and temporal variations (Hastrup 1985). However, recent zooarchaeological evidence (Amorosi 1991a) and a re-reading of documentary data (Ingimundarsson 1995) has indicated that the actual range of variability and regionalization in the premodern Icelandic economy may have been far greater than previously believed.

Several substantial stratified archaeofauna which span the transition from later Medieval to Early Modern periods in different parts of Iceland (Table 10.17) are now available. These include Midbaer on Flatey in Breidafjord in the west (see Chapter 5), Svalbard in Thistilfjordur in the northeast (see Chapter 9, also Amorosi 1992a), Nesstofa in modern Seltjarnarnes near Reykjavik (see Chapter 5, also Amorosi, Buckland, Magnusson, Sadler and McGovern 1994), Bessastadir just to the southeast of Reykjavik (see Chapter 6, also Amorosi, Buckland, Olafson, Sadler and Skidmore 1992), Storaborg on the central south coast (see Chapter 8, also Snaesdottir 1991) as well as Videy. Other stratified archaeofauna from sites in northwestern Strandasysla (see Chapter 5, the Akurvik and Gjogur sites) have been excavated

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but are not yet available for analysis. These comparative data can be used to place the Videy animal bone collections in a larger Icelandic context.

While it is always challenging to directly compare archaeofauna from different sites, all these archaeofauna are the result of modern excavations and all have been analyzed by the same zooarchaeological team using the same methods of quantification and computer recording system. As indicated above, single archaeofauna are interesting, but multiple archaeofauna can provide the sort of mutual pattern-checking that gives us the capacity to discern site-specific and general trends. As in other areas of archaeology, inter-site comparison is a key step in any zooarchaeological analysis.

Table 10.17 presents a summary of these six major archaeofauna in a common format. The upper rows provide some limited site context data, while the body of the table presents NISP percentage data for domestic mammals, the archaeofauna as a whole, and some selected direct ratios. The major limitation of this attempt to directly compare archaeofauna is the broad dating of the "later Medieval" and "Early Modern" periods into which these collections are lumped. Dating resolution problems affect all archaeology in the Scandinavian North Atlantic and are a limitation on

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all our efforts to understand the past. It is hoped that an ongoing NABO radiocarbon dating program will shortly provide tighter dates for several of these sites (which may cause some revision of this table).

Figure 10.27 compares the ratio of the two major domestic mammals (cattle and caprines) of the archaeofauna of Table 10.17 (in all cases a longer bar means relatively more sheep). One contrast is surely regional, i.e. the large number of sheep relative to cattle at Svalbard in the northeast. Other sites from eastern Iceland, the Adalbol and Hakonarstadir sites, show very high ratios of sheep relative to cattle from early Commonwealth times. At the Svalbard site, stratified deposits extending back to 1050-1100 show a transition from sheep to cattle ratios of around 3-4 : 1 (Amorosi 1992a), in early Commonwealth times to the ca. 6-7 : 1 ratios of the late Medieval to Early Modern period. At Svalbard, the transition from an early Medieval/ Viking age "cattle rich" herding strategy to a late Medieval/ Early Modern "sheep rich" herding strategy happened early and rather completely.

In the other archaeofauna, the transition is less striking and may take place later in time. Midbaer, Videy, and Bessastadir all show an increase in the relative number of sheep bones by the 17th-18th centuries. Storaborg shows

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no marked change in the cattle to caprine ratio (ca. 2 caprine per cattle), while the Nesstofa collections appear to show a reverse trend with more cattle bones relative to sheep in the upper layers. Both the Midbaer and Nesstofa collections are from narrow column samples and lack the size and area distribution of the other samples. The Midbaer collection is a of its total midden than the Nesstofa collection is of its much larger and dispersed deposit. It is very likely that the Nesstofa collection is far more "noisy" than the other stratified collections. Note, however, that for all the depositional and excavational "noise" the clear contrast between "cattle rich" and "sheep rich" districts is evident.

Figure 10.28 narrows the comparison of major domestic mammals, concentrating on the three large (and probably most comparable) southern archaeofauna. The dramatic shift at Bessastadir suggests some sort of economic or depositional change at the site and further investigation of the archaeofauna of the ongoing excavations will be interesting.

All three sites in this figure were church farms of relatively high status though Bessastadir and Videy were clearly in a different class from Storaborg by Early Modern times. Since the cattle : caprine ratio has been shown to correlate with social status in other parts of Atlantic

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Scandinavia (McGovern 1985a, 1992b), it would be interesting to compare the archaeofauna of these relatively prosperous farms with those of poorer holdings in the same districts.

Figure 10.29 again compares the six stratified archaeofauna, presenting the ratio of all domestic mammal bones to all fish bones. Again, some contrasting distributions are evident. The peak in fishbones at Nesstofa (especially in the basal levels) is interesting and needs further investigation, but the limited horizontal area sampled again makes interpretation of this collection problematic. The dense fish bone of the upper level at Nesstofa greatly resembles the "fish rich" concentrations from Bessastadir and Videy. It may reflect another specialized fish processing area and its presence effectively skews the graph.

The Midbaer collection again reflects a larger sample of what may be a more homogeneous midden deposit. Before its abandonment 1600-1650, Midbaer had only a very limited amount of fairly rich pasture available on the small island of Flatey in Breidafjordur. The midden is extremely rich in fish, seals, birds, and shellfish, almost resembling Inuit middens from the Eastern Arctic and Western Arctic, this probably reflecting a special adaptation to the rich marine and inshore resources of Breidafjordur. The very high ratio

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of fishbones at Midbaer thus does not indicate a vast surplus of fish but, rather, the very limited number of domestic mammals possible on a small island.

Figure 10.30 again narrows the focus to the three sites of Videy, Bessastadir, and Storaborg. In this figure, the contrast between the depositional patterns of the medieval period and the archaeological signature of large scale commercial fishing in southern Iceland becomes more clear (see Amorosi 1991a for discussion).

Figure 10.31 illustrates the percentage of seal bones found in the six stratified archaeofauna. Only Midbaer, Svalbard, and Videy have any substantial numbers of seal bones. While both Midbaer and Videy seals are nearly all young common seals, (*Phoca vitulina*), the great increase of seal bones at Early Modern Svalbard is made up of adult and young harp seals, (*Pagophilus groenlandicus*). Harp seals are closely associated with drift ice and the presence of both adults and whitecoat pups near northeast Iceland in early spring are a clear indicator of the so called "Little Ice Age" conditions (Amorosi 1992a).

Figure 10.32 illustrates the percentage of bird bones found in the stratified archaeofauna. In this case, Midbaer and Videy clearly produce far more bird bones than the other collections. While Videy had greater access to resources

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than Midbaer, both sites occupy islands on the edge of broad, biologically rich fjords with abundant bird life. These local resources clearly contributed to the economy of both island farms.

10.8 SUMMARY OF MAJOR TRENDS

The 1987-88 archaeofauna from Videy shows many points of continuity between the Medieval and Early Modern phases. The general size and apparent breed of cattle and sheep seem to have undergone little significant alteration during the whole occupation. Butchery patterns and general evidence of foodways also show great continuity, with the intriguing exception of the apparently "Georgian" portions occasionally served by the late 18th century. The Videy archaeofauna shows few of the dramatic shifts which are evident in the Svalbard collections to the far northeast, and it seems likely that most of the economic changes at Videy were the result of changing social relationships rather than dramatic climate impact. During all periods, Videy's archaeofauna shows most of the zooarchaeological signatures of high status.

However, the Videy archaeofauna does show some evident trends over time (Table 10.18, Figure 10.33). As in other

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parts of Iceland, the Early Modern period saw a steady rise in the amount and concentration of fishbones deposited on site. This increase in fish bone deposition is associated with a general shift from cattle to sheep (though not as far as the modern agricultural pattern). It also seems to be associated with a general decline in all domestic mammals relative to other major taxa in the collections (birds, mollusca). These trends did not go as far as in some other sites and probably were less marked than in lower status holdings. While Videy's special social character is evident in several aspects of its animal bone collection, it is also clear that the farmers at Videy were caught up in the complex economic changes of their period.

The Videy archaeofauna represents a very important resource for the investigation of social, ecological and economic change in Iceland. While this preliminary report can indicate some major trends and may underline interesting areas for further research, it is only one step in a larger process of cooperative investigation.

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Chapter 11

TAPHONOMY

11.1 TAPHONOMIC CONSIDERATIONS

Discussions of taphnomic indicators have been purposely limited throughout this work. The discussion of attritional agents, problems of recovery and sample size issues has been limited to particular site context descriptions. This is, in part, due to the growing skepticism of North Atlantic and Eastern Arctic zooarchaeologists who have discovered that many attritional indicators might not apply to this region. Within the corpus of this work I would argue that site and midden formation processes are very different from what might be expected in the North American temperate zone or on the East African plains. This difference can essentially be seen in two areas, cultural and environmental.

The Icelandic part of the western North Atlantic is different from most of the North Atlantic in that there is a

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particular set of culturally developed landscapes which has formed over a short period of time, i.e. a little more than 1,000 years (although most bone collections are even younger). It is environmentally different in that there are a host of frozen ground to permafrost-like conditions that affect cultural accumulations (Johannesson 1960). Iceland is an odd place to hunt for sites and middens with excellent bone preservation and neutral pH soil conditions. Some valley systems have acidic soils in which very little animal bone will be preserved (an example in the Bogarfjordur area). Often, when this has been observed, other organics, such as insect remains, may be found in great quantity. In contrast, there are many other regions in Iceland, such as the areas in which the Gjogur, Akurvik and Svalbard middens are located, where the preservation of animal bones is excellent to good depending on the site's particular formation of midden deposits. Such deposits often yielded nearly complete, large-sized mammalian long bones as well as the complete skeleta of much smaller species such as cod fish.

Field observations made at sites such as these are often the same. The excavators reported a non-compacted earth in which materials were buried in a horizontal position with little conjoinable fragmentation across strata. These

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observations suggest that most midden deposits are primary in nature, i.e. relatively undisturbed by humans and dogs hunting through the midden for carrion, frost heaving, and other micro-biological and geo-chemical attritional agents. Due to the low rates of decay in aerobic conditions many excavators have also reported a "medieval smell" from newly exposed midden deposits and adicopere residues were often found among the bird and fish bones. Dating laboratories working with the radiocarbon and C12/C13 ratio samples have reported a high portion of bone collagen in the submitted samples. When similar samples were used to test for the possible recovery of DNA (done by Alan Gilbert at Fordam University), not only could DNA chains be reconstructed (for cattle remains), but the Icelandic materials were thought to be among the best sampled Arctic materials.

11.1.1 Bone Fragmentation

Although this is all rather impressionistic, it is informative and indicates that a set of particular taphonomic indicators need to be developed for the Icelandic materials. Perhaps the most surprising aspect of the Icelandic materials is the rather high rate of identification. This would indicate that there is a low

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rate of fragmentation of bone (not necessarily processing for bone grease and fat) and that the bone bearing deposits are primary in nature with little effect from attritional agents (like dogs and biological/chemical micro-organisms).

Tables 11.1 to 11.5 present a general overview of the numbers of bones represented in the Icelandic collections reported in this text [60]. Among these large numbers, it is interesting to note that:

1. - the fragment count identified to a zoological Class level (TNF=Total Number of Fragments) is only 57.7% (of 214,722 remains) of the entire reported bone count.

2. - within the large collections (described in chapters 6-10) there is an even lower fragment count, with 34.5% (of 92,661 remains) of this subgroup total. The mammalian subset of these same materials also demonstrates a somewhat higher number, with 56% of

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60. Although a total of 214,722 remains are reported, the actual total number of faunal remains currently being examined is closer to 250,000-300,000 and this fragment count will shortly rise as the large 1990 bone collections from Aukurvik and Gjogur will be released with additional materials from the sites of Bessastadir, the two Hofstadir collections (from Gardbaer and Lake Myvatn area), and the Melakot site located in the south central part of Iceland.

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this subgroup (TNF=16,784, NISP=13,077, TNB=29,861). It is also interesting to note that this group of assemblages has been subjected to the most demanding recovery standards (*"in-situ"*, screening soils and bulk sampling methods).

3. - the old collections and column samples (described in Chapter 5) also show this same trend, with 16.4% of this subgroup. However, this percentage should be treated with a "jaundiced eye" given the variation in recovery methods. If the Midbaer and Nesstofa column samples and the Hjallholl test are examined (collections with a comparible recovery standard to the larger archaeofauna), a similar trend is observed with a rate of 12.7% (of 23,798 remains).

Although there is variation within these percentages, the basic trend is a relatively low fragment count. This is very unlike the situation which can be observed in large urban archaeofauna (based upon the author's experience with New York City urban archaeofauna), or the more closely related materials from Norse Greenland [61]. The low

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61. As a point of comparison the rate of identification (this is the inverse of the number of unidentifiable mammalian fragments) is much higher with the Icelandic materials than with the Norse Greenlandic materials.

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fragmentation of the Icelandic materials can be attributed to a number of variables, but the primary factor to consider is the nature of deposition and accumulation for most of these archaeofauna.

The architectural and midden contexts from which these materials were recovered are primary accretational deposits. This would suggest that these deposits were rarely disturbed either by human or animal agents. The frequency of canid/carnivore gnawing is extremely low (see Table 11.6), again pointing to little ground disturbance of the bone bearing deposits.

These low rates of fragmentation would also have another implication, the suggestion that the bone materials were not heavily processed for fat and bone grease. Certainly the noting of high levels of bone collagen (in radiocarbon samples) would suggest that the last bits of protein were not boiled out of these materials as was the case with Norse Greenlandic materials (T.H. McGovern personal communication 1996, also see Buckland, Amorosi, Barlow, Dugmore, Mayewski, McGovern, Ogilvie, Sadler and Skidmore 1996).

Iceland's rate ranges from 47.5-93.55%, with a mean of 79.42% in the larger sample size collections. The Greenlandic assemblages are much lower, ranging from 22.81-48%, with a mean of 32.66% in the larger sample size collections, each with a relatively higher fragment percentage.

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Unfortunately, this is a more qualitative than quantitative statement. Much more detailed work from other North Atlantic regions needs to be pulled together and examined if we are to go beyond this simplistic comparison.

11.1.2 Skeletal Element Comparisons

Admittedly, the overall comparison of the TNF counts are a crude measure of fragmentation. A more refined measure can be found by examining the skeletal element distributions across the recovered taxa. For purposes of discussion here I will only focus on two of the most common mammalian species recovered from the Icelandic archaeofauna, the cattle and caprines. The skeletal element distributional data is transformed by looking at the Relative Frequency (RF as defined by Perkins in 1973) percentages. The RF is based upon the NISP count of a recovered element and divided by the number of times each bone element appears in the body. For example, 20 whole humeri are recovered and the RF count is divided by two, yielding a RF count of 10. The relative percentage of RF is based upon the RF count total.

As noted above there are few realistic reference points to compare the Icelandic materials against. Use of other similar taphonomic/skeletal element distributions are

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available but these were developed for other cultural regions outside the North Atlantic (cf. Binford 1978, 1981; Binford and Bertram 1977; Lymann 1994). To make a more realistic comparison, a series of skeletal element "dummy" distributions were developed. This series is represented by a whole skeleton exhibiting no fragmentation. A second series is a whole skeleton exhibiting minimal fragmentation, where the long bones are broken into proximal (P), distal (D) and shafts (SH) fragments. This category also has the calvarium discarded nearly as a whole unit, the facial portion broken into bilateral fragments, and the phalanages whole. The third category (labelled as ravaged) has only the most dense long bones (as defined in Binford 1978, 1981 and Lymann 1994). The fourth group is a Gourmet scenario, where only the high MGUI values (Modified General Utility Index (Binford 1978, 1981) are present. Although there are no whole long bones present, these elements could be broken into proximal, distal and shaft fragments. The last category is a rejects scenario. This category has only low MGUI values, in which the only long bones are phalanges. The calvarium is also discarded as a nearly whole unit.

Data drawn from the Icelandic sites of Granastadir, Svalbard, Tjarnargata 4 and Videy are compared against these "dummy" categories. Each site has a large bovid sample and

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the choice of sites represents a cross section of possible archaeological contexts of architectural and midden deposits. As a point of reference, the Norse Greenlandic site of Sandnes (these data were kindly made available to author by T.H. McGovern) was also added. These data are provided in Table 11.6. The "dummy" categories are presented in Tables 11.7-11.11.

Before a comparison of these "dummy" categories can be made with the Icelandic data, several relationships should be examined. The first is an old quantification measure first described by Shotwell (1958), later utilized by Binford (1978) and summarized in Grayson (1984). Essentially this measure takes the NISP count of a particular species and divides it by the MNI count. Although there are a number of methods to calculate MNI counts, the method used here is very similar to RF counts defined by Perkins (1973). In Figure 11.1 and 11.2 the NISP/MNI relationship is charted for cattle and caprine remains from the above mentioned Icelandic sites and the Norse Greenlandic site of Sandnes. Though the results are a somewhat statistically noisy pattern, they do demonstrate that these abundance measures are somewhat comparable. The cattle remains (Figure 11.1) fall below the observed approximate mean of 30-31. More than half of the caprine

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remains (Figure 11.2) fall above the observed approximate mean of 23-24. In either case, it is also interesting to note that the earlier phased material falls above the observed means.

Another manner in which to examine this data comparability issue is to use density dependent factors such as the RF multiplied by a bone density figure (see Binford 1978, 1981). This sum is then divided by the NISP (RF*Density/NISP) to normalize for sample size. Similarly, Binford's MGUI can also be substituted for the density variable (RF*MGUI/NISP). Figures 11.3 and 11.4 chart the density relationship and figures 11.5 and 11.6 graph the MGUI relationship. In either case, values for each temporally phased subset fall close to the observed means. Again, this would suggest that these data are roughly comparable.

What is particularly interesting in these comparisons (seen in Figures 11.1 to 11.6) is that the Icelandic and Greenlandic data are also roughly comparable. This would suggest that it is possible to make both intersite and North Atlantic regional level comparisons. It remains to be seen if eastern North Atlantic materials are comparable to their western cousins. Such a comparison will only be possible in the near future when a detailed set of indicators examining

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site formation processes are standardized and agreed upon by the North Atlantic community of zooarchaeologists.

The comparison of the observed Icelandic skeletal element distributions to the proposed "dummy" skeletal element distributions also yields some interesting results. When the RF*MGUI/NISP is plotted, the Icelandic bovid materials show a closer relationship to the first three categories (whole, ravaged and gourmet groups). These relationships can be seen in Figure 11.7 (for cattle) and 11.8 (for caprines). However, when the RF*MGUI/NISP relationship is plotted (Figures 11.9 for cattle and Figure 11.10 for caprines), the Icelandic materials show a much stronger resemblance to the ravaged group. Figure 11.11 examines one other measure, the percentage of RF (or sometimes referred as MAU). In this figure the cranial, upper limb and lower limb portions are charted. The results are similar to Figures 11.7 and 11.8, where the Icelandic materials are closer to the whole carcass scenario.

These results indicate that no matter what the status of the farmstead or temporal period was, Icelanders, for the most part, were utilizing most of the bovid carcasses and that the animal is remaining on or near the site. This is quite unlike urban site archaeofauna which usually have specialized deposits where only certain portions of the

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carcass remain on site (cf. Amorosi, Russell and Greenfield 1985; Maltby 1979; Russell and Amorosi 1987). Once again this demonstration points to the fact that the Icelandic materials are relatively homogeneous and diachronic intersite comparisons are possible.

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Chapter 12

FROM PALEOECONOMY TOWARD HISTORICAL ECOLOGY

12.1 SOME PALEOECONOMIC CONCERNS

Given what has been learned in the last 30 years about concerning effects of differential attrition, depositional contexts, excavation and recovery strategies, the meaningful comparison of multiple archaeofauna may appear problematic at first glance. Certainly the industriousness of the taphonomic experts has tended to emphasize many factors of attrition and recovery that make every site collection unique in one respect or another (Binford 1977, 1981; Behrensmeyer 1993; Behrensmeyer and Hill 1980; Bonnichsen and Sorg 1989; Brain 1981; Gifford 1981; Hudson 1993; Jones 1991; Koch 1989, Lyman 1994; Schafer 1972; Shipman 1981). Each site and each location within a site will inevitably experience somewhat different taphonomic processes. The

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perfect correlation between different archaeological contexts (or between recovery and analytic technique) is unrealistic to expect. Therefore, the goal is the comparison of archaeofauna that will always be in some aspect incomparable.

Many zooarchaeologists are now willing to assume that all archaeofauna are not equally useful. Many large scale research projects and some commercial zooarchaeology laboratories regularly employ explicit excavation and recovery protocols designed to identify contexts that may be compromised. These same groups also regularly employ data management packages which regularly include a battery of taphonomic indicators (see Appendix I as an example). Such data packages are designed to both identify assemblages that are not likely to repay intensive analytic effort and to identify collections whose attributes suggest extreme attrition. Without determining the nature of taphonomic variability, it becomes easy to assume that observed species, their skeletal element distributions, etc. entirely reflect human activity (for further discussion see Amorosi, Woollett, Perdikaris and McGovern 1996).

However, not all types of archaeological sites are equally useful from a zooarchaeological perspective which attempts regional comparisons. This is not just a problem

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of sample size or recovery strategy but a more fundamental problem of interpreting depositional context and site type. Archaeofauna derived from urban archaeological sites have generated truly massive collections of animal bone, but the interpretation of these materials in the context of a regional landscape presents some challenges. Kenward and Hall (1994) have demonstrated that rural production strategies and urban provisioning needs interact in a very complex manner, making the interpretation of rural economies based upon urban pit fill contexts a hazardous enterprise (also see Biddick 1989). On the opposite side of this spectrum are very small, low intensity sites formed by a long series of brief occupations (often leaving small bone collections as a residue). These site types likewise create serious problems in quantification and interpretation for the analyst. Although these small sites have the potential for combination into a general regional perspective, in practice these collections are often treated individually, resulting in problems of interpretative equifinality.

Most zooarchaeological assemblages fall between these two extremes. There are a great many archaeofauna that are recovered from rural contexts that have generated substantial sample sizes but are still smaller than some urban archaeofauna and are far larger than the spare low

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intensity sites. These sort of rural production and consumption centers have a better chance of retaining some record of the larger range of past economic behaviors with less skewing effects of high residential mobility or intensive craft specialization, and are inherently better suited to answering landscape related questions than are other site types. This is, of course, the sort of site context that dominates the Icelandic materials.

12.1.1 All Archaeofauna are not Created Equal

If all archaeological sites are not created equal, than neither are archaeofauna and, more importantly, research questions. Large, well excavated and meticulously documented bone assemblages are of course more desirable than small, poorly excavated and record samples. However, in a particular research context, the value of an archaeofauna is directly connected to the nature and difficulty of the research question being asked. The small and poorly documented assemblages can answer simple biogeographic questions. The large sized archaeofauna may not fully support questions such as "what are the cattle breeds found within Svalbard's Analytic Unit 2". It is the research question that ranks archaeofauna as effectively as

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any internal characteristic. The quality of the Icelandic materials are uneven and many collections are not closely dated. Instead of focusing upon a search for the "ideal" collection which would be capable of answering all possible research questions, this work has attempted to match the different Icelandic materials to appropriate research questions and goals.

Although sample size is far from the only issue affecting the general utility of archaeofauna, it is certainly a central and important issue. Sample size per level, per site or other unit of comparison may be the single most important factor swamping the stochastic noise created by attritional agents. Collections below some minimum sample size may be inherently so noisy as to be useful only for generating a species present/absence list. All other factors being equal, the larger the collection, the greater the range of research questions that can be addressed. What is really less clear is the approximate cut off point for the comparability in the context of a particular research problem. The question "How large must the archaeofauna be to provide a reasonably accurate assessment of the relative importance of the major taxa?" is regionally specific. In two Norse Greenlandic examples set forth in a recent paper (Amorosi, Woollett, Perdikaris and McGovern 1996: 7) a level

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of 300-500 identified specimens to a taxon (NISP counts) was demonstrated. When working with the Icelandic materials, the lower minimum limit of 300 NISP is reasonable in order to establish data for inter-site comparisons of major taxa. The less common taxa, or the "trace" species in the collections, cannot be used in such a detailed manner but can still provide broad paleoeconomic patterns. However, it should be kept in mind that these experimental results may not transfer directly to other regional areas or archaeological contexts different from architectural midden deposits. Other regional areas and other kinds of archaeological deposits will certainly require different approaches and will suggest a different minimum sample size for major taxa comparisons.

12.1.2 Modeling Paleoeconomic Patterns

At the outset of this thesis a series of interlocking research questions which are central to understanding the complex interplay of humans and their landscape was proposed. Although not organized along strict processualist guidelines (hypotheses and their test implications), these questions served to identify major zooarachaeological topics and their correlates. In particular, issues of Landnam (or

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first settlement) impacts, the expansion and overshoot of the Commonwealth period, Maritime-Terrestrial interactions and response to Climate Change were asked of the Icelandic zooarchaeological data.

It is also instructive to note that these research topics cannot be answered with simplistic applications of these faunal data. Such questions might revolve around a "forced percentage" (the more of one, the less of another variable) approach. For example, if the reconstructed subsistence strategy indicates more of a hunting/fishing component, then there should be less of a livestock component. Another example might be the mix of the livestock kept; if there are more horses, then there should be less cattle and caprines. The problem with assumptions of this nature are that they are impossible to operationalize with zooarchaeological data. There is no reason to assume that "forced percentages" are operating within these data. Such approaches regularly ingore the archaeological context of the archaeofauna whereby some collections are derived from specialized deposits, such as the Bessastadir deep test which uncovered a pit containing modified horse bone resulting from craft waste, chosen for the durable quality of the long bones. This problem also ignores issues of

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recovery (Casteel 1972; Grayson 1984; Payne 1972, 1975; Thomas 1969, 1972) and taphonomy.

Fortunately the Icelandic zooarchaeological materials represent a very effective means to examine issues and the interaction between people and their landscape. Icelandic archaeofauna now temporally span the entire human occupation of this relatively isolated island. By grouping the Icelandic collections into four periods (those collections discussed in chapters 5-10), a broad paleoeconomic picture comes clearly into view. However, it is important to remember that these are only four arbitrary phases in a dynamic set of economic patterns. The time stops were chosen to fit with the more traditional Icelandic historic periods. These are the Settlement period (ca. AD. 870s-930s), the Commonwealth era (ca. AD. 930s-1260s), the Later Medieval period (ca. AD. 1260s-1500s) and the Early Modern period (ca. AD. 1500s - 1850-1900).

The settlement period archaeofauna are represented by two sites, Tjarnargata 4 and Herjolfsdalur (see Figure 12.1). These two sites exhibit a pattern which has a very high relative percentage of cattle and a low percentage of caprines. There are also some pig present. Fish remains are relatively rare while bird remains are fairly common. This pattern has already been argued in the previous

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chapters as a "settler" or colonizing pattern suggesting that the colonizing population placed an emphasis on cattle breeding and exploitation of native wild species in a previously unhunted landscape.

The Commonwealth samples show a contrasting picture where caprines have become far more common than cattle (see Figure 12.2). The northeastern interior sites of Adalbol and Hakonarstadir are dominated by caprines, suggesting that the sheepherding pattern known today extended back into the 12th century. There is also the untested implication that by the 12th Century the interior northeast uplands had become more marignal in regards to the pasture quality than did the coastal area. The lower levels at the Svalbard site bordering on the Arctic Ocean demonstrate a pattern that is relatively high in seals and whales and in which cod fish seem to have grown in importance. The Granastadir site in the interior of northern Iceland exhibits a relatively high percentage of pigs and horses in its domestic economy. It becomes clear from these varied patterns that Icelanders were adapting their particular farm economies to the local landscapes and its environmental parameters. There is nothing to suggest that Icelanders have become what is generally called an established island colonizer within this time frame. It is within the next two time frames that the

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terrestrial and even the maritime economies stop this oscillation around local conditions and become more established.

It is in this same period that "expansion and overshoot" can be illustrated with the archaeofauna from Granastadir. The grazing productivity and climate in the Eyjafjord district may have been in transition when the farmers at Granastadir first established their farmstead. If these indications are correct, it is possible that the farmer was a victim to these fluctuating variables. As resources fluctuated, competition for good pasture land and the intensification of farm production may have caused a struggling Granastadir farmer to push the pastures and his livestock beyond the landcsape's capacity. The end result was the abandonment of the farm by the later Medieval period.

The later Medieval materials (see Figure 12.3) from Svalbard, Midbaer and Videy reflect a steady increase in the relative importance of fish. The large numbers of bird remains in the Videy collection may simply reflect the control of an elite site over the bird-rich islands in the Faxafloi while the large percentages of marine species in the Midbaer assemblage reflect the farm's island catchment area.

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The Early Modern archaeofauna (see Figure 12.4) are represented by Storaborg, Svalbard, Midbaer, Bessastadir, Nesstofa and Videy materials. Although seals look to be important in the northeast part of Iceland, the entire pattern has now become dominated by cod fish. These gadid species and their tremendous numbers suggest a shift to full-scale commercial exploitation.

Although site formation processes, recovery and dating problems inevitably inject stochastic noise into these patterns, the collections also reflect the end results of planned animal production decisions worked out upon a series of landscapes undergoing historical change. Different archaeofauna are thus a product of a dynamic interaction between a people and their animals, soil and pasture productivity, and social and economic regional landuse patterns constructed some time in the past. Landscapes were in a state of flux not only due to the Norse agricultural system but also due changing climate and continued geological and geomorphological processes.

12.1.3 Modeling Human Impacts Within the Settlement Period

The term "ovigenic landscape" was first coined by Dugmore and Buckland (1991) to explain the effect of grazing

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caprines on Iceland's fragile dwarf tree, grass and sedge communities. Rather than seeing a purely "ovigenic" landscape, it is a mix of species with different feeding habits that the Norse introduced to Iceland which caused overgrazing and contributed to massive amounts of soil erosion. Cattle and goats striped trees of leaves and bark, pigs efficiently tore up roots and successive grazing of low arctic woodland by horses and cattle and sheep rapidly rolled back forest and prevent its regeneration. Together this mix of animals makes up the vast majority of the major mammalian taxa recovered in the Icelandic archaeofauna. While pigs became rare in the later phased material, their remains are not uncommon in the 9th through to early 11th century samples. This pattern is also noted in the Norse Greenlandic collections (cf. Amorosi, Buckland, Dugmore, Ingimundarson and McGovern in press) and their impact made these animals more expensive to keep in later landscapes (McGovern, Bigelow, Amorosi, Woollett and Perdikaris 1993).

Together these mammals formed a "landnam package" that helped to effectively bulldoze a diverse set of low Arctic/high Boreal ecosystems into more of a steppe/grassland pasture (or culturesteppe). Direct human intervention involving fuel collection, charcoal making and deliberate clearance with fire also had an immediate effect.

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McGovern has noted that the earliest phase at the Sandnes church farm (one of the first sites to be settled in the Western Settlement of Greenland) contained "charcoal and twig layers", evidence of initial brush clearance for this area of Norse Greenland. Test excavations throughout the Western Settlement have also been found to contain thick willow and birch mats at the base of many Norse middens (McGovern and Jordan 1982). Pollen evidence from both Greenland and Iceland confirm the rapid and widespread removal of forest (Fredskild 1988, Hallsdottir 1987, Zutter 1989, 1992). It would seem, then, that the creation of a cultural landscape from an uninhabited wilderness was not just a linguistic event recorded in some Sagas.

This discussion was further extended in a recent paper concerning the initial Norse settlement impacts and subsequent consequences for the western North Atlantic (Amorosi, Buckland, Dugmore, Ingimundarson and McGovern in press). One of the many observations that came out from this paper was the noting of rapid destruction of native vegetation as seen from pollen diagrams. This reduction of native species was replaced by many European introductions. Buckland, Dugmore and Sadler (1991) have noted that eutrophication by dung and other waste, both in middens and manure, has also led to significant changes in native insect

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fauna and introduced species spread rapidly into the surrounding landscape. The use of manure and irrigation in the home fields of Norse farms led to other changes in the flora and fauna which are still evident today. It is interesting to note that these particular plant communities have benefitted from the Norse environmental impact (cf. Buckland, Dugmore, Perry, Savory, Sveinbjarnardottir 1991).

Another major point that was stressed within this joint paper (Amorosi, Buckland, Dugmore, Ingimundarson and McGovern in press) was that human impacts upon an Arctic landscape are variable and whether a modification is favorable or not depends on the scale studied. If the immediate farmstead is the chosen scale then impacts would seem variable. However, if a larger field of focus on a regional scale is applied, many more consistent patterns emerge. The assessment of overall impact, the creation of a whole cultural landscape and the regional picture of this landscape becomes more precise.

12.1.4 Regionalism within the Icelandic Assemblages

At the outset of this project in 1985 there was a basic assumption that each of the Norse North Atlantic colonies (excluding mainland Scandinavia and the U.K.) had their own

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general paleoeconomic pattern. This assumption was contrasted by the saga historians that argued that the western North Atlantic economies were based upon an imported "Iron Age" economy (see Byock 1988 for a further discussion). Both views saw Norse economy to be some combination of northern farming and fishing with a much smaller hunting component. Iceland's paleoeconomic signature remained more of a question with early results from the Adalbol and Storaborg collections indicating farming strategies that were somewhat similar to those observed from Norse Shetland. The problem with this view of a general economic patterns per colony was a question of scale. These patterns were based upon single site archaeofauna where a regional zooarchaeological analysis was rare (see McGovern 1979, 1985a for such an analysis of Norse Greenland).

The geography of the North Atlanticis another factor to consider. Iceland is relatively isolated from the European mainland, the northern U.K. island groups and Greenland [62]. It is a relatively large island, covering some 39,709 square miles (about the size of the state of Virginia). Most

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62. The nearest landmasses are eastern Greenland, some 178 nautical miles or 287 km. to the northwest, the Faroe islands, 260 miles or 420 km. to the southeast, Jan Mayen, 335 miles or 550 km. to the north-northeast, Scotland, 496 miles or 798 km. to the south-southeast and Norway, 603 miles or 970 km. to the east-southeast.

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settled areas are within 400 m. asl. and within 25 km. of the coastline, occupying about 1/6 the entire area of Iceland. Despite what may seem a small habitable area, Iceland represents one of the largest settled landscapes in the North Atlantic region.

Because of its large size Iceland occupies two maritime biomes which geographers and biologists have described as low arctic and boreal in nature (cf. Amorosi 1991a). This oceanographic zonation can also be traced to the circulation of the North Atlantic currents and the extent of the permanent sea drift ice. The same hydrological boundaries also have an effect on the distribution of marine and native terrestrial elements in Iceland. Keeping these factors in mind, the economic patterns already described also reflect this environmental zonation (cf. Amorosi 1991a). Examples of the low arctic zonation can be seen in the Svalbard seal components where the distribution of harp seals can be tied to the incidence of the sea drift ice. Likewise, the Storaborg material reflects its boreal zonation the rather stable cattle/ caprine ratios. The bi-regional picture that emerges from the geographic and animal bone data would seem to be consistent with the Old Icelandic four quarter system. The low arctic husbandry zone might roughly correspond to

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the western, northern and eastern quarters, while the boreal husbandry zone might correspond to the southern quarter.

Observations of geographic zonation are not new and can be argued as an example of cultural boundary maintenance reinforced by geographic and climatic variables. Yesner (1985:51-91) has noted such an example for the Alaskan peninsula. The peninsula is divided into two natural biomes that cut the landscape along a northeastern/southeastern line. The native Aleut/Inuit cultures are well adapted to this maritime zonation. The southern biome is rather different in its mix of coastal, riverine and tundra-like environs. Yesner argues that this natural division of landscape provides the basis for a cultural buffer zone which divides the Aleut from the Yupik (Inuit) speakers of this region. I have made this same argument for the southern New England and Long Island area of the United States (Amorosi 1991b). It does seem clear that the Icelandic economy was regionally variable and that it may be possible to define regional zooarchaeological signatures to particular local economic strategies.

Although these are broad scale patterns, it might be possible to track smaller scale variations in the near future. Part of this might revolve around a more tightly focused landscape modeling of archaeological and

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zooarchaeological data. The core of such a model is an attempt to see the dynamics of human social relationship over time in conjunction with the human ecological response. Such social relations have consequences that are locked onto a particular temporal landscape, usually in the form of environmental impacts.

But in order to construct such a working model several issues still need to be resolved:

1. - a form of model currency is needed to measure human relations and their interaction/impacts. In Iceland this would be a cow standard (or "cattle grazing units" to borrow a term borrowed from Agricultural Science) [63].

2. - questions of where the unit of production should be focused remain a problem. In Iceland, this resolution should be at the hreppur level [64] and not the household. Households can present a problem since the

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63. According to the 12th century legal code known as Gragas each household should have one cow-unit productive capacity for each member. Cow units could be measured as a boat that was debt free, or the necessary farm implements to run a farm (Sveinsson 1953:49).

64. A hreppur is the basic Icelandic community size of 20-25 households, capable of self reliant subsistence and support of the landless tenants.

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total value of their production will vary over its life cycle. A mature Icelandic household is capable of being self-sufficient, but a newly formed household has not the resources or social relations to make it self-reliant (cf. Miller 1990). The use of a hreppur as a unit of analysis will average the effect of a household's life cycle.

3. - if this could be resolved, then a more tightly set of excavated archaeofauna within a particular hreppur could be sampled (somewhat similar to the Gjogur farmstead and Akurvik fishing boothes).

12.2 THERE ONCE WERE MANY BIG OLD COD: MARITIME-TERRESTRIAL INTERACTIONS

Presently a number of North Atlantic countries are struggling with management plans for the remaining cod stocks and there is growing concern over the collapsing North Pacific salmon and halibut stocks. Many of these plans are now calling for a management strategy that uses a conservation focus on a species-by-species basis (Beckman 1995). Using the reconstructed cod length data, Amorosi,

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McGovern and Perdikaris (1994) demonstrated that past fishing methods, fishing locations and preferred fishing seasons in Iceland and Arctic Norway have all differentially selected for large cod. These data also indicate that there were many very large cod in the sea to be landed in premodern times. Table 12.1 presents the Icelandic data which demonstrates that Medieval Icelanders were regularly landing cod whose live length can be reconstructed to 100-120 cm. in length. Similar trends were also observed for the Norwegian data and noted for other zooarchaeological data in the Maritimes of Canada (Rojo 1990), Shetland (Bigelow 1984), Orkney (Colley 1983, 1990) and Caithness (Barrett 1992, 1995; Jones 1991) [65].

Technological, attritional and recovery biases have certainly skewed the archaeological sample distribution. Baited hand lines used to catch the Medieval-Early Modern cod selected for larger age classes and the shortage of smaller cod in the archaeological collections is certainly a reflection of this technological factor as well as any bias toward the survival and recovery of large specimens. For

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65. It is also interesting to note that these authors are using different methods to reconstruct the live length of archaeological specimens. But, despite these different methods, a very similar trend of 100-120 cm. length, and 10-12+ year age classes can be observed.

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these and other reasons, a direct comparison of the size distribution of the archaeological and modern fish collections is highly problematic. The important pattern of Table 12.1 is the comparison of the absolute numbers of large cod (> 100 cm.) between a few excavated Icelandic sites and a very comprehensive modern research trawling effort carried out over three years and using fine wire mesh nets. Figure 12.5 visually charts the comparison made in Table 12.1. Figure 12.6 charts the number of archaeological specimens 100 cm. and longer.

Although inevitably incomplete, the archaeological samples generated more elements reconstructible to live lengths greater than 100 cm. than did the Icelandic research trawl's sample of over 10,000 cod. In absolute numbers the modern research trawling effort could not duplicate the number of large cod indicated by a small sample of sites from the south of Iceland, Storaborg, the southwest, Videy, the northwest, Midbaer and the northeast, Svalbard. Such large cod are extremely rare in modern Icelandic waters (Jakobsson et al. 1994) but were common enough in the past to be regularly landed and to enter into the archaeological record in substantial quantities.

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12.2.1

So what else is new? This archaeological data is only telling us something we already knew.

This has been a reviewer comment made by many fisheries biologists about these data. The biologists claimed that the gradual disappearance of 100 cm. length (10-12+ year age class) was already known since the 1960s (especially in Iceland) and the archaeological evidence confirms the fishery community's belief that there were once sustainable groups of the 10-12+ year old age classes in each of the North Atlantic stocks. Although this comment is unfair to make given the difference in data used by fishery biology/ecology and zooarchaeology, it is important to view the fisheries' argument in order to gain a perspective on the concept of "sustainable resource". For anthropologists and archaeologists working within the new paradigm of Historical Ecology this concept is somewhat meaningless because it was intended for use by modern governmental agencies for the continued exploitation of the circumpolar zone and the world oceans. For fisheries biologists, the crash of one the world's major sustainable resources, the North Atlantic cod, has serious political, economic, social

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and environmental implications. The scope of these implications will not be addressed here (see Jakobsson et. al. 1994; McEvoy 1986, 1988; McGoodwin 1990; Palsson 1991), but the pattern of the cod stocks crash does add a critical view to explain the difference between biological and zooarchaeological prospectives.

In a seminal article concerning the fluctuations of the Icelandic cod stock during the 20th century, Schopka (1994) reviews fisheries data to discuss the relation of the cod to the environment. In this paper he examines the variation in stock abundance and landings with regard to changes in the Icelandic stock recruitment and growth. Although there are some attempts to address environmental impacts on this stock, Schopka concerns himself with the rate of exploitation (human). One of the more surprising and somewhat frightening observations that Schopka makes is that this stock's fishable level of 3.3 million tons in 1928 has been steadily declining, with some fluctuations reflecting variation in stock recruitment and immigration from Greenland (with the lowest Greenlandic level on record of only 600,000 tons in 1993). The western North Atlantic stocks (Iceland and Greenland) show a similar declining trend of the spawning-stock biomass. Fishing mortality has

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increased since the 1920s and Schopka thinks that this death rate is still at unacceptable levels.

With regard to the zooarchaeological data Schopka (1994:184, Figure 6) produced a graph of major importance. Figure 12.7 reproduces Schopka's finding for the biomass of the older component of the Iceland stock. This component is the 10+ year age classes:

> "In the mid-1920s and mid-1930s this component of the population was about 1 million tonnes. There was a continuous drop until 1940 and subsequently an increase during World War II [this period's shipping was used for the War effort and not for fishing] to some 700,000 t. This component of the stock has been declining ever since. There was increase when the 1945 year class reached this age in 1955, but with increased fishing this part of the population continued to decrease; since 1968 the old cod have contributed very little to the spawing and the catches. Nowdays very few are captured (Schopka 1994:184)."

Schopka is also able to correlate this observation with the disappearance of the 10+ year age classes and the general reduction of the biomass of this stock. In looking at Year-class Strength, Schopka notes:

> "After a period of some good year classes, there follows an interval of poor recruitment succeeded by stronger year classes and so on. These periods seem to be of 3-5 years, but it is remarkable that after 1970 the periods of poor recruitment, compared to those of better recruitment, are longer than during years when the spawning stock was of considerable size. It is also interesting to note that outstanding year classes show up regularly in a period of 10-12 years (Schopka 1994:186)".

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Schopka also notes that the shift in climate after 1965 combined with the high fishing effort has driven the Icelandic stock spawning potential to a historically low level. If this low level continues, the risk of a continuous recruitment failure (already noted for North America, Greenland, Faroe, the United Kingdom and the Baltic) and subsequent stock collapse is greater than ever. This unfortunate but clear trend has already been noted throughout most of the North Atlantic region (Jokobsson et al. 1994), and one would think that, until the advent of 20th Century fishing technologies, cod were a sustainable resource.

But is this impression correct? As seen from a fisheries perspective this would be a correct view of this human impact. However, from an historical/archaeological view this is only a partial answer. Indeed, the crash of North Atlantic cod (and other global stocks of fish) within the 20th century has few, if any, zooarchaeological precedents [66]. Historians have noted reports of poor fishing in fjord systems in Iceland (Ogilvie 1981), but nothing like the global scale that has recently been observed.

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66. The fisheries crash maybe analogous to some degree with the biomass crash of at the end of the Pleistocene.

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If one looks at the fishery data a bit closer, the duration of observation is very short and usually contained within the 20th century. Schopka's data for Iceland only extends back to 1925. Historical data noted by Jonsson (1994) extends further back to the 16th century, where the 1500's data points are very scarce. In essence, the long term view of the fishery crash and stock fluctuations is only covered by a 400-500 year observational series with a true instrumental record extending back less than 90 years.

This is a problem considering that cod are a long lived, Arctic adapted species. Haedrich (in his address to the Marine Resource and Human Societies in the North Atlantic Since 1500 symposium) described cod as having a life span of between 70-100 years. He further described the species as being adapted to the Arctic, having survived many climatic fluxes for the last 12 million years, and being a very opportunistic predator (and a large sized one at that!). It becomes clear from this description that the baseline used by biologists is far too short to see any of the first cascading impacts of human exploitation. What the fisheries biologists are able to do is chart the most recent and dramatic effects of overfishing (also combined with some effects of climatic shifts), but the first impacts of commercialized fishing remain invisible to their record.

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Aside from the short observational series there is the problem of when 20th century technologies first appear in the North Atlantic in general and, more specifically, in the Icelandic waters. Both Scopka (1994:180) and Jonsson (1994) note that Icelanders adopted the use of seines and other active gear along with its the first trawler in 1904. Until this time Icelanders fished from large open row boats using hand long lines. Decked fishing craft generally become available to Icelanders between the 1870-1890s. Other Europeans fishing in the "Iceland Trade" have used a mother ship/dory system with hand lines since the 1390s (Jonsson 1994; Marcus 1981). But, with the adoption of steam power starting in the 1850s and active gear using multiple hook systems (ie. such as a bulltoe) by the 1880s, the total landed tons statistic underwent a radical increase by several orders of magnitude.

12.2.2
The Icelandic Cod Pattern seen from a Zooarchaeological Prospective

Figures 12.8-12.10 visually chart the reconstructed length of the zooarchaeological samples from Iceland. Figure 12.8 incorporates the 1976-1979 fishery trawl data

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(Palsson 1983) with the archaeological reconstructed length and focuses on specimens longer than 50 cm. Clearly the mean length of the archaeological samples is between 90-100 cm., with some specimens extending beyond 120cm., while the modern data is trailing off (also see Table 12.1). This mean size can consistently be seen using either dentary or premaxillary bone elements for reconstructed length and is illustrated in Figure 12.9-12.10. These same relationships are graphed differently for the sake of clarity in Figures 12.11 and 12.12. The purpose of this demonstration is to illustrate the consistency of the archaeological data. The same size relationship can be charted temporally as "high/low" charts for each site collection and are graphed in Figures 12.13-12.19 (these graphs portray the Midbaer, Storaborg, Svalbard and Videy materials using both premaxillary and dentary bone elements). Again, a consistency can be seen over time where the mean lengths fall between 90-100 cm. in length.

But how does one interpret these consistent patterns? Certainly the consistency of the reconstructed length data does not indicate a declining 10-12+ year old classes biomass over time (as Schopka was able to demonstrate for the period of 1925-1991). What these data may indicate is a stable fishable biomass until the advent of modern fishing

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technologies. Or, does this consistent reconstructed length pattern indicate something else?

The "sameness" of these graphs may indicate that Icelanders were attempting to land cod at a fixed size and weight starting in the late Norse period. The reconstructed length of these cod specimens fall between 80-100+ cm. consistently over time and region. This length dimension generally fits with definitions of Icelandic Stockfish and Saltfish (Jonsson 1994, Kristjanson 1983). It is also interesting to note that this size of fish has been "targeted" by Icelanders for use in the Late Medieval "Iceland Trade" and most likely the antecedents of this trade in the Late Norse period.

If the size of fish is a major concern, then the composition of the landed species should also reflect this. It does within the Icelandic archaeofauna in which the most numerous recovered family are the Gadidae, and the North Atlantic cod dominates any site's fish component. Icelanders are essentially "targeting" this one species as a dependable resource. In the eastern North Atlantic there is also a focus on the family Gadidae, but it is not so centrally targeted on the North Atlantic cod (Amorosi, McGovern and Perdikaris 1994; Bigelow 1984; Barrett 1995; Colley 1990 and S. Perdikaris personal communication 1995).

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As a further point of comparison, Inuit subsistence fishing prior to any European involvement (such as the salmon canneries in the North Pacific Rim) has an even broader mix of species. This exploitation of a diverse mix of species will minimize the risk of poor fishing years. Recent research with zooarchaeological materials from Kodiak Island, Alaska (Amorosi 1986b, 1987b, 1988b) indicates that these complex, hierarchical chiefdoms targeted their fishing effort on three near-shore families, the North Pacific cod, Salmon and Flatfish (which breaks down to 1 cod species, 7 salmon species and 3-5 flatfish species). In Figures 12.20 and 12.21 and Table 12.2 the comparison of the archaeological fishing effort for Iceland and Kodiak Island is demonstrated. What becomes immediately obvious is that the Icelanders are focused upon cod not as a means to minimize risk of some poor fishing years, but as a commercial species to be traded with other Europeans. This trade would help farmers acquire items and prestige goods that were in scare supply in Iceland, essentially acting as an additional buffer during hard times. These patterns raise a number of testable research questions which might lead to the discovery of the earlier part or the first cascade effects/impacts on the North Atlantic cod.

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12.2.3

Nibbles Away: Cascading Impacts in the Icelandic Fisheries

The recent crash of the North Atlantic fisheries was not as sudden as it first would appear. Rather, it was a series or gradual set of cascading impacts that brought the North Atlantic marine ecosystem into jeopardy. Some of the major impacts appear to be:

1. - With the advent of the "Iceland Trade" by the English and German Hansa in the early 14th century, Icelanders re-established trade networks with mainland Europe (essentially Iceland has been recontacted by mainland Europe). In fact this trade is on a much larger scale than in the Viking/ Early Medieval period. One factor that contributes to the increase in trade is the scale of shipping tonnage. Late Medieval vessels have almost 10 times the hull capacity of a Late Norse Knorr. In addition, merchant and fishing vessels travel in small fleets (usually ranging between 2-10 ships -- Braudel 1979; Kristjansson 1950; Marcus 1981). Therefore, the nature of Icelandic fishing should change and the Late

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Norse pattern of broad-based landings of Gadids narrowed down to concentrate on the North Atlantic cod by the late 14th century. This pattern has yet to be confirmed with the Icelandic zooarchaeological data. The problem is that there are too few midden collections that have a high resolution, dated sequence. Thus far only the Svalbard midden is capable of testing this and results are pending.

2. - As there is an increase in commercial fishing (as already noted in the Icelandic archaeofauna), does a "Truck" system develop between European sea captains and local landowners? The development of the Icelandic fisheries is analogous to the development of the fisheries of Newfoundland, the Maritimes of Canada and the New England coast of the United States (Pope nd.; Proulx 1986; Sider 1986). Icelandic historians have noted that the cargoes of English vessels in the 15th and 16th centuries contain large quantities of fishing gear that was traded to Icelanders (Thorsteinsson 1969; Marcus 1981). What would be the nature of the exchange? Does the Storaborg pattern of keeping the head of the fish for home consumption illustrate the zooarchaeological signature of this system? Are Magnusson's (1990) 19th century

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observations of Icelandic fishing the end result of this early "Truck" system?

3. - This also raises the question of labor allocation on the medium to small farmsteads. Truck systems are very exploitative of their clients. A fisherman who falls into increasing debt is unable to pay back (in the amount of landed fish) the credit advanced him in the forms of fishing gear and boats by the merchant. As Truck systems become established is there an increasing number of landless laborers? One of the first records of a fishing village with landless laborers is recorded around 1350 in Strandasysla just south of Arneshreppur (J. Ingimundarson, personal communication 1995). Landowners and Church officials were worried that more fishing villages would appear and would help to erode the tax base of the district. Therefore, would the larger landowners attempt to establish "fishing boothes" on their land holdings in order to control the tax base (as might be the case with the farm of Gjogur and the fishing station at Akurvik)? There is also a demographic issue to raised. Does the increase in fishing equate with an increase in the availability of marriageable partners at these "fishing stations", hence an increase in the

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tenant population with a subsequent increase in subsistence fishing as well?

4. - There are biological implications to be asked of the zooarchaeological data as well. Borrowing the phrase "It's like doing Archaeology on Mars" [67], the biology and structure of the cod population pre-1850 is unknown today. Because very old cod are extremely rare in the modern stock, zooarchaeologists are now in the position to record an unknown biology of this animal. A suite of gross anatomical, incremental and paleopathological research needs to be done with the older segment of pre-1850 zooarchaeological specimens. The Icelandic specimens of this old age group exhibit an unusual swelling of the cranial elements. Figure 12.22 illustrates some of the more common elements subject to this age and, possibly sex related, phenomena. The cleithrum is particularly interesting from an incremental point of view. The ventral portion of the cliethrum becomes swollen and will resemble a "Brazil Nut" (see Figure 12.23 for a progression of boney growth) with age. Broken

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67. A phrase coined by Don Grayson, used to describe the late Pliestocene of North America.

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specimens along a transverse plane have been cleaned and an incremental structure can be noted by visual inspection. Pilot tests to determine if these structures can be regularly counted are underway by the author. If a regular annual count can be observed, a new means to construct harvest profiles of the fish samples can be done for the 10-+ year old age classes [68]. This particular bone element has been also noted by Kristjansson (1983) as raw materials for folk art carvings of animals. Another age related characteristic of these old year classes are the fused thoracic vertebrae (usually 3-5 in number). Although the frequency of this pathology is low in the Icelandic samples, it would be useful to define other geriatric phenomena.

5. - ***The Nibble Effect*** - It would seem that a set of cascading impacts slowly destroyed the cod stocks (if not the North Atlantic ecosystem) over the last 450-500 years, seeming as if the North Atlantic stocks were essentially "nibbled away" with better and better

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68. This has many advantages over the aging of otoliths. The swollen cliethrum survive in a much better state of preservation than do otoliths, and are more numerous within the Icelandic materials.

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technology. The 20th century crash was really the last large mouthful; the cod stocks are no longer viable.

Can archaeological/ zooarchaeological data chart the nature of these cascades effectively? The first few thresholds might be the harder impacts to document. In the Late Norse period Icelanders were fishing their near-shore waters and had easy access to the 0-10/12 year age classes. Then, with the advent of the "Iceland Trade", Europeans introduced a new technology of the mother ship/dory and Truck systems to the Icelanders. Essentially a threshold was crossed with a different order of magnitude in the amount of fish landed (measured by the tonnage instead of the barrel load) and perhaps a new segment of the stock was accessed. This new segment would be the much older year classes, perhaps the critical spawning part of the population. It would be interesting to chart the frequency of the 10-?+ year old bone elements in the zooarchaeological collections across the North Atlantic. When do these bone elements appear in some high relative frequency and when does the frequency wane. Could the zooarchaeological data demonstrate

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poor recruitment cycles somewhat akin to what Schopka (1994) has noted?

6. - Where does the climatic variable fit into this story? Situational events like the Great Salt Anomaly (Dickson et. al. 1988) need to be correlated with the high quality paleoecological data that is now available. Although cod are an Arctically adapated species, their eggs and fry are vulnerable to sea storms. Can data from the GISP2 and GRIP ice cores be useful in identifying likely periods when 0-3 year old age classes were vulnerable? This type of predictive model could be tested with both the historical and zooarchaeological data.

7. - Given this type of modeling, what kind of management plan can be developed? Although there are numerous plans to manage what is left, it should not rest on a "species-by-species" concept of conservation but rather on a well thought-out plan of government and community self-regulation cutting across national boundaries.

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12.3 FUTURE DIRECTIONS

Although it may seem that each research topic has been answered in some detail, there is still more complex picture to be seen. The issue of human response and impacts caused by global climate change (and possibly its converse interaction) has been sketched out, but this complex interplay is far from being fully understood. Presently, multidisciplinary research has been adding more and more finely tuned views of this interaction (as in with Norse Greenland), but the complete is far from finished.

Perhaps the weakest aspect of this research has been the comparative methodology used in this multidiscplinary research. Much of the comparative work has involved the searching for complementary patterns in different sources of data. If several lines of evidence point to the same direction, then a link is thought to exist. For example, the radiocarbon dates for the terminal phase of the Western Settlement in Norse Greenland indicate abandonment sometime around AD. 1350. The documentary sources suggest a date between 1350-1360. Likewise, the GISP2 isotopic signals of deuterium and oxygen suggest that overall the 14th century was lower in temperature than in the 15th century. The seasonal resolved isotopic records suggest clusters of low

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temperature time periods at AD. 1308 and 1319, representing the longest time period of low winter values until the 1560s. There is also a 20 year time period of low summer values between AD. 1343 and 1362 (cf. Buckland, Amorosi, Barlow, Dugmore, Mayewski, McGovern, Ogilvie, Sadler and Skidmore 1996). These data all suggest that the terminal phase of occupation in the Western Settlement of Greenland was between 1340-1360.

While these data do indicate a strong convergence of evidence, this methodology, a sort of "Goodness of Fit" model certainly needs to be much more rigorous. In the Icelandic examples mentioned in this thesis (such as at Granastadir and Svalbard), the convergence of evidence needs to go beyond the archaeological, zooarchaeological and enthnohistoric sources. Like the fine work that is being conducted for Norse Greenland, the question of climate interactions and human responses needs to be flushed out and refined.

Some of this research is already underway with the North Atlantic Biocultural Organizations (NABO) zooarchaeology, climate and modeling working groups. These working groups are now attempting to develop data and comparative protocols that will be extended into a GIS model of human-climate interactions and responses as seen from Iceland. This

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thesis essentially represents an evaluation of all known Icelandic zooarchaeological data, much of which will be incorporated into this modeling effort.

Another area of research that certainly needs to be fleshed out, is Lamb's (1977) concept of "overshoot". Within the Icelandic zooarchaeological material the operationalizing this concept has only just begun. Further multi- and interdisciplinary research needs to be conducted or else making sense of the Icelandic Landnam (Settlement) impacts on the landscape will never go beyond our current understanding.

12.3.1
Toward Practical Protocols - A Plea for a Systems Science Approach

It would seem obvious that the questions raised in this thesis will require a multidisciplinary approach that will have to reach beyond the confines of anthropology/archaeology. The use of regional (meso-scale) data sets will allow scholars, no matter what their discipline, to unravel signals of human impacts from climatic change. The zooarchaeological data now being compiled for the North Atlantic can help to signal some of

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the plausible connections to these other lines of evidence. Such regional perspectives and cooperative pattern searching is at the core of the Arctic System Science (ACRSS) research initiatives funded by the U.S. National Science Foundation. The North Atlantic Biocultural Organization (NABO 1992, 1993, 1994) is also part of this initiative, helping to coordinate multidiscplinary approaches to questions of global change and human impacts. The NABO consortium has brought together most of the North Atlantic bio-archaeologists and paleoecologists in order to pool paleoenvironmental data on regional and broad temporal scales.

From a zooarchaeological perspective, working with groups of archaeofauna on a regional basis with as broad a temporal scale as possible, inter-site comparison is both feasible and very productive. There is no reason to accept every bone collection as equally valuable. There is even less reason to assert that archaeological sites are inherently incomparable (or that there is nothing that can be done with small sample sized archaeofauna). Rather than prolonging the numerous debates about sample size it is now time to focus on the patterning that is contained with regional zooarchaeological data.

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Zooarchaeologists around the globe need to cooperate broadly in working out practical research protocols that can allow realistic assessments of global change issues. While a coordinated effort is clearly needed, small working groups with a specific research problem firmly in mind will prove more productive than a grand attempt to provide universal protocols for all zooarchaeology. Although such closely focused regional cooperation is difficult, it is not impossible. The northern palynological and limnological community has already shown their PALE collective research protocols to be useful tools for the study of global change (Anderson, Andrews et al. 1993) [69].

The avenues that might be followed could be:

1. - To develop regional zooarchaeological atlases that would go beyond the biogeographic data bases that already exist. Such fine data bases as the Faunmap program of Quaternary mammal distributions in North America (Graham and Lundelius 1994) only contain species specific distributional data. There is no

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69. Paleoclimates of Arctic Lakes and Estuaries, a sub-group of Past Global Changes (PAGES), International Geosphere-Biosphere Program (IGBP) and the U.S. National Science Foundation's Arctic System Science (ARCSS) Program. The PALE Protocol is available from PAGES, Barenplatz 2, CH 3011, Bern, Switzerland.

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attempt to correlate the distributional data to detailed climatic data (there is some attempt to match Pliestocene species to the extent of the continental ice sheets). Even more so, there is no attempt to match faunal distributional data to the archaeological record. Granted that the Faunmap program was not designed to match the archaeological record, this should be attempted.

2. - Many of the current paleoecological data bases were only designed for the Quaternary. This is because of the interest in specific time periods thought to be critical to the understanding of the collapse of continental ice sheets. The time periods that most of these programs lack are data for the 0-500 and 0-2000 BP resolution. Although a time resolution is not exceptionally useful for researchers working with the more recent past, there is much useful data. Although such data could be applied to the current programs and models, the time resolution could be reduced down into 100 year (perhaps even smaller) cycles.

   If such an attempt is made, zooarchaeological data can be viewed as critical to this endeavor and its synthesis is vital for multidiscplinary research.

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TABLES AND FIGURES

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Table 2.1 - Listing of organic materials used for radiocarbon dating of Icelandic archaeological deposits.

Organic Material	No. of Samples	% of Total
FAUNAL		
Human	5	
Bovid	2	
Cattle	6	
Sheep	5	
Polar Bear	1	
Unident. Mammal	2	
	21	21.79%
FLORAL		
Trees Species		
Birch		
bark	1	
charred	54	
misc.	3	
Charred birch/larch	1	
Larch	2	
Poplar	2	
Pine	1	
Spruce	1	
Unident. Driftwood	1	
Other		
Unident. Hay species	1	
Barley species	1	
Unident. charcoal	2	
	75	74.25%
Unspecified	5	4.95%

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Notes to Table 2.1:

The faunal sample species identifications are as follows:
1 - the bovid designations refers to both cattle and sheep,
2 - the 6 cattle samples were identified as ***Bos taurus***, and
3 - only three of the sheep samples were positively identified as ***Ovis aries***.

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Table 2.2 - Icelandic Archaeofauna dated by radiocarbon.

SITE	SAMPLE TYPE	NO. SAMPLES	SAMPLE LOCATION
ADABOL	STRAT.	1	HC
DRANGAR	BURIAL	1	HC
GRANASTADIR	STRAT.	5	I-NM
HERJOLFSDALUR	STRAT.	10	I
MIDBAER	STRAT.	2	HC
STONG (DEGERBOL '39)	STRAT.	6	DEN-ZM
STONG (VOV SAMPLE '83-84)	STRAT.	6	I-NM
STONG (VOV SAMPLE '86)	STRAT.	2	I-NM
SVALBARD (6706-60)	STRAT.	2	HC
TJARNARGATA 4	STRAT.	2	HC
VIDEY	STRAT.	13	HC & I

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Notes to Table 2.2:

1. - Samples listing derived from Amorosi (nd., 1992:132); Hallsgrimsdottir (1992:93-98); Vilhjalmsson (1990:61-65, 1991:108-110).

2. - Key for institutions listed in table are: HC = Bioarchaeological Laboratory, Dept. Of Anthropology, Hunter College, CUNY; I = Iceland; I-NM = Iceland-National Museum of Iceland; I-NH = Iceland-Icelandic Museum of Natural History; I-EG = Iceland-Egilstadir Museum; I-SA = Iceland-material curated by Stefan Adalsteinsson; and DEN-ZM = Denmark-Zoological Museum, Copenhagen.

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Table 2.3 - Radiocarbon Dates for Icelandic Archaeofauna.

Site/Lab.	Material	Date	Calibrated Date AD. Sigma 1	Sigma 2
Adabol, Hrafnkelsdalur				
U-4327	charred birch	1110+/-65	783-994	770-1020
Drangar				
Beta-65533 & CAMS 9007	polar bear	07.6+/-.7	1694-1955	1689-1955
Granastadir				
Ki-2854	charred birch	1070+/-50	897-1016	783-1145
Ki-2855	charred birch	1032+/-80	900-1147	780-1189
Ki-2856	charred birch	1110+/-60	783-992	770-1020
Ki-3235	charred birch	1170+/-90	694-981	660-1020
Ki-3236	charred birch	1100+/-50	888-992	779-1020
Herjolfsdalur, Heimaey				
U-2529	not known	1260+/-60	672-855	650-937
U-2531	charred birch	1060+/-65	896-1020	780-1152
U-2532	charred birch	550+/-60	1319-1427	1280-1440
U-2533	not known	1240+/-60	681-869	660-943
U-2660	charred birch	1390+/-60	602-670	540-769
U-2561	charred birch	1340+/-60	642-765	584-800
U-2662	charred birch	1240+/-50	686-864	660-937
U-2663	charred birch	1300+/-60	655-775	640-873
U-4402	charred birch	1035+/-65	904-1026	784-1157
U-4403	larch	1070+/-75	890-1020	776-1153
Midbaer				
Beta-65534	cow bone	420+/-80	1421-1619	1329-1650
Beta-65535	cow bone	670+/-60	1277-1388	1232-1410

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Table 2.3 (cont) - Radiocarbon Dates for Icelandic Archaeofauna.

Site/Lab.	Material	Date	Calibrated Date AD. Sigma 1	Sigma 2
Strong (Degerbol '39)				
Ua-1419	cow bone	970+/-40	1000-1152	985-1185
Ua-1420	cow bone	1080+/-40	897-996	784-1021
Ua-1421	sheep bone	1200+/-40	773-888	687-975
Ua-1422	sheep bone	1035+/-50	979-1023	890-1151
K-5365	cow bone	970+/-50	998-1153	980-1191
K-5366	cow bone	800+/-50	1193-1276	1071-1280
Strong (VOV Sample '83-84)				
K-4488	bovid bone	840+/-50	1157-1258	1030-1280
K-4489	bovid bone	890+/-65	1029-1219	1000-1275
K-4490	charred birch	860+/-50	1067-1225	1020-1276
K-4491	birch bark	950+/-65	1000-1160	980-1220
K-4492	charred birch	930+/-65	1004-1191	980-1256
Ua-1427	charred birch	1120+/-50	783-984	776-1017
Strong (VOV Sample '86)				
K-5014	charred birch	1220+/-50	691-879	670-944
Ua-1428	charred birch	1205+/-50	729-889	680-980
Svalbard				
Beta-52977 & CAMS-2675	sheep bone	380+/-60	1035-1221	1002-1276
Beta-52976	sheep bone	810+/-60	1162-1276	1038-1280
Tjarnargata 4				
U-2082	larch	1140+/-70	778-984	687-1020
U-2167	birch	1190+/-90	689-978	650-932

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Table 2.3 (cont.) - Radiocarbon dates for Icelandic Archaeofauna.

Site/Lab.	Material	Date	Calibrated Date AD. Sigma 1	Sigma 2
Videy				
Beta-49857	charcoal	490+/-50	1409-1440	1326-1473
Beta-49859	wood	1010+/-70	980-1150	890-1190
Beta-49860	charcoal	810+/-50	1164-1275	1044-1280
Beta-49866	charcoal	670+/-70	1276-1390	1220-1410
Beta-49867	charcoal	1420+/-90	543-670	430-795
Beta-49869	charcoal	730+/-50	1258-1283	1210-1386
Beta-49870	charcoal	180+/-50	1655-1955	1640-1955
Beta-49872	charcoal	1250+/-60	676-863	650-940
Beta-49878	charcoal	550+/-70	1311-1430	1280-1450
Beta-49879	charcoal	330+/-80	1434-1638	1410-1660
Beta-65536	wool	750+/-80	1214-1284	1045-1392
Beta-65537	unident. bone	380+/-60	1438-1630	1420-1650
Beta-65538	organic soil	1260+/-60	672-855	650-937

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Notes to Table 2.3:

1. - The sample used to derive the Drangar date (Drangar #1, Beta-65533, CAMS 9007) was identified as ***Ursus maritimus***, sample included a thoracic vertebra.

2. - The sample used to derive the Midbaer dates are: 1 - (Midbaer #1. Beta-65534, CAMS 9008), identified as ***Bos taurus***, sample included fragmentary crania, radius and distal femur; 2 - (Midbaer #2. Beta65535, CAMS 9009), identified as ***Bos taurus***, sample included a nasal bone, mandible, metacarpus and phalanx I.

3. - The sample used to derive the Svalbard dates are: 1 - (Svalbard #1. Beta-52977, CAMS 2675), identified as ***Ovis aries***, sample included a proximal femur; 2 - (Svalbard #2. Beta-52976) identified as ***Ovis aries***, sample included a scapula.

4. - The Strong dates derived from Degerbol 1939 are not detailed other than to say that the animal bone samples were identified as cow or sheep bone samples.

5. - The Strong dates derived from Vilhjalmsson (VOV) 1983-84 (K-1419 & K-1420) used a combined set of samples of cattle, ***Bos taurus*** and sheep, ***Ovis aries***, ***Ovis/Capra sp.*** remains. No effort was made to base these dates on a single species sample.

6. - The calibration of the first and second sigma ranges are based upon the "Calib" program, v. 1.3, 1987, developed by the University of Washington, Quaternary Isotope Laboratory. These calibrations were performed with a 10 year atmospheric record, 2490 CAL. BC. (ca. 4020 14-C BP.).

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Table 2.4 - Calibration for the Adabol radiocarbon date, U 4327.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Adabol U4327

Radiocarbon Age BP	1110.0	± 65.0£					Reference(s)
Calibrated age(s)	cal AD	902,	918,	955			(Stuiver and Becker)
		972,	975				
	cal BP	1048,	1032,	995			
		978,	975				

cal AD/BC (cal BP) age ranges:

One Sigma**	cal AD	783- 787(1167-1163)	834- 836(1116-1114)
		869- 994(1081- 956)	
Two Sigma**	cal AD	770-1020(1180- 930)	

Intercepts and maximum range:

one sigma	cal AD	783 (	902,	918,	955,	972,	975) 994
	cal BP	1167 (	1048,	1032,	995,	978,	975) 956
two sigma	cal AD	770 (	902,	918,	955,	972,	975) 1020
	cal BP	1180 (	1048,	1032,	995,	978,	975) 930

References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
£This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.5 - Calibration for the Drangar radiocarbon date, Beta 65533.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Drangar1 Beta65533
Radiocarbon Age BP 107.6 ± .7E — Reference(s)
Calibrated age(s) cal AD 1707, 1718, 1814
1826, 1880, 1916
1955*
cal BP 243, 232, 136
124, 70, 34
0*
cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 1694-1713(256- 237) 1715-1721(235- 229)
1812-1856(138- 94) 1870-1887(80- 63)
1912-1921(38- 29) 1955*
Two Sigma** cal AD 1689-1725(261- 225) 1810-1894(140- 56)
1909-1926(41- 24) 1955*

Intercepts and maximum range:
one sigma cal AD 1694 (1707, 1718, 1814, 1826, 1880, 1916,
1955*) 1955*
cal BP 256 (243, 232, 136, 124, 70, 34
0*) 0*
two sigma cal AD 1689 (1707, 1718, 1814, 1826, 1880, 1916,
1955*) 1955*
cal BP 261 (243, 232, 136, 124, 70, 34
0*) 0*

References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
&This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.6 - Calibrations for the Midbaer radiocarbon date, Beta65534.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

MDB1 Beta65534
Radiocarbon Age BP 420.0 @ 80.0
Calibrated age(s) cal AD 1443 — Reference(s): (Stuiver and Becker)
cal BP 507

cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 1421-1517(529- 433) 1597-1619(353- 331)
Two Sigma** cal AD 1329-1348(621- 602) 1390-1650(560- 300)

Intercepts and maximum range:
one sigma cal AD 1421 (1443) 1619
cal BP 529 (507) 331
two sigma cal AD 1329 (1443) 1650
cal BP 621 (507) 300

References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
&This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.6 (cont.) - Calibration for the Midbaer radiocarbon date, Beta65535.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

MDB2 Beta65535
Radiocarbon Age BP 670.0 @ 60.0
Reference(s)
Calibrated age(s) cal AD 1283 (Stuiver and Becker)
cal BP 667
cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 1277-1324(673- 626) 1367-1388(583- 562)
Two Sigma** cal AD 1232-1239(718- 711) 1260-1410(690- 540)

Intercepts and maximum range:
one sigma cal AD 1277 (1283) 1388
cal BP 673 (667) 562
two sigma cal AD 1232 (1283) 1410
cal BP 718 (667) 540

References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
@This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.7 - Calibration & Weighted Average for the Granastadir radiocarbon dates, Ki 2854, 2855, 2856, 3235, 3236.

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QUATERNARY ISOTOPE LAB
RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Gran. Ki2854
 Radiocarbon Age BP 1070.0 q 49.0£ Reference(s)

Gran. Ki2855
 Radiocarbon Age BP 1032.0 q 80.0£

Gran. Ki2856
 Radiocarbon Age BP 1110.0 q 60.0£

Gran. Ki3235
 Radiocarbon Age BP 1170.0 q 90.0£

Gran. Ki3236
 Radiocarbon Age BP 1100.0 q 50.0£

 Weighted average:

all
 Radiocarbon Age BP 1091.5 q 27.0£
  Calibrated age(s) cal AD   979 (Stuiver and Becker)
                    cal BP   971
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD 896- 921(1054-1029) 940- 986(1010- 964)
   Two Sigma**   cal AD 886- 999(1064- 951)

  Intercepts and maximum range:
   one sigma   cal AD 896 (979) 986
               cal BP 1054 (971) 964
   two sigma   cal AD 886 (979) 999
               cal BP 1064 (971) 951

References for datasets [and intervals] used:
Stuiver.M and Becker.B. 1986. Radiocarbon. 28. 863-910.

Comments:
£This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.8 - Calibrations for the Granastadir radiocarbon date, Ki 2854.

```
                    UNIVERSITY OF WASHINGTON
                      QUATERNARY ISOTOPE LAB
                  RADIOCARBON CALIBRATION PROGRAM 1987
                              REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Gran. Ki2854
 Radiocarbon Age BP   1070.0  q 50.0£                          Reference(s)
  Calibrated age(s) cal AD    983                          (Stuiver and Becker)
                    cal BP    967
  cal AD/BC (cal BP) age ranges:
   One Sigma**    cal AD  897- 921(1053-1029)  941-1000(1009- 950)
                  1014-1016( 936- 934)
   Two Sigma**    cal AD  783- 787(1167-1163)  834- 836(1116-1114)
                   870-1030(1080- 920)

  Intercepts and maximum range:
   one sigma    cal AD  897 (  983) 1016
                cal BP 1053 (  967)  934
   two sigma    cal AD  783 (  983) 1145
                cal BP 1167 (  967)  805


References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986, Radiocarbon, 28, 863-910.

Comments:
£This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.8 (cont.) - Calibration for the Granastadir radiocarbon date, Ki 2855.

```
                    UNIVERSITY OF WASHINGTON
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                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Gran. Ki2855
 Radiocarbon Age BP  1032.0  σ 80.0δ                          Reference(s)
  Calibrated age(s) cal AD   997                          (Stuiver and Becker)
                    cal BP   953
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD  900- 919(1050-1031)  944-1033(1006- 917)
                 1143-1147( 807- 803)
   Two Sigma**   cal AD  780- 790(1170-1160)  803- 824(1147-1126)
                  826- 842(1124-1108)  860-1160(1090- 790)
                 1170-1189( 780- 761)

  Intercepts and maximum range:
   one sigma    cal AD  900 (  997) 1147
                cal BP 1050 (  953)  803
   two sigma    cal AD  780 (  997) 1189
                cal BP 1170 (  953)  761


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
δThis standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.8 (cont.) - Calibration for the Granastadir radiocarbon date. Ki 2856.

```
                    UNIVERSITY OF WASHINGTON
                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Gran. Ki2856
 Radiocarbon Age BP  1110.0  q 60.0£                          Reference(s)
  Calibrated age(s) cal AD   902.  918.  955              (Stuiver and Becker)
                             972.  975
                    cal BP  1048. 1032.  995
                             978.  975
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD  783- 787(1167-1163)  872- 992(1078- 958)
   Two Sigma**   cal AD  770-1020(1180- 930)

  Intercepts and maximum range:
   one sigma    cal AD  783 (  902.  918.  955.  972.  975)  992
                cal BP 1167 ( 1048. 1032.  995.  978.  975)  958
   two sigma    cal AD  770 (  902.  918.  955.  972.  975) 1020
                cal BP 1180 ( 1048. 1032.  995.  978.  975)  930


References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986. Radiocarbon. 28. 863-910.

Comments:
£This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.8 (cont.) - Calibration for the Granastadir radiocarbon date, Ki 3225.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Gran. Ki3235
Radiocarbon Age BP 1170.0 q 90.0£ Reference(s)
Calibrated age(s) cal AD 784. 786. 874 (Stuiver and Becker)
cal BP 1166. 1164. 1076
cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 694- 696(1256-1254) 727- 745(1223-1205)
769- 981(1181- 969)
Two Sigma** cal AD 660-1020(1290- 930)

Intercepts and maximum range:
one sigma cal AD 694 (784. 786. 874) 981
cal BP 1256 (1166. 1164. 1076) 969
two sigma cal AD 660 (784. 786. 874) 1020
cal BP 1290 (1166. 1164. 1076) 930

References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986, Radiocarbon, 28, 863-910.

Comments:
£This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.8 (cont.) - Calibration for the Granastadir radiocarbon date, T- 2016.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Gran. Ki3236
Radiocarbon Age BP 1100.0 @ 50.0£ Reference(s)
Calibrated age(s) cal AD 910. 915. 977 (Stuiver and Becker)
cal.BP 1040. 1035. 973
cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 888- 992(1062- 958)
Two Sigma** cal AD 779- 792(1171-1158) 800-1020(1150- 930)

Intercepts and maximum range:
one sigma cal AD 888 (910. 915. 977) 992
cal BP 1062 (1040. 1035. 973) 958
two sigma cal AD 779 (910. 915. 977) 1020
cal BP 1171 (1040. 1035. 973) 930

References for datasets [and intervals] used:
Stuiver.M and Becker.B. 1986. Radiocarbon. 28. 863-910.

Comments:
£This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.9 - Calibration & Weighted Average for the Herjolfsdalur radiocarbon dates. U 2529, 2531, 2532, 2533, 2660, 2661, 2662, 2663, 4402, 4403.

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QUATERNARY ISOTOPE LAB
RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Herj. U2529
 Radiocarbon Age BP 1260.0 q 60.0E Reference(s)

Herj. U2531
 Radiocarbon Age BP 1060.0 q 65.0E

Herj. U2532
 Radiocarbon Age BP 550.0 q 60.0E

Herj. U2533
 Radiocarbon Age BP 1240.0 q 60.0E

Herj. U2660
 Radiocarbon Age BP 1390.0 q 60.0E

Herj. U2661
 Radiocarbon Age BP 1340.0 q 60.0E

Herj. U2662
 Radiocarbon Age BP 1240.0 q 50.0E

Herj. U2663
 Radiocarbon Age BP 1300.0 q 60.0E

Herj. U4402
 Radiocarbon Age BP 1035.0 q 65.0E

Herj. U4403
 Radiocarbon Age BP 1070.0 q 75.0E

 Weighted average:

herj.
 Radiocarbon Age BP 1158.6 q 19.2E
  Calibrated age(s) cal AD 887 (Stuiver and Becker
  cal BP 1063
  cal AD/BC (cal BP) age ranges:
   One Sigma** cal AD 781- 789(1169-1161) 804- 821(1146-1129)
   829- 840(1121-1110) 861- 896(1089-1054)
   922- 940(1028-1010)
   Two Sigma** cal AD 777- 793(1173-1157) 798- 978(1152- 972)

  Intercepts and maximum range:
   one sigma cal AD 781 (887) 940
   cal BP 1169 (1063) 1010
   two sigma cal AD 777 (887) 978
   cal BP 1173 (1063) 972

References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986, Radiocarbon, 28, 863-910.

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Table 2.10 - Calibrations for the Herjolfsdalur radiocarbon date, U 2529.

```
                    UNIVERSITY OF WASHINGTON
                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Herj. U2529
 Radiocarbon Age BP  1260.0  q 60.0£                          Reference(s)
  Calibrated age(s) cal AD   695.  728.  744                (Stuiver and Becker)
                             769
                    cal BP  1255. 1222. 1206
                             1181
  cal AD/BC (cal BP) age ranges:
   One Sigma**    cal AD  672- 780(1278-1170)   790- 803(1160-1147)
                   842- 855(1108-1095)
   Two Sigma**    cal AD  650- 890(1300-1060)   924- 937(1026-1013)

  Intercepts and maximum range:
   one sigma     cal AD  672 (  695,  728,  744,  769)  855
                 cal BP 1278 ( 1255, 1222, 1206, 1181) 1095
   two sigma     cal AD  650 (  695,  728,  744,  769)  937
                 cal BP 1300 ( 1255, 1222, 1206, 1181) 1013


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
£This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.10 (cont.) - Calibration for the Herjolfsdalur radiocarbon date, U 2531.

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                    UNIVERSITY OF WASHINGTON
                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Herj. U2531
 Radiocarbon Age BP  1060.0  σ 65.0δ                          Reference(s)
  Calibrated age(s) cal AD   985                          (Stuiver and Becker)
                    cal BP   965
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD  896- 922(1054-1028)  939-1020(1011- 930)
   Two Sigma**   cal AD  780- 790(1170-1160)  803- 824(1147-1126)
                  826- 842(1124-1108)  860-1040(1090- 910)
                 1092-1121( 858- 829) 1139-1152( 811- 798)

  Intercepts and maximum range:
   one sigma    cal AD  896 (  985) 1020
                cal BP 1054 (  965)  930
   two sigma    cal AD  780 (  985) 1152
                cal BP 1170 (  965)  798


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
δThis standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.10 (cont.) - Calibration for the Herjolfsdalur radiocarbon date, U 2532.

```
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                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Herj. U2532
 Radiocarbon Age BP    550.0  ± 60.0δ                          Reference(s)
  Calibrated age(s) cal AD  1407                           (Stuiver and Becker)
                    cal BP   543
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD 1319-1368( 631- 582) 1387-1427( 563- 523)
   Two Sigma**   cal AD 1280-1440( 670- 510)

  Intercepts and maximum range:
   one sigma    cal AD 1319 ( 1407) 1427
                cal BP  631 (  543)  523
   two sigma    cal AD 1280 ( 1407) 1440
                cal BP  670 (  543)  510


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
δThis standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.10 (cont.) - Calibration for the Herjolfsdalur radiocarbon date, U 2533.

```
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                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Herj. U2533
 Radiocarbon Age BP  1240.0  σ 60.0δ                          Reference(s)
  Calibrated age(s) cal AD   774                          (Stuiver and Becker)
                    cal.BP  1176
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD  681- 783(1269-1167)  787- 834(1163-1116)
                  836- 869(1114-1081)
   Two Sigma**   cal AD  660- 900(1290-1050)  919- 943(1031-1007)

  Intercepts and maximum range:
   one sigma    cal AD  681 (  774)  869
                cal BP 1269 ( 1176) 1081
   two sigma    cal AD  660 (  774)  943
                cal BP 1290 ( 1176) 1007


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
δThis standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.10 (cont.) - Calibration for the Herjolfsdalur radiocarbon date, U 2660.

```
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                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                        REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Herj. U2660
 Radiocarbon Age BP  1390.0  σ 60.0£                        Reference(s)
  Calibrated age(s) cal AD   644                        (Stuiver and Becker)
                    cal BP  1306
  cal AD/BC (cal BP) age ranges:
   One Sigma**    cal AD  602- 633(1348-1317)  636- 670(1314-1280)
   Two Sigma**    cal AD  540- 690(1410-1260)  696- 727(1254-1223)
                   745- 769(1205-1181)

  Intercepts and maximum range:
   one sigma    cal AD  602 (  644)  670
                cal BP 1348 ( 1306) 1280
   two sigma    cal AD  540 (  644)  769
                cal BP 1410 ( 1306) 1181


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
£This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.10 (cont.) - Calibration for the Herjolfsdalur radiocarbon date, U 2661.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Herj. U2661
Radiocarbon Age BP 1340.0 ± 60.0δ

			Reference(s)
Calibrated age(s)	cal AD 665		(Stuiver and Becker)
	cal BP 1285		
cal AD/BC (cal BP) age ranges:			
One Sigma**	cal AD 642- 691(1308-1259)	700- 710(1250-1240)	
	749- 765(1201-1185)		
Two Sigma**	cal AD 584- 587(1366-1363)	600- 780(1350-1170)	
	792- 800(1158-1150)		

Intercepts and maximum range:

one sigma	cal AD 642 (665)	765	
	cal BP 1308 (1285)	1185	
two sigma	cal AD 584 (665)	800	
	cal BP 1366 (1285)	1150	

References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986, Radiocarbon, 28, 863-910.

Comments:
δThis standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
› 2497 BC represents end of calibration data

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Table 2.10 (cont.) - Calibration for the Herjolfsdalur radiocarbon date, U 2662.

```
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                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Herj. U2662
 Radiocarbon Age BP  1240.0  q 50.0&                          Reference(s)
  Calibrated age(s) cal AD   774                          (Stuiver and Becker)
                    cal BP  1176
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD  686- 754(1264-1196)  756- 781(1194-1169)
                  789- 805(1161-1145)  819- 830(1131-1120)
                  839- 864(1111-1086)
   Two Sigma**   cal AD  660- 890(1290-1060)  924- 937(1026-1013)

  Intercepts and maximum range:
   one sigma   cal AD  686 (  774)  864
               cal BP 1264 ( 1176) 1086
   two sigma   cal AD  660 (  774)  937
               cal BP 1290 ( 1176) 1013


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
&This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.10 (cont.) - Calibration for the Herjolfsdalur radiocarbon date, U 2663.

```
                    UNIVERSITY OF WASHINGTON
                     QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Herj. U2663
 Radiocarbon Age BP  1300.0  q 60.0E                          Reference(s)
  Calibrated age(s) cal AD   682                          (Stuiver and Becker)
                    cal BP  1268
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD  655- 775(1295-1175)
   Two Sigma**   cal AD  640- 780(1310-1170)  786- 873(1164-1077)

  Intercepts and maximum range:
   one sigma    cal AD  655 (  682)  775
                cal BP 1295 ( 1268) 1175
   two sigma    cal AD  640 (  682)  873
                cal BP 1310 ( 1268) 1077


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
EThis standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.10 (cont.) - Calibration for the Herjolfsdalur radiocarbon date, U 4402.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Herj. U4402
Radiocarbon Age BP 1035.0 @ 65.0£ Reference(s)
Calibrated age(s) cal AD 996 (Stuiver and Becker)
cal BP 954

cal AD/BC (cal BP) age ranges:

One Sigma**	cal AD 904- 916(1046-1034)	977-1026(973- 924)	
Two Sigma**	cal AD 784- 786(1166-1164)	870-1130(1080- 820)	
	1136-1157(814- 793)		

Intercepts and maximum range:

one sigma	cal AD 904 (996) 1026		
	cal BP 1046 (954) 924		
two sigma	cal AD 784 (996) 1157		
	cal BP 1166 (954) 793		

References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986, Radiocarbon, 28, 863-910.

Comments:
£This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.10 (cont.) - Calibration for the Herjolfsdalur radiocarbon date. U 4403.

```
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                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Herj. U4403
 Radiocarbon Age BP  1070.0  ± 75.0£                      Reference(s)
  Calibrated age(s) cal AD   983                        (Stuiver and Becker)
                    cal BP   967
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD  890-1020(1060- 930)
   Two Sigma**   cal AD  776- 794(1174-1156)  800-1070(1150- 880)
                 1087-1125( 863- 825) 1138-1153( 812- 797)

  Intercepts and maximum range:
   one sigma   cal AD  890 (  983) 1020
               cal BP 1060 (  967)  930
   two sigma   cal AD  776 (  983) 1153
               cal BP 1174 (  967)  797


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
£This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.11 - Calibrations for the Stong radiocarbon date, Ua 1419.

```
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                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Stong Ua1419
 Radiocarbon Age BP    970.0  q 40.0£                      Reference(s)
  Calibrated age(s) cal AD  1025                        (Stuiver and Becker)
                    cal BP   925
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD 1000-1014( 950- 936) 1016-1042( 934- 908)
                 1093-1121( 857- 829) 1139-1152( 811- 798)
   Two Sigma**   cal AD  985-1161( 965- 789)

  Intercepts and maximum range:
   one sigma    cal AD 1000 ( 1025) 1152
                cal BP  950 (  925)  798
   two sigma    cal AD  985 ( 1025) 1185
                cal BP  965 (  925)  765


References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986, Radiocarbon, 28, 863-910.

Comments:
£This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
› 2497 BC represents end of calibration data
```

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Table 2.11 (cont.) - Calibration for the Stong radiocarbon date, Ua 1420.

```
                    UNIVERSITY OF WASHINGTON
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                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Stong Ua1420
 Radiocarbon Age BP  1080.0  ± 40.0δ                          Reference(s)
  Calibrated age(s) cal AD   981                          (Stuiver and Becker)
                    cal BP   969
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD  897- 921(1053-1029)  940- 996(1010- 954)
   Two Sigma**   cal AD  784- 786(1166-1164)  873-1021(1077- 929)

  Intercepts and maximum range:
   one sigma    cal AD  897 (  981)  996
                cal BP 1053 (  969)  954
   two sigma    cal AD  784 (  981) 1021
                cal BP 1166 (  969)  929


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
δThis standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.11 (cont.) - Calibration for the Stong radiocarbon date, Ua 1421.

```
                    UNIVERSITY OF WASHINGTON
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                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Stong Ua1421
 Radiocarbon Age BP  1200.0  ± 40.0£                          Reference(s)
  Calibrated age(s) cal AD   780,  790,  802              (Stuiver and Becker)
                       .     843,  853
                    cal BP  1170, 1160, 1148
                            1107, 1097
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD  773- 888(1177-1062)
   Two Sigma**   cal AD  687- 753(1263-1197)  758- 902(1192-1048)
                  918- 945(1032-1005)  973- 975( 977- 975)

  Intercepts and maximum range:
   one sigma    cal AD  773 (  780,  790,  802,  843,  853)  888
                cal BP 1177 ( 1170, 1160, 1148, 1107, 1097) 1062
   two sigma    cal AD  687 (  780,  790,  802,  843,  853)  975
                cal BP 1263 ( 1170, 1160, 1148, 1107, 1097)  975


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
£This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.11 (cont.) - Calibration for the Stong radiocarbon date, Ua 1422.

```
                    UNIVERSITY OF WASHINGTON
                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Stong Ua1422
 Radiocarbon Age BP  1035.0  σ 50.0δ                          Reference(s)
  Calibrated age(s) cal AD   996                          (Stuiver and Becker)
                    cal BP   954
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD  979-1023( 971- 927)
   Two Sigma**   cal AD  890-1040(1060- 910) 1093-1120( 857- 830)
                 1140-1151( 810- 799)

  Intercepts and maximum range:
   one sigma   cal AD  979 (  996) 1023
               cal BP  971 (  954)  927
   two sigma   cal AD  890 (  996) 1151
               cal BP 1060 (  954)  799


References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986, Radiocarbon, 28, 863-910.

Comments:
δThis standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.11 (cont.) - Calibrration foor the Stong radiocarbon date, K 5365.

```
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                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Stong K5365
 Radiocarbon Age BP    970.0  ± 50.0δ                          Reference(s)
  Calibrated age(s) cal AD  1025                           (Stuiver and Becker)
                    cal BP   925
  cal AD/BC (cal BP) age ranges:
   One Sigma**    cal AD  998-1045( 952- 905) 1048-1066( 902- 884)
                  1088-1124( 862- 826) 1138-1153( 812- 797)
   Two Sigma**    cal AD  980-1160( 970- 790) 1165-1191( 785- 759)

  Intercepts and maximum range:
   one sigma    cal AD  998 ( 1025) 1153
                cal BP  952 (  925)  797
   two sigma    cal AD  980 ( 1025) 1191
                cal BP  970 (  925)  759


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
δThis standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.11 (cont.) - Calibration for the Stong radiocarbon date, K 5366.

```
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                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Stong K5366
 Radiocarbon Age BP    800.0  @ 50.0&                          Reference(s)
  Calibrated age(s) cal AD  1230, 1243, 1256              (Stuiver and Becker)
                    cal BP   720,  707,  694
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD 1193-1201( 757- 749) 1206-1276( 744- 674)
   Two Sigma**   cal AD 1071-1084( 879- 866) 1128-1137( 822- 813)
                 1150-1280( 800- 670)

  Intercepts and maximum range:
   one sigma    cal AD 1193 ( 1230, 1243, 1256) 1276
                cal BP  757 (  720,  707,  694)  674
   two sigma    cal AD 1071 ( 1230, 1243, 1256) 1280
                cal BP  879 (  720,  707,  694)  670


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
&This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.11 (cont.) - Calibration for the Stong radiocarbon date, K 4488.

```
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                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Stong K4488
 Radiocarbon Age BP    840.0  q 50.0E                        Reference(s)
  Calibrated age(s) cal AD  1212                          (Stuiver and Becker)
                    cal BP   738
  cal AD/BC (cal BP) age ranges:
   One Sigma**    cal AD 1157-1258( 793- 692)
   Two Sigma**    cal AD 1030-1140( 920- 810) 1150-1280( 800- 670)

  Intercepts and maximum range:
   one sigma    cal AD 1157 ( 1212) 1258
                cal BP  793 (  738)  692
   two sigma    cal AD 1030 ( 1212) 1280
                cal BP  920 (  738)  670


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
EThis standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.11 (cont.) - Calibration for the Stong radiocarbon date, K 4489.

```
                    UNIVERSITY OF WASHINGTON
                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Stong 4489
 Radiocarbon Age BP    890.0  @ 65.0&                          Reference(s)
  Calibrated age(s) cal AD  1158                           (Stuiver and Becker)
                    cal BP   792
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD 1029-1144( 921- 806) 1146-1219( 804- 731)
   Two Sigma**   cal AD 1000-1260( 950- 690) 1271-1275( 679- 675)

  Intercepts and maximum range:
   one sigma    cal AD 1029 ( 1158) 1219
                cal BP  921 (  792)  731
   two sigma    cal AD 1000 ( 1158) 1275
                cal BP  950 (  792)  675


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
&This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.11 (cont.) - Calibration for the Stong radiocarbon date, K 4490.

```
                    UNIVERSITY OF WASHINGTON
                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Stong K4490
 Radiocarbon Age BP   860.0  q 50.0&                          Reference(s)
  Calibrated age(s) cal AD  1191                          (Stuiver and Becker)
                    cal BP   759
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD 1067-1087( 883- 863) 1125-1138( 825- 812)
                 1153-1225( 797- 725)
   Two Sigma**   cal AD 1020-1260( 930- 690) 1270-1276( 680- 674)

  Intercepts and maximum range:
   one sigma    cal AD 1067 ( 1191) 1225
                cal BP  883 (  759)  725
   two sigma    cal AD 1020 ( 1191) 1276
                cal BP  930 (  759)  674


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
&This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.11 (cont.) - Calibration for the Stong radiocarbon date, K 4491.

```
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                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Stong K4491
 Radiocarbon Age BP    950.0  q 65.0&                          Reference(s)
  Calibrated age(s) cal AD  1033, 1143, 1147              (Stuiver and Becker)
                    cal BP   917,  807,  803
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD 1000-1014( 950- 936) 1015-1160( 935- 790)
   Two Sigma**   cal AD  980-1220( 970- 730)

  Intercepts and maximum range:
   one sigma    cal AD 1000 ( 1033, 1143, 1147) 1160
                cal BP  950 (  917,  807,  803)  790
   two sigma    cal AD  980 ( 1033, 1143, 1147) 1220
                cal BP  970 (  917,  807,  803)  730


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
&This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.11 (cont.) - Calibration for the Stong radiocarbon date, K 4492.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Stong K4492
Radiocarbon Age BP 930.0 @ 65.0E Reference(s)
Calibrated age(s) cal AD 1040. 1095. 1119 (Stuiver and Becker)
1140. 1151
cal BP 910. 855. 831
810. 799

cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 1004-1007(946- 943) 1019-1165(931- 785)
1167-1191(783- 759)
Two Sigma** cal AD 980-1230(970- 720) 1237-1256(713- 694)

Intercepts and maximum range:
one sigma cal AD 1004 (1040. 1095. 1119. 1140. 1151) 1191
cal BP 946 (910. 855. 831. 810. 799) 759
two sigma cal AD 980 (1040. 1095. 1119. 1140. 1151) 1256
cal BP 970 (910. 855. 831. 810. 799) 694

References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986. Radiocarbon. 28. 863-910.

Comments:
*This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY:
** 1 sigma = square root of (sample std. dev.** + curve std. dev.**)
2 sigma = 2 * square root of (sample std. dev.** + curve std. dev.**)
2* represents a "negative" age BP
1955* denotes influence of bomb C-14
* 2497 BC represents end of calibration data

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Table 2.11 (cont.) - Calibration for the Stong radiocarbon date. Ua 1427.

```
                    UNIVERSITY OF WASHINGTON
                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM [illegible]
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Stong Ua1427
 Radiocarbon Age BP   1120.0  ± 50.0E                          Reference: 1
  Calibrated age(s)  cal AD   898.  920.  942                  (Stuiver and Becker)
                     cal BP  1052. 1030. 1008
  cal AD/BC (cal BP) age ranges:
   One Sigma**       cal AD  783- 787(1167-1163)  871- 984(1079- 966)
   Two Sigma**       cal AD  776- 794(1174-1156)  900-1000(1150- 950)
                     1011-1017( 939- 933)

  Intercepts and maximum range:
   one sigma    cal AD  783 (  898.  920.  942) 984
                cal BP 1167 ( 1052. 1030. 1008) 966
   two sigma    cal AD  776 (  898.  920.  942) 1017
                cal BP 1174 ( 1052. 1030. 1009) 933


References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986. Radiocarbon. 28. 863-910.

Comments:
**This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY:
** 1 sigma = square root of (sample std. dev.** + curve std. dev.**)
   2 sigma = 2 * square root of (sample std. dev.** + curve std. dev.**)
1* represents a 'negative' age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.11 (cont.) - Calibration for the Stong radiocarbon date, Ua 1428.

```
                    UNIVERSITY OF WASHINGTON
                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: CI4FIL.TXT
Plot file: CI4FIL.PLT

Stong Ua1428
 Radiocarbon Age BP   1205.0   @ 50.0E                          Reference(s)
  Calibrated age(s)  cal AD    779.   791.   801                (Stuiver and Becker)
                              844.   848
                     cal BP  1171.  1159.  1149
                             1106.  1102

  cal AD/BC (cal BP) age ranges:
   One Sigma**    cal AD  729- 741 (1221-1209)  769- 889 (1181-1061)
   Two Sigma**    cal AD  680- 880 (1270- 970)

  Intercepts and maximum range:
   one sigma    cal AD  729 (  779.  791.  801.  844.  848)  889
                cal BP 1221 ( 1171. 1159. 1149. 1106. 1102) 1061
   two sigma    cal AD  680 (  779.  791.  801.  844.  848)  880
                cal BP 1270 ( 1171. 1159. 1149. 1106. 1102)  970


References for datasets (and intervals) used:
Stuiver,M and Becker,B. 1986. Radiocarbon. 28. 863-910.

Comments:
*This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev.)+ curve std. dev.)!
   2 sigma = 2 * square root of (sample std. dev.)+ curve std. dev.)!
2* represents a "negative" age BP
1955* denotes influence of bomb C-14
 1437 BC represents end of calibration data
```

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Table 2.11 (cont.) - Calibration for the Stong radiocarbon date, K 5014.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Stong K5014
Radiocarbon Age BP 1220.0 ± 50.0E Reference(s)
Calibrated age(s) cal AD 777. 793. 798 (Stuiver and Becker)
cal BP 1173. 1157. 1152
cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 691- 700(1259-1250) 711- 743(1239-1207)
766- 784(1184-1166) 796- 879(1154-1071)
Two Sigma** cal AD 670- 900(1280-1050) 918- 944(1032-1006)

Intercepts and maximum range:
one sigma cal AD 691 (777. 793. 798) 879
cal BP 1259 (1173. 1157. 1152) 1071
two sigma cal AD 670 (777. 793. 798) 944
cal BP 1280 (1173. 1157. 1152) 1006

References for datasets (and intervals) used:
Stuiver,M and Becker,B. 1986. Radiocarbon. 28. 863-910.

Comments:
EThis standard deviation (error) may include an error multiplier.
IF SO, SPECIFY:
** 1 sigma = square root of (sample std. dev.)² + curve std. dev.)²)
2 sigma = 2 x square root of (sample std. dev.)² + curve std. dev.)²)
0* represents a 'negative' age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.12 - Calibrations for the Svalbard radiocarbon date, Beta 52977.

```
                    UNIVERSITY OF WASHINGTON
                    QUATERNARY ISOTOPE LAB
                 RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

SVB Beta52977
 Radiocarbon Age BP    880.0  ± 60.0£                          Reference(s)
  Calibrated age(s) cal AD  1161, 1185                    (Stuiver and Becker)
                    cal BP   789,  765
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD 1035-1142( 915- 808) 1148-1221( 802- 729)
   Two Sigma**   cal AD 1002-1011( 948- 939) 1020-1260( 930- 690)
                 1271-1276( 679- 674)

  Intercepts and maximum range:
   one sigma    cal AD 1035 ( 1161, 1185) 1221
                cal BP  915 (  789,  765)  729
   two sigma    cal AD 1002 ( 1161, 1185) 1276
                cal BP  948 (  789,  765)  674


References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
£This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.12 (cont.) - Calibartion for the Svalbard radiocarbon date, Beta 52975.

UNIVERSITY OF WASHINGTON
QUATERNARY ISOTOPE LAB
RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

SVB 52976
Radiocarbon Age BP 810.0 ± 60.0δ
Reference(s)
Calibrated age(s) cal AD 1223 (Stuiver and Becker)
cal BP 727

cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 1162-1178(788- 772) 1187-1265(763- 685)
1265-1276(685- 674)
Two Sigma** cal AD 1038-1103(912- 847) 1116-1141(834- 809)
1150-1280(800- 670)

Intercepts and maximum range:
one sigma cal AD 1162 (1223) 1276
cal BP 788 (727) 674
two sigma cal AD 1038 (1223) 1280
cal BP 912 (727) 670

References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986, Radiocarbon, 28, 863-910.

Comments:
δThis standard deviation (error) may include an error multiplier.
IF SO, SPECIFY:
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.13 - Calibrations for the Tjarnargata radiocarbon date, U 2157.

```
                    UNIVERSITY OF WASHINGTON
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                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Tjarn. U2167
 Radiocarbon Age BP   1190.0  σ 90.0Ε                          Reference(s)
  Calibrated age(s) cal AD    781,   789,   805               (Stuiver and Becker)
                              821,   829,   839
                              862
                    cal BP   1169, 1161, 1145
                             1129, 1121, 1111
                             1088
  cal AD/BC (cal BP) age ranges:
   One Sigma**    cal AD  689- 703(1261-1247)  707- 751(1243-1199)
                   762- 978(1188- 972)
   Two Sigma**    cal AD  650-1000(1300- 950) 1010-1018( 940- 932)

  Intercepts and maximum range:
   one sigma     cal AD  689 (  781,   789,   805,   821,   829,   839,
                                862)  978
                 cal BP 1261 ( 1169, 1161, 1145, 1129, 1121, 1111
                              1088)  972
   two sigma     cal AD  650 (  781,   789,   805,   821,   829,   839,
                                862) 1018
                 cal BP 1300 ( 1169, 1161, 1145, 1129, 1121, 1111
                              1088)  932


References for datasets (and intervals) used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
ΣThis standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.13 - Calibartion for the Tjarnargata radiocarbon date, U 2082.

```
                    UNIVERSITY OF WASHINGTON
                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Tjarn. U2082
 Radiocarbon Age BP  1140.0  ± 70.0&                          Reference(s)
  Calibrated age(s) cal AD   892.  925.  936              (Stuiver and Becker)
                    cal BP  1058. 1025. 1014
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD  778- 792(1172-1158)  799- 984(1151- 966)
   Two Sigma**   cal AD  687- 753(1263-1197)  760-1020(1190- 930)

  Intercepts and maximum range:
   one sigma    cal AD  778 (  892.  925.  936)  984
                cal BP 1172 ( 1058. 1025. 1014)  966
   two sigma    cal AD  687 (  892.  925.  936) 1020
                cal BP 1263 ( 1058. 1025. 1014)  930


References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986. Radiocarbon. 28. 863-910.

Comments:
&This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
   2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.14 - Calibrations for the Videy radiocarbon date, Beta 49857.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Videy Beta49857
Radiocarbon Age BP 490.0 ± 50.0
Calibrated age(s) cal AD 1426 (Stuiver and Becker)
cal BP 524

cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 1409-1440 (541- 510)
Two Sigma** cal AD 1326-1352 (624- 598) 1390-1473 (560- 477)

Intercepts and maximum range:
one sigma cal AD 1409 (1426) 1440
cal BP 541 (524) 510
two sigma cal AD 1326 (1426) 1473
cal BP 624 (524) 477

References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
#This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev.)² + curve std. dev.)²)
2 sigma = 2 x square root of (sample std. dev.)² + curve std. dev.)²)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.14 (cont.) - Calibartion for the Videy radiocarbon date, Beta 49859.

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REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Videy Beta49859
Radiocarbon Age BP 1010.0 @ 70.0
Calibrated age(s) cal AD 1001, 1012, 1017 (Stuiver and Becker)
cal BP 949, 938, 933

cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 980-1038(970- 912) 1103-1116(847- 834)
1141-1150(809- 800)
Two Sigma** cal AD 890-1160(1060- 790) 1167-1190(783- 760)

Intercepts and maximum range:
one sigma cal AD 980 (1001, 1012, 1017) 1150
cal BP 970 (949, 938, 933) 800
two sigma cal AD 890 (1001, 1012, 1017) 1190
cal BP 1060 (949, 938, 933) 760

References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
&this standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev.)+ curve std. dev.)
2 sigma = 2 x square root of (sample std. dev.)+ curve std. dev.)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.14 (cont.) - Calibartion for the Videy radiocarbon date, Beta 49860.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Videy Beta49860
Radiocarbon Age BP 810.0 @ 50.0
Calibrated age(s) cal AD 1223 — Reference(s)
cal BP 727 (Stuiver and Becker)

cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 1164-1168(786- 782) 1190-1263(760- 687)
1273-1275(677- 675)
Two Sigma** cal AD 1044-1090(906- 860) 1123-1139(827- 811)
1150-1280(800- 670)

Intercepts and maximum range:
one sigma cal AD 1164 (1223) 1275
cal BP 786 (727) 675
two sigma cal AD 1044 (1223) 1280
cal BP 906 (727) 670

References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986, Radiocarbon, 28, 863-910.

Comments:
@This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev.**2 + curve std. dev.**2)
2 sigma = 2 x square root of (sample std. dev.**2 + curve std. dev.**2)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.14 (cont.) - Calibration for the Videy radiocarbon date, Beta 49866.

UNIVERSITY OF WASHINGTON
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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Videy Beta49866
Radiocarbon Age BP 670.0 @ 70.0

		Reference(s)
Calibrated age(s)	cal AD 1283	(Stuiver and Becker)
	cal BP 667	

cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 1276-1326(674- 624) 1352-1390(598- 560)
Two Sigma** cal AD 1220-1410(730- 540)

Intercepts and maximum range:
one sigma cal AD 1276 (1283) 1390
cal BP 674 (667) 560
two sigma cal AD 1220 (1283) 1410
cal BP 730 (667) 540

References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986. Radiocarbon. 28. 863-910.

Comments:
&This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev.²+ curve std. dev.²)
2 sigma = 2 x square root of (sample std. dev.²+ curve std. dev.²)
0= represents a "negative" age BP
1955^ denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.14 (cont.) - Calibration for the Videy radiocarbon date, Beta 49867.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Videy Beta49867
Radiocarbon Age BP 1420.0 @ 90.0
Calibrated age(s) cal AD 640 — Reference(s)
cal BP 1310 (Stuiver and Becker)
cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 543- 670(1407-1280)
Two Sigma** cal AD 430- 780(1520-1170)

Intercepts and maximum range:
one sigma cal AD 543 (640) 670
cal BP 1407 (1310) 1280
two sigma cal AD 430 (640) 795
cal BP 1520 (1310) 1155

References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
&this standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev.)+ curve std. dev.)
2 sigma = 2 x square root of (sample std. dev.)+ curve std. dev.)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.14 (cont.) - Calibration for the Videy radiocarbon date, Beta 49369.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: INTCAL.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Videy Beta49869
Radiocarbon Age BP 730.0 @ 50.0
Calibrated age(s) cal AD 1278 — Reference(s): (Stuiver and Becker)
cal BP 672
cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 1258-1283(692- 667)
Two Sigma** cal AD 1210-1310(740- 640) 1369-1386(581- 564)

Intercepts and maximum range:
one sigma cal AD 1258 (1278) 1283
cal BP 692 (672) 667
two sigma cal AD 1210 (1278) 1386
cal BP 740 (672) 564

References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
&This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.14 (cont.) - Calibration for the Videy radiocarbon date, Beta 49870.

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                    UNIVERSITY OF WASHINGTON
                    QUATERNARY ISOTOPE LAB
                RADIOCARBON CALIBRATION PROGRAM 1987
                          REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Videy Beta49870
 Radiocarbon Age BP   180.0  ± 50.0#                    Reference(s)
  Calibrated age(s) cal AD  1671, 1747, 1761          (Stuiver and Becker)
                            1770, 1799, 1944
                            1955*
                    cal BP   279,  203,  189
                             180,  151,    6
                               0*
  cal AD/BC (cal BP) age ranges:
   One Sigma**   cal AD 1655-1690( 295- 260) 1724-1810( 226- 140)
                 1924-1955*(  26-   0*)
   Two Sigma**   cal AD 1640-1900( 310-  50) 1907-1955*(  43-   0*)

  Intercepts and maximum range:
   one sigma   cal AD 1655 ( 1671, 1747, 1761, 1770, 1799, 1944,
                             1955*) 1955*
               cal BP  295 (  279,  203,  189,  180,  151,    6
                               0*)    0*
   two sigma   cal AD 1640 ( 1671, 1747, 1761, 1770, 1799, 1944,
                             1955*) 1955*
               cal BP  310 (  279,  203,  189,  180,  151,    6
                               0*)    0*


References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986, Radiocarbon, 28, 863-910.

Comments:
#This standard deviation (error) may include an error multiplier.
 IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev.**2 + curve std. dev.**2)
   2 sigma = 2 x square root of (sample std. dev.**2 + curve std. dev.**2)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data
```

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Table 2.14 (cont.) - Calibration for the Videy radiocarbon date, Beta 49872.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Videy Beta49872
Radiocarbon Age BP 1250.0 ± 60.0
Calibrated age(s) cal AD 735, 772 (Stuiver and Becker)
cal BP 1215, 1178

cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 676- 781(1274-1169) 789- 805(1161-1145)
820- 830(1130-1120) 839- 863(1111-1087)
Two Sigma** cal AD 650- 900(1300-1050) 922- 940(1028-1010)

Intercepts and maximum range:
one sigma cal AD 676 (735, 772) 863
cal BP 1274 (1215, 1178) 1087
two sigma cal AD 650 (735, 772) 940
cal BP 1300 (1215, 1178) 1010

References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
&This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev.)+ curve std. dev.)
2 sigma = 2 x square root of (sample std. dev.)+ curve std. dev.)
0= represents a "negative" age BP
1955= denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.14 (cont.) - Calibration for the Videy radiocarbon date, Beta 49878.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Videy Beta49878
Radiocarbon Age BP 550.0 ± 70.0

Reference(s)
(Stuiver and Becker)

Calibrated age(s) cal AD 1407
cal BP 543

cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 1311-1370(639- 580) 1386-1430(564- 520)
Two Sigma** cal AD 1280-1450(670- 500)

Intercepts and maximum range:
one sigma cal AD 1311 (1407) 1430
cal BP 639 (543) 520
two sigma cal AD 1280 (1407) 1450
cal BP 670 (543) 500

References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986, Radiocarbon, 28, 863-910.

Comments:
&This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.14 (cont.) - Calibration for the Videy radiocarbon date, Beta 49879.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Videy Beta49879
Radiocarbon Age BP 380.0 @ 80.0
Calibrated age(s) cal AD 1476 Reference(s)
cal BP 474 (Stuiver and Becker)
cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 1434-1533(516- 417) 1538-1638(412- 312)
Two Sigma** cal AD 1410-1660(540- 290)

Intercepts and maximum range:
one sigma cal AD 1434 (1476) 1638
cal BP 516 (474) 312
two sigma cal AD 1410 (1476) 1660
cal BP 540 (474) 290

References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
&This standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev.)+ curve std. dev.)
2 sigma = 2 x square root of (sample std. dev.)+ curve std. dev.)
0= represents a "negative" age BP
1955= denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.14 (cont.) - Calibartion for the Videy radiocarbon date, Beta 65536.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Videy Beta65536
Radiocarbon Age BP 750.0 ± 80.0
Calibrated age(s) cal AD 1264, 1268, 1276 (Stuiver and Becker)
cal BP 686, 682, 674

cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 1214-1284(736- 666)
Two Sigma** cal AD 1045-1049(905- 901) 1066-1088(884- 862)
1124-1138(826- 812) 1150-1330(800- 620)
1348-1392(602- 558)

Intercepts and maximum range:
one sigma cal AD 1214 (1264, 1268, 1276) 1284
cal BP 736 (686, 682, 674) 666
two sigma cal AD 1045 (1264, 1268, 1276) 1392
cal BP 905 (686, 682, 674) 558

References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986, Radiocarbon, 28, 863-910.

Comments:
#this standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev.)+ curve std. dev.)
2 sigma = 2 x square root of (sample std. dev.)+ curve std. dev.)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.14 (cont.) - Calibration for the Videy radiocarbon date, Beta 65537.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: CLQFIL.TXT
Plot file: CLQFIL.PLT

Videy Beta65537
Radiocarbon Age BP 380.0 ± 60.0
Calibrated age(s) cal AD 1476 (Stuiver and Becker)
cal BP 474

cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 1438-1526(512- 424) 1561-1630(389- 320)
Two Sigma** cal AD 1420-1650(530- 300)

Intercepts and maximum range:
one sigma cal AD 1438 (1476) 1630
cal BP 512 (474) 320
two sigma cal AD 1420 (1476) 1650
cal BP 530 (474) 300

References for datasets [and intervals] used:
Stuiver,M and Becker,B. 1986. Radiocarbon, 28, 863-910.

Comments:
#this standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev.)+ curve std. dev.)
2 sigma = 2 x square root of (sample std. dev.)+ curve std. dev.)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.14 (cont.) - Calibration for the Videy radiocarbon date, Beta 65538.

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RADIOCARBON CALIBRATION PROGRAM 1987
REV. 1.3

Calibration file: ATM10.14C
Listing file: C14FIL.TXT
Plot file: C14FIL.PLT

Videy Beta65538
Radiocarbon Age BP 1260.0 @ 60.0
Calibrated age(s) cal AD 695, 728, 744 769
cal BP 1255, 1222, 1206 1181

Reference(s)
(Stuiver and Becker)

cal AD/BC (cal BP) age ranges:
One Sigma** cal AD 672- 780(1278-1170) 790- 803(1160-1147)
842- 855(1108-1095)
Two Sigma** cal AD 650- 890(1300-1060) 924- 937(1026-1013)

Intercepts and maximum range:
one sigma cal AD 672 (695, 728, 744, 769) 855
cal BP 1278 (1255, 1222, 1206, 1181) 1095
two sigma cal AD 650 (695, 728, 744, 769) 937
cal BP 1300 (1255, 1222, 1206, 1181) 1013

References for datasets [and intervals] used:
Stuiver,M and Becker,B, 1986, Radiocarbon, 28, 863-910.

Comments:
&this standard deviation (error) may include an error multiplier.
IF SO, SPECIFY!
** 1 sigma = square root of (sample std. dev./+ curve std. dev./)
2 sigma = 2 x square root of (sample std. dev./+ curve std. dev./)
0* represents a "negative" age BP
1955* denotes influence of bomb C-14
> 2497 BC represents end of calibration data

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Table 2.15 - Assemblages dated by associated tephra.

Site: ADALBOL
Tephra: H1. Hekla AD.1104
Association: none
Interpretation: Bone materials were recovered immediately below this tephera, dating the material older than AD. 1104 (personal communication Stefan Adalsteinsson 1986).

Site: AKURVIK
Tephra: Snaesfellsjokull 1750 BP.
Assoc.: Site structures dug into sterile subsoil
Interpretation: The tephera represents a Holocene beach surface which is situated below the site (personal communication Haukur Johannesson 1992).

Site: BESSASSTADIR
Tephra: K~1485, Katla AD.1485
Assoc.: Found capping the "Black Hole" or pit containing bone workshop debris
Interpretation: Only one tephera has been found in association with the animal bone remains thus far. This deposit was located at the end of the eastern drive way in front of the Icelandic presidential residence (see Figure 3, Amorosi, Buckland, Olafsson, Sadler and Skidmore 1992: 172-174). This feature was a pit deposit containing the debris from a bone workshop.

Site: GRANASTADIR
Tephra: H3- Helka 2900 Bp., LNS- Landnam AD.850-900, H1- Hekla AD.1104, G-1332- Grimsvotn AD.1477
Assoc.: For H3, Structures 3 & 9C, dig into sterile subsoil. For LNS, Found in structural turf. For H1, Found above Struct. 9 hearth. For G-1332. Fouond on site.
Interpretation: The Granastadir homestead was established approx. AD.850-900 and abandoned long before AD. 1104. The G-1332 tephra was found on site and not associated to the occupational deposits (Einarsson 1994:100-101).

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Table 2.15 (cont.) - Assemblages dated by tephra.

Site: HAKONARSTADIR
Tephra: H1- Hekla AD.1104, G-1332- Grimsvotn AD.1477, Askja AD.1875
Assoc.: For H1, found 45cm BGS. For G-1332, found 20-23cm BGS. For Askja, found 0cm BGS.
Interpretation: Bone materials were recovered at 100-140 cm BGS (Below Ground Surface), dating the collection older than AD. 1104 (personal communication Stefan Adalsteinsson, 1986).

Site: HERJOLFSDALUR
Tephra: Vo~900 (K VIIa)- Landnam AD.900, K~1000 (Katla/K-V)- Katla AD.900-950
Assoc.: For Vo~900, found 90-95cm BGS. For K~1000, none.
Interpretation: The site's radiocarbon dating has been the subject of much debate among Icelandic and North Atlantic scholars (Crawford 1991; Hallsdottir 1982; Hermanns -Audardottir 1986, 1987, 1989, 1991 & Reply; Kaland 1991; Mahler and Malmros 1991; Morris 1991; Sigurdsson 1991). The associated tephera clearly point to a Viking period date for first settlement of this site.

Site: LANDANROVI
Tephra: G-1332- Grimsvotn AD.1477
Assoc: none
Interpretation: Bone material was recovered immediately below the G-1332, dating the material older than AD. 1477.

Site: STONG
Tephra: Vo~900 (K VIIa)- Landnam AD.900, H1- Hekla AD.1104
Assoc.: none
Interpretation: The Strong farmstead was most likely abandoned during the 13th century (Rousell 1943:72, Thorarinsson 1943:8, Vilhjalmsson 1991:98).

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Table 2.15 (cont.) - Assemblages dated by associated tephra.

Site: SVALBARD
Tephra: H3- Hekla 2900 BP., H1- Hekla AD.1104, Hekla AD. 1636, Vatnajokull AD.1717
Assoc.: For H3, found at base of midden. For H1, base of midden at I20. For H1636, in midden, AU 7 & 8. For V1717, in midden, Au 7 & 8.
Interpretation: Although further confirmation of the tephra identifications are pending, the preliminary results indicate that the Hekla 2900 BP. tephra lies on a Holocene beach terrace which is situated below the site's midden and associated farmstead and is designated as Analytic Unit (AU) 1. The Hekla AD.1104 ash was only noticed in one location of the midden, in the Main Units at grid point I20, at the base of the midden deposits. This tephera date along with the radiocarbon dates and artifactual associations, place the start of midden soil accumulation somewhere within the late 11th to early 12th centuries AD. (AD.1050-1150). The last two tephra are found throughout the upper layers of the midden, in Analytic Units 7 & 8 (Amorosi 1992; Amorosi and McGovern 1989).

Site: VIDEY
Tephra: Vo~900 (K VIIa+b)- Landnam AD.900, K~1500- Katla AD.1500
Assoc.: none
Interpretation: These two ash falls are recorded at the base (Vo~900) and occupational layers (K~1500) of the Videy site (Hallsgrimsdottir 1987b, Sneasdottir 1987c).

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Table 2.16 - The C13/C12 (d C13%) ratio for Norse Icelandic mammals.

SAMPLE	SPECIES	CALIB. DATE AD. SIGMA 1	CALIB. DATE AD. SIGMA 2	C13/C12 RATIO (d C13%)
Drangar #1 BETA 65533 & CAMS 9007	*Ursus maritimus* polar bear	1694-1955	1689-1955	-27.4
Midbaer #1 BETA 65534 & CAMS 9008	*Bos taurus* cattle	1421-1619	1329-1650	-24.4
Midbaer #2 BETA 65535 & CAMS 9009	*Bos taurus* cattle	1277-1388	1232-1410	-27.3
Svalbard 245 BETA 52977 & CAMS 2675	*Ovis aries* sheep	1035-1221	1002-1276	-29.9
Svalbard 385 BETA 52976	*Ovis aries* sheep	1162-1276	1038-1280	-22.3

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Table 2.17 - The C13/C12 ratio for Norse Greenlandic mammals.

SITE/SAMPLE	SPECIES	C13/C12 RATIO (d C13‰)
WESTERN SETTLEMENT		
V48-K3197	***Bos taurus*** cattle	-19.90
V48-K3198	Phocidae seal family	-13.90
V48-K3199	Mixed species sample of caribou, cattle & caprine	-19.00
V48-K3200	Phocidae seal family	-13.20
V48-K3201	Mixed species sample of caribou, cattle & caprine	-18.30
V48-K3202	Phocidae seal family	-13.90
V48-K3203	Mixed species sample of caribou, cattle & caprine	-18.70
V48-K3204	Phocidae seal family	-13.80
V48-K4730	Phocidae seal family	-14.80
V48-K4731	***Bos taurus*** cattle	-19.30
V48-K4732	Phocidae seal family	-13.20
V48-K4733	***Rangifer tarandus*** caribou	-17.90

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Table 2.17 (cont.) - The C13/C12 ratio for Norse Greenlandic mammals.

SITE/SAMPLE	SPECIES	C13/C12 RATIO (d C13‰)
WESTERN SETTLEMENT		
V48-K4734	Phocidae seal family	-12.90
V48-K4735	Mixed species sample of caribou & caprine	-17.70
V48-K4736	Phocidae seal family	-13.00
V48-K4747	Phocidae seal family	-12.90
V48-K4739	Phocidae seal family	-13.10
V48-K4740	Mixed species sample of caribou & cattle	-19.60
EASTERN SETTLEMENT		
O167-K5889	***Homo sapiens sapiens*** human	-19.10
O167-AAR909	***Mus musclus*** house mouse	-17.75
O17a-K5904	***Salix glauca*** willow	-26.8
O17a-K5905	***Betula pubescens*** birch	-26.7

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Notes to Table 2.17:
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Table 2.18 - Temporal Phasing of Icelandic Archaeofauna without radiocarbon dates.

SITE	STRAT. or SURFACE	BURIAL	POSSIBLE DATE	SAMPLE LOCATION
ADALSTRAETI 8	STRAT	-	17-18 C.	HC
AKURVIK '88	STRAT	-	MED.-EM.	HC
AKURVIK '90	STRAT	-	MED.-EM.	I-NM
BAEGISSTADIR	STRAT	-	19 C.	I-NM
BESSASTADIR	STRAT	-	V.-EM.	HC & I
ELDVORP	STRAT?	-	18-19 C.	I-NM
ESJUBORG	STRAT?	-	19 C.	I-NM
EYVINDAR KOFI	STRAT?	-	MED.-EM.	DEN-ZM
FLAJTSDALEN	STRAT?	-	MED.-EM.	DEN-ZM
FINNBOGISTADIR '90	STRAT	-	MED.-EM.	I-NM
FO2 (Sandar 2)	SURFACE	-	15-17 C.	HC
GAMMEL-GRIMSTADIR	SURFACE	-	18-19 C.	HC
GRUNNASUNNES	STRAT?	-	V.-MED.	I-NM *
GJOGUR '88	STRAT	-	V.-EM.	HC
GJOGUR '90	STRAT	-	V.-EM.	I-NM
HALLFREDARSTADIR	-	MIXED	19 C.	HC
HARKONARSTADIR	STRAT	-	V.-MED.	HC
HAUKADALUR	STRAT?	-	V.-MED.	I-NH
HELLISSANDUR	SURFACE	-	MED.-EM.	HC
HOFSSTADIR, gardbaer	STRAT	-	V.-MED.	I-NM
HOFSSTADIR, myvatnsveit	STRAT	-	9-10 C.	DEN-ZM
HOLAR	STRAT?	-	1700-1750	HC
HORNEFJORDUR	STRAT?	-	MED.-EM.	DEN-ZM
HJALLHOLL	STRAT	-	V.-EM.	HC
HVITARVATN	STRAT?	-	MED.-EM.	DEN-ZM
ISLANDSK KOKKENMADDING	STRAT?	-	MED.-EM.	DEN-ZM
KOLLAFARDARNES	STRAT?	-	MED.-EM.	DEN-ZM
KOLTHOLTSHELLIR	SURFACE?	-	MED.-EM.	I-NM
LAMBASTADIR	SURFACE	-	EM.?	I-NH
LANDAROVI	-	HORSE	V.-MED.	I-SA
LJOSAVATN	STRAT?	-	MED.-EM.	DEN-ZM
MELHOLAR	STRAT?	-	12 C.	I-SA
MELSTADIR	SURFACE	-	MED.-EM.	I-NH
MESSTOFA	STRAT	-	V.-EM.	HC
MYRBAER	STRAT?	-	MED.-18 C.	HC

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Table 2.18 (cont.) - Temporal Phasing of Icelandic Archaeofauna without radiocarbon dates.

SITE	STRAT. or SURFACE	BURIAL	POSSIBLE DATE	SAMPLE LOCATION
ODADAHRAUN	STRAT?	-	MED.-EM.	DEN-ZM
ODDBJARNARSKER	STRAT	-	17-19 C.	HC
REYKHOLT	STRAT	-	18-19 C.	HC
REYKARNES '90	STRAT	-	19-20 C.	I-NM
ROFUNUM (HRAUN)	STRAT?	-	MED.?	I-NH
SKALHOLT	STRAT?	-	18-19 C.	I-NM
STORABORG	STRAT	-	V.-MED.	HC
THINGNESS	STRAT?	-	9-10 C.	I-NM
THORSTEINSSTADIR	STRAT?	-	MED.-EM.	I-NM
TJORNES	STRAT?	-	MED.-EM.	DEN-ZM
VAD	-	DOG	V.-MED.	I-EG

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Notes to Table 2.18

1. - Key for this table: V. - Viking (ca. AD. 874-930); MED. - Medieval (ca. AD. 930-1500); EM. - Early Modern (ca. AD. 1500-1880/90s).

2. - Missing from this table are 76 pre-christian graves with horse (58 in number) and dog (18 in number) burials mentioned in Eldjarn (1956) and mentioned in Amorosi (1987:9-11). None of these exist at the National Museum or any other Icelandic institute, and according to Vilhjalmsson (1990 & 1991) have not been dated.

3. - The archaeofauna housed at the Danish Zoological Museum in Copenhagen, are yet to be analyzed.

4. - The "*" indicates that the full temporal range of the site has not yet been ascertained. Sites indicated with a "STRAT?" refer to the uncertainty that the archaeological deposit was stratified. These materials were collected late in the last century or early this century, and represent a biased sample. The one "MIXED" grave from the site of Hallfredarstadir contained several species, horse, dog, and seal (see chapter 3).

5. - This table is based upon personal communications with Stefan Adalsteinsson, Gudmundur Olafsson, Mjoll Snaesdottir, and Gudrun Sveinbjarnardottir from 1986-1990. The temporal phasing listed here is based on artifactual and tephera associations.

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Table 3.1 - The list of Viking period horse and dog graves.

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Table 3.1 (cont.) - The list of Viking period horse and dog graves.

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Table 3.1 (cont.) - The list of Viking period horse and dog graves.

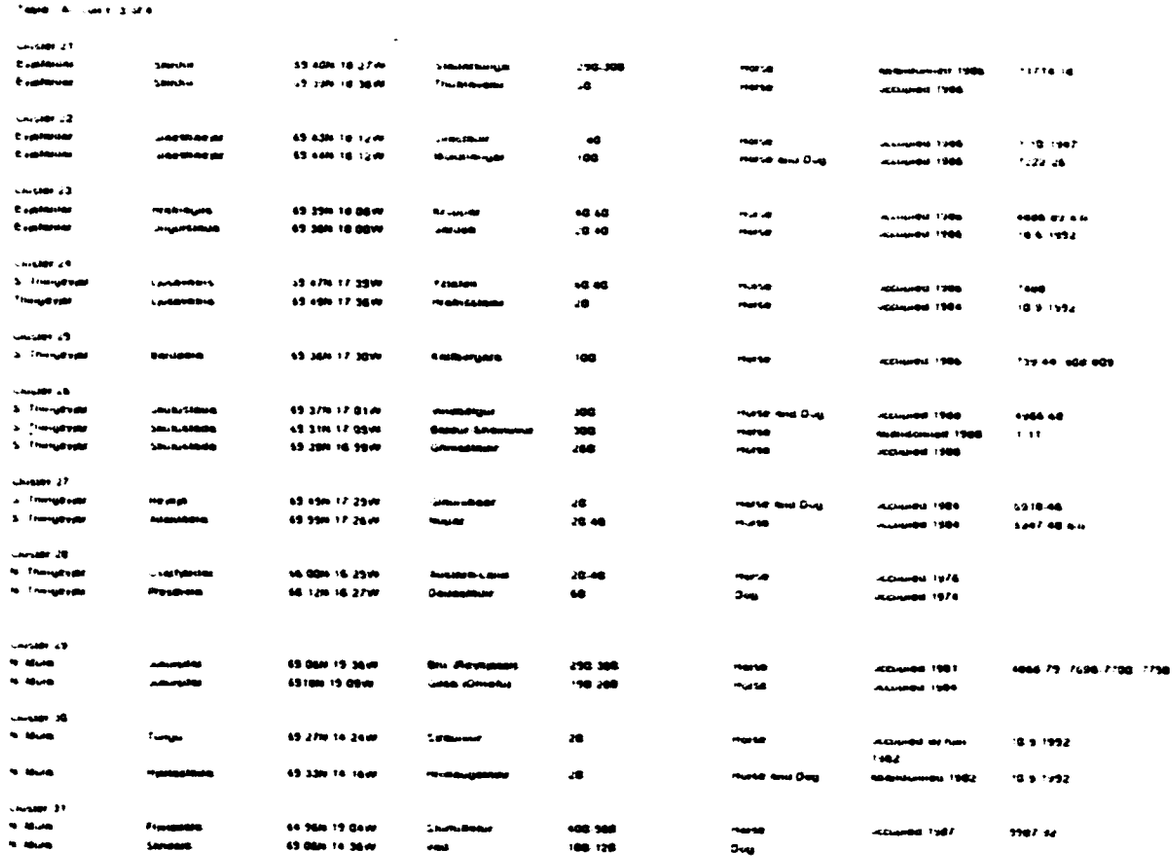

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Table 3.1 (cont.) - the list of Viking period horse and dog graves.

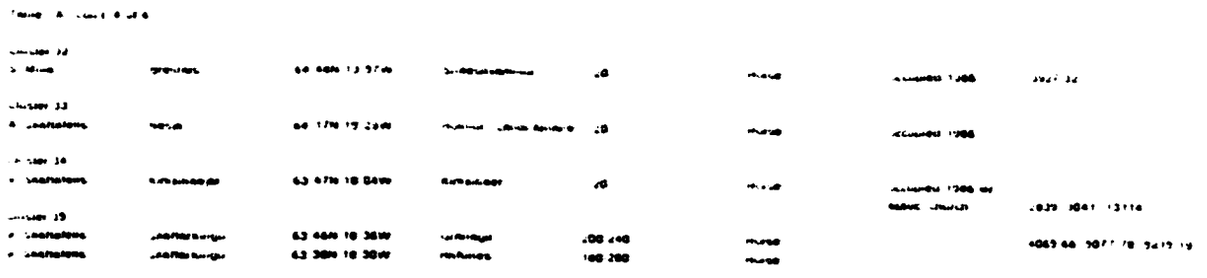

Table 3.2 - The osteometrics of the Vad dog burial.

FILE: Vad.WQ2 Date: 6/11/95 1OF1
Table C Vad Dog Burial.

vdD codes	Measurement in cm.
Skull:	
15	Rt. 6.33. Lt.- 6.25
16	Rt.-1.85. Lt.- 1.87
17	Rt.-. Lt.- 4.85
23	Rt.- 5.02. Lt.--
25	Rt.- 3.69. Lt.--
26	Rt. 5.08. Lt.
27	Rt.- 1.80. Lt.--
Mandible	
1	Rt.- 14.02. Lt.- 13.95
2	Rt.- 14.34. Lt.--
4	Rt. 12.37. Lt.- 12.58
7	Rt.- 3.95. Lt. 3.95
13	Rt.- 2.04. Lt.- 2.05
18	Rt.- 5.54. Lt.--
19	Rt. 2.38. Lt.- 2.38
Atlas	
GB	6.99
GL	3.67
LAD	1.19
Axis	
LAPa	4.70
LCDe	5.02
Scapula	
SLC	Rt. 2.23. Lt.- 2.31
GLP	Rt. 2.77. Lt. 2.73
Humerus:	
BP	Rt. 2.55. Lt. 2.53
GL	Rt. 15.50. Lt. 15.50
SD	Rt. 1.21. Lt.- 1.20
BD	Rt.- 3.06. Lt.- 2.99
Dp	Rt.- 3.70. Lt. 3.79

vdD codes	Measurement in cm.
Radius:	
Bp	Rt.- 1.65. Lt. 1.50
GL	Rt.- 15.30. Lt.- 15.00
SD	Rt. 1.11. Lt.- 1.15
Bd	Rt.- 2.05. Lt.--
Ulna:	
SDO	Rt. 2.06. Lt. 1.74
DPA	Rt. 2.55. Lt.- 2.49
Innominate:	
LA	Rt. 2.45. Lt. 2.45
SH	Rt. 1.92. Lt.- 1.90
Femur:	
GL	Rt.- 16.6. Lt.--
Bp	Rt.- 3.69. Lt.
SD	Rt. 1.19. Lt.- 1.18
GLC	Rt.- 17.40. Lt. 17.30
Bd	Rt. 2.79. Lt. 2.77
DC	Rt.- 1.73. Lt. 1.69
Tibia:	
GL	Rt.- 17.40. Lt. 1.75
Bp	Rt.-2.86. Lt.- 2.88
SD	Rt.-1.14. Lt.- 1.13
Bd	Rt.-1.82. Lt. 1.88

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Table 3.3 - The osteometrics of the Landanrovi horse burial.

FILE: Landanro.WQ2 Date: 6/11/95 1OF1
Table D Landanrovi Horse Burial

vdD codes	Measurement in cm.
Rt Innominate:	
GL	350.00
SH	26.80
LFo	67.20
LS	135.20
LA	64.60
LAR	56.20
Lt Innominate	
GL	372.00
SH	28.30
LFo	65.40
LS	139.00
LA	65.20
LAR	56.40
Rt Femur	
SD	40.40
GLC	325.00
DC	47.90
Lt Femur	
GL	355.00
Bp	101.80
SD	40.60
Bd	80.30
GLC	320.00
DC	46.80

vdD codes	Measurement in cm.
Sacrum:	
PL	200.00
Thoracic Vertebra (mid series)	
H	108.10
HFcr	32.30
HFcd	33.00
BFcr	35.40
BFcd	44.30
PL	45.70
Phalanx I	
GL	71.00
Bp	49.50
SD	31.90
Bd	39.30
BFd	36.00

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Table 3.4 - The osteometrics for the Hallfredarstadir horse skull A: skull.

FILE: HALLFRED.WQ Date: 1 17 95 1OF9
Table 1. Hallfredarstadir 19th century Horse Burial

vdD codes	Measurement in cm	vdD codes	Measurement in cm
Horse Skull A:			
1	51 50	25-L	2 44
2	48.00	25-B	1 84
3	45 70	26-L	2 38
3a	45 00	26-B	2 57
4	33 20	27-L	----
5	11 32	27-B	----
6	34 50	28-L	2.12
7	----	28-B	3 02
8	17 50	29-L	2.20
9	19 50	30-L	2.80
10	29 00	30-B	2.46
11	16 28	31	5 66
12	34 00	32	5.70
13	28.10	33	10 38
14	18.39	34	7 51
15	34 00	35	10 19
16	17 00	36	3.17
17	21 40	37	3.51
18	24 50	38	9 72
18a	24 50	39	7 51
19	18 00	40	13 20
20	16 00	41	19 00
21	9 32	42	12.78
22	15 35	43	14.00
22a	15 05	44	7 16
23	7 50	45	7 03
24	8 72	46	6.17
24a	8.27	47	5 20
		48	9 90
		49	27 50
		50	9.12

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Table 3.5 - The osteometrics for the Hallfredarstadir horse skull A: mandible.

FILE: HALLFRED.WQ1 Date: 1.17.95 3OF9
Table 1, cont. Hallfredarstadir 19th c Horse Burial

vaO codes	Measurement in cm
Horse Mandible A:	
1	35.10
2	38.00
3	11.50
4	25.00
5	28.10
6	16.12
6a	15.33
7	8.00
7a	7.74
8	7.83
8a	7.62
9-L	3.03
9-B	1.82
10-L	2.46
10-B	1.64
11-L	2.21
11-B	2.15
12-L	2.27
12-B	1.78
13-L	2.30
13-B	1.70
14-L	2.96
14-B	1.47
15	8.73
16	6.08
17	6.23
18	4.72
19	20.00
20	18.10
21	24.00
22a	7.93
22b	6.30
22c	5.35
23	10.78
24	8.10
25	10.58

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Table 3.6 - The osteometrics for the Hallfredarstadir horse skull B: skull.

FILE: HALLFRED WQ Date: 1-17-95 2OF9
Table 1, cont. Hallfredarstadir 19th c. Horse Burial

vdD codes	Measurement in cm.	vdD codes	Measurement in cm
Horse Skull B:			
1	----	25-L	2.96
2	----	25-B	2.09
3	----	26-L	----
3a	----	26-B	----
4	----	27-L	2.06
5	----	27-B	2.41
6	36.50	28-L	1.92
7	----	28-B	2.70
8	21.00	29-L	1.95
9	----	29-B	2.30
10	37.20	30-L	2.75
11	----	30-B	2.12
12	22.45	31	6.99
13	29.50	32	5.75
14	----	33	----
15	36.00	34	----
16	13.10	35	----
17	----	36	----
18	26.00	37	----
18a	26.00	38	----
19	29.70	39	----
20	16.90	40	14.10
21	11.39	41	----
22	14.12	42	14.12
22a	13.55	43	16.00
23	6.65	44	7.34
24	7.05	45	6.75
24a	6.24	46	6.70
		47	5.63
		48	5.10
		49	----
		50	----

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Table 3.7 - The osteometrics for the Hallfredarstadir horse skull B: mandible.

FILE: HALLFRED.WQ1 Date: 1/17/95 4OF9

Table 1, cont. Hallfredarstadir 19th c. Horse Burial

vdD codes	Measurement in cm.
Horse Mandible B:	
1	38.00
2	38.70
3	13.79
4	24.37
5	28.87
6	15.16
6a	----
7	7.24
7a	6.82
8	7.23
8a	----
9-L	----
9-B	----
10-L	2.61
10-B	1.96
11-L	2.47
11-B	1.43
12-L	2.05
12-B	1.18
13-L	2.20
13-B	1.24
14-L	2.86
14-B	1.05
15	10.03
16	6.20
17	6.15
18	2.88
19	21.20
20	19.00
21	25.70
22a	7.91
22b	5.63
22c	4.89
23	----
24	----
25	----

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Table 3.8 - The osteometrics for the Hallfredarstadir horse individual bone elements.

FILE =ALLFRED.W Date [illegible] 7:35 [illegible]
Table 1 cont =Hallfredarstadir Sm 3 =Horse Bone.

vCD codes	Measurement in cm	vCD codes	Measurement in cm
Isolated Horse Elements			
METACARPUS			
Specimen No.1		Specimen No. 3	
GL	20.07	GL	20.16
GL'	19.33	GL'	19.56
Bp	4.88	Bp	4.47
Dp	3.55	Dp	3.32
SD	3.04	SD	3.01
DD	1.91	DD	2.01
Bd	4.17	Bd	4.20
Dd	3.24	Dd	3.20
Specimen No 2		Specimen No 4	
GL	19.74	GL	19.64
GL'	19.33	GL'	19.16
Bp	5.65	Bp	5.41
Dp	3.28	Dp	3.00
SD	3.13	SD	3.12
DD	2.25	DD	1.97
Bd	4.12	Bd	4.27
Dd	3.19	Dd	3.25
METATARSUS			
Specimen No 1		Specimen No 3	
GL	24.54	GL	24.79
GL'	24.16	GL'	23.34
L'	24.16	L'	23.34
Bp	4.54	Bp	4.54
Dp	4.11	Dp	4.24
SD	2.76	SD	2.67
DD		DD	.....
DD	2.27	DD	2.31
Bd	4.13	Bd	4.31
Dd	3.19	Dd	3.41
Specimen No 2			
GL	23.64		
GL'	22.43		
L'	22.43		
Bp	4.74		
Dp	4.60		
SD	2.93		
DD	.....		
Bd	4.17		
Dd	3.37		

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Table 3.8 (cont.) - The osteometrics for the Hallfredarstadir horse individual bone elements.

FILE =ALLFRED.WQ1 DATE 11-7-95 EOF?

Table 3.8 (cont.) =Hallfredarstadir Farm 1 =Horse Burial

Code Codes	Measurement in cm	Code Codes	Measurement in cm
Isolated Horse Elements			
F=ALANX I			
Specimen No 1		Specimen No 4	
GL	7.61	GL	5.97
Bp	4.35	Bp	4.80
BFp	4.43	BFp	4.11
Dp	3.44	Dp	3.07
SD	2.99	SD	3.00
Bd	3.79	Bd	3.83
BFd	3.13	BFd	3.73
Specimen No 2		Specimen No 5	
GL	7.68	GL	7.58
Bp	4.33	Bp	4.97
BFp	4.40	BFp	4.30
Dp	3.30	Dp	3.33
SD	3.12	SD	3.00
Bd	3.38	Bd	3.33
BFd	3.77	BFd	3.52
Specimen No 3			
GL	7.66		
Bp	4.73		
BFp	4.26		
Dp	3.24		
SD	2.98		
Bd	4.12		
BFd	3.51		
F=ALANX II			
Specimen No 1		Specimen No 3	
GL	4.44	GL	4.45
Bp	4.68	Bp	4.27
BFp	3.86	BFp	4.02
Dp	2.98	Dp	3.62
SD	3.85	SD	4.13
Bd	4.03	Bd	4.65
Specimen No 2			
GL	4.51		
Bp	4.60		
BFp	3.77		
Dp	4.50		
SD	4.10		
Bd	4.40		

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Table 3.8 (cont.) - The osteometrics for the Hallfredarstadir horse individual bone elements.

FILE: HALLFRED.W DATE: 1/17/95 7OF9
Table 1, cont. Hallfredarstadir 19th c. Horse Burial

vdD codes	Measurement in cm.
Isolated Horse Elements	
PHALANX III:	
Specimen No. 1	
GL	----
GB	5.58
LF	----
BF	4.15
Ld	----
HP	3.11
Specimen No. 2	
GL	5.93
GB	6.35
LF	----
BF	4.85
Ld	4.05
HP	4.71

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Table 3.9 - The osteometrics for the Hallfredarstadir dog individual bone elements.

FILE. HALLFRED.WQ1 DATE: 1-17-95 8OF9

Table 1. cont. Hallfredarstadir 19th c. Horse Burial

vdD codes	Measurement in cm.
Isolated Dog Elements	
HUMERUS:	
Specimen No. 1	
GL	12.24
GLC	12.57
Bp	1.92
Dp	2.88
SD	1.00
Bd	2.21
Specimen No. 2	
GL	----
GLC	----
Bp	----
Dp	----
Bd	2.29
OS PELVIS:	
Specimen No. 1	
GL	----
LA	1.83
LAR	2.00
SB	6.93
Specimen No. 2	
GL	----
LA	1.83
LAR	2.01
SB	7.00
RT. FEMUR:	
GL	13.50
GLC	13.50
Bp	2.81
SD	1.16
Bd	2.13
DC	1.23

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Table 3.9 (cont.) - The osteometrics for the Hallfredarstadir individual bone elements.

FILE: HALLFRED.W DATE: 1/17/95 9OF9
Table 1, cont. Hallfredarstadir 19th c. Horse Burial

vdD codes	Measurement in cm.
Isolated Dog Elements	
LT. TIBIA:	
GL	13.13
Bp	2.05
SD	9.28
Bd	1.65
Dd	1.20
METAPODIAL:	
Specimen No. 1	
GL	4.31
Bd	0.60

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Table 4.1 - Preliminary Presence/Absence list of species found in the Zoological Museum, Denmark.

Site	Temporal Phasing	Species
Hofstadir	AD. 9th-10th century	Mammalia: Equus caballus Bos taurus Ovis aries Capra hircus Sus scrofa Pisces: M. aeglefinus
Hornafjodur	Medieval-Early Modern	Equus caballus
Hvitarvatn	Medieval-Early Modern	Equus caballus Bos taurus Ovis aries ?
Ljosavatn	Medieval-Early Modern	Equus caballus Bos taurus Ovis aries
Odadahraun	Medieval-Early Modern	Equus caballus Bos taurus Ovis aries Capra hircus
Tjornes	Medieval-Early Modern	P. groenlandicus Orcinus orca

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Table 4.2 - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB < 300.

BAEGISTADIR, SVALBARDSHREPPUR, NORDUR-THINGEYJARSYSLA
Dating: 19th century
Species: Anas crecca
Bone Element: Distal Humerus
Age: Adult

von den Driesch (1976) codes (vdD codes)	Measurement in cm.
Bd	1.07

Bone Element: Ulna
Age: Adult

vdD codes	Measurement in cm.
GL	5.65
Did	0.92
SC	0.33
Bp	0.72

Species: Gallus gallus
Age: Adult

vdD codes	Measurement in cm.
GL	3.27
Did	0.63
Bp	0.92

DRANGAR, ARNESHREPPUR, STRANDASYSLA
Dating: 17th-20th century, calibrated first sigma values AD. 1694-1955.
Species: Ursus maritimus
Bone Element: Thoracic Vertebra, used for radiocarbon assay
Age: Adult

vdD codes	Measurement in cm.
PL	4.17
GLPa	4.44
BPacr	4.58
BFcr	3.88
HFcr	3.62

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB < 300.

ELDVORP, GRINDAVIKURHREPPUR, GULLBRINGUSYSLA
Dating: 18th-19th century
Species: Ovis/Capra
Bone Element: Proximal Humerus
Age: Adult, 42+ months

vdD codes	Measurement in cm.
Bp	3.92
Dp	5.02

Bone Element: Proximal Humerus
Age: Adult, 36-42 months, this specimen exhibits lapsed fusion along the epiphyseal line.

vdD codes	Measurement in cm.
Bp	3.50
Dp	3.94

Bone Element: Scapula
Age: Adult

vdD codes	Measurement in cm.
SLC	1.29
LG	3.01
GLP	3.82
BG	2.41

Bone Element: Scapula
Age: Adult

vdD codes	Measurement in cm.
SLC	1.85
LG	2.72
GLP	3.34
BG	2.15

Bone Element: Scapula
Age: Adult

vdD codes	Measurement in cm.
SLC	1.90
LG	2.50
GLP	3.13
BG	2.05

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

ELDVORP (cont.)

Bone Element: Proximal Ulna
Age: Adult, 42+ months

vdD codes	Measurement in cm.
LO	4.11
BPC	1.76
SDO	2.29
DPA	2.57

Bone Element: Proximal Ulna
Age: Adult, 42+ months

vdD codes	Measurement in cm.
BPC	1.83

Bone Element: Distal Radius
Age: Adult, 36 months

vdD codes	Measurement in cm.
Bd	2.90
BFd	2.14

Bone Element: Innominate
Age: Adult

vdD codes	Measurement in cm.
LS	3.00
LFo	2.50
SH	1.32
LA	2.44

Bone Element: Navicular Cuboid
Age: Adult

vdD codes	Measurement in cm.
GB	2.16

Bone Element: Navicular Cuboid
Age: Adult

vdD codes	Measurement in cm.
GB	2.04

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Table 4.2 (cont.) Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

ELDVORP (cont.)	
Bone Element: Calcaneus	
Age: Adult	
vdD codes	Measurement in cm.
GB	1.34
Bone Element: Phalanx I	
Age: Adult	
vdD codes	Measurement in cm.
Bp	1.05
SD	0.85
GL	3.64
Bd	1.07
Bone Element: Atlas.	
Age: Adult	
vdD codes	Measurement in cm.
BFcd	4.40
H	3.58
LAd	2.13
Bone Element: Axis	
Age: Adult	
vdD codes	Measurement in cm.
Bptr	2.29
LAPa	5.10
BPacd	3.25
BFcr	2.45
SBV	2.82
LCDe	5.62
Bone Element: Axis	
Age: Adult	
vdD codes	Measurement in cm.
H	5.02

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Table 4.2 (cont.) - Osteometircs for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

ELDVORP (cont.)

Bone Element: Lumbar Vertebra, articulated with the next two lumbar and sacral vertebrae
Age: Adult

vdD codes	Measurement in cm.
H	4.31
BPcd	3.98
HFcr	1.35
HFcd	1.35
BFcr	2.32
PL	3.05

Bone Element: Lumbar Vertebra
Age: Adult

vdD codes	Measurement in cm.
H	4.29
BFcd	2.64
HFcr	1.51
HFcd	1.34
BFcr	2.07
BPtr	9.78
PL	3.53

Bone Element: Lumbar Vertebra
Age: Adult

vdD codes	Measurement in cm.
H	4.71
BFcd	2.19
HFcr	1.57
HFcd	1.41
BFcr	1.98
BPtr	9.78
PL	3.37

Bone Element: Sacrum
Age: Adult

vdD codes	Measurement in cm.
GB	7.82
PL	6.79
GL	8.90
BFcr	2.50
HFcr	1.29

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

ESJUBERG, KJALARNES, KJARLARNESHREPPUR, KJOSARSYSLA	
Dating: 19th century	
Species: Equus caballus	
Bone Element: Metacarpus	
Age: Adult, 15+ months	
vdD codes	Measurement in cm.
Bp	4.11
Bone Element: Metacarpus	
Age: Adult, 15+ months	
vdD codes	Measurement in cm.
Bd	4.12
Bone Element: Phalanx I	
Age: Adult, 15+ months	
vdD codes	Measurement in cm.
SD	2.97
Species: Bos taurus	
Bone Element: Humerus	
Age: Mature Adult, 42-48 months	
vdD codes	Measurement in cm.
BT	6.60
Bone Element: Patella	
Age: Adult	
vdD codes	Measurement in cm.
GL	4.92
GB	3.70
Bone Element: Metacarpus	
Age: Adult, 30+ months	
vdD codes	Measurement in cm.
Bd	5.28
SD	3.23
Bone Element: Metacarpus	
Age: Adult, 30+ months	
vdD codes	Measurement in cm.
SD	3.15

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 anf TNB > 300>.

ESJUBERG (cont.)	
Bone Element: Metacarpus	
Age: Adult, 30+ months	
vdD codes	Measurement in cm.
SD	3.14
Species: Ovis/Capra	
Bone Element: Distal Femur	
Age: Mature Adult, 42+ months	
vdD codes	Measurement in cm.
Bd	3.89
Bone Element: Distal Humerus	
Age: Adult	
vdD codes	Measurement in cm.
BT	2.88
Bone Element: Humerus	
Age: Adult, 42+ months	
vdD codes	Measurement in cm.
SD	1.67
GRUNNASUNDNES, STYKISSHOLMUR, STYKIISHOLMHREPPUR, SNAESFELLNES AND HNAPPADALSSYSLA	
Dating: Medieval (13th century)	
Species: Bos taurus	
Bone Element: Mandible	
Age: Mature Adult, 36+ months	
vdD codes	Measurement in cm.
3	10.35
7	12.64
8	8.09
9	4.60
10	B -- 3.30
	L -- 1.22
15	a -- 3.68
	b -- 4.54
	c -- 4.65

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

HAUKADALUR, RANGARVALLASYSLA
Dating: Viking to Medieval, AD.871-1300
Species: Ovis aries
Bone Element: Metatarsus
Age: Adult, +28 months

vdD codes	Measurement in cm.
GL	13.02
Bp	2.15
SD	1.20
Bd	2.43
DD	1.11

Species: Ovis/Capra
Bone Element: Metcarpus
Age: Adult, 24+ months

vdD codes	Measurement in cm.
SD	1.46
DD	1.07
Bd	2.49

Bone Element: Phalanx I
Age: Adult

vdD codes	Measurement in cm.
GL	3.48
Bp	1.56
SD	0.99
GLpe	3.44

HOLAR, SKAGAHREPPUR, AUSTUR-HUNAVATNSSYSLA
Dating: AD. 1700-1750
Species: Bos taurus
Bone Element: Femur
Age: Adult, 48+ months

vdD codes	Measurement in cm.
DC	4.48

Bone Element: Calcaneus
Age: Adult, 42+ months

vdD codes	Measurement in cm.
GL	12.08

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

HOLAR (cont.)	
Bone Element: Phalanx I	
Age: Adult, 24+ months	
vdD codes	Measurement in cm.
Bp	2.82
Bd	2.69
GLpe	4.97
SD	2.49
Bone Element: Phalanx II	
Age: Adult, 24+ months	
vdD codes	Measurement in cm.
GL	3.35
Bp	2.54
SD	2.04
Species: Ovis/Capra	
Bone Element: Scapula	
Age: Adult	
vdD codes	Measurement in cm.
GLP	3.51
LG	2.75
SLC	2.25
Bone Element: Humerus	
Age: Adult, 42+ months	
vdD codes	Measurement in cm.
BT	3.31
Bd	3.38
Bone Element: Humerus	
Age: Adult, 42+ months	
vdD codes	Measurement in cm.
BT	3.16
Bd	3.26
Bone Element: Humerus	
Age: Adult, 42+ months	
vdD codes	Measurement in cm.
Bd	2.77

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

HOLAR (cont.)		
Bone Element: Radius		
Age: Adult, 42+ months		
vdD codes		Measurement in cm.
	BFd	2.77
	Bd	3.21
Bone Element: Metacarpus		
Age: Adult, 24+ months		
vdD codes		Measurement in cm.
	Bp	2.26
Bone Element: Innominate		
Age: Adult		
vdD codes		Measurement in cm.
	SH	2.03
	LA	3.99
Bone Element: Innominate		
Age: Adult		
vdD codes		Measurement in cm.
	SH	1.74
	LA	3.30
Bone Element: Metatarsus		
Age: Adult, 28+ months		
vdD codes		Measurement in cm.
	Bp	1.98
Bone Element: Navicular Cuboid		
Age: Adult		
vdD codes		Measurement in cm.
	GB	2.11
Bone Element: Astragalus		
Age: Adult		
vdD codes		Measurement in cm.
	Dm	1.52
	Dl	1.56
	GL1	2.59
	Glm	2.70
	Bd	1.81

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizses of NISP < 100 and TNB > 300.

HOLAR (cont.)
Bone Element: Astragalus
Age: Adult

vdD codes	Measurement in cm.
Dm	1.86
Dl	1.83
GL1	3.18
GLm	3.00
Bd	1.96

LAMBASTADIR, GARDAHREPPUR, GULLBRINGUSYSLA
Dating: Early Modern ?
Species: Ovis aries
Bone Element: Humerus
Age: Adult, 42+ months

vdD codes	Measurement in cm.
GL	16.79
GLC	14.86
SD	1.73
BT	3.32
Bd	3.42
Bp	4.51

Bone Element: Humerus
Age: Adult, 42+ months

vdD codes	Measurement in cm.
SD	1.77
BT	3.26
Bd	3.36

Bone Element: Calcaneus
Age: Adult

vdD codes	Measurement in cm.
GL	6.26
GB	1.74

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

LAMBASTADIR (cont.)		
Species: Ovis/Capra		
Bone Element: Lumbar Vertebra		
Age: Adult		
vdD codes		Measurement in cm.
	Hcr	1.59
	BFcr	3.33
	BPtr	2.95
	BPacr	3.34
	GLPa	4.99
	BPacd	2.95
Bone Element: Sacrum		
Age: Adult		
vdD codes		Measurement in cm.
	GL	7.83
	PL	6.85
	GB	7.32
	BFcr	3.01
	HFcr	1.34
Species: Alopex alopex		
Bone Element: Axis		
Age: Adult		
vdD codes		Measurement in cm.
	LAPa	2.55
	H	1.83
	LCDe	2.62
	BFcr	1.16
	SBV	1.24
	BPacd	1.49

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Table 4.2 (con.t) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and > 300.

LAMBASTADIR (cont.)

Bone Element: Cervical Vertebra
Age: Adult

vdD codes	Measurement in cm.
H	2.53
PL	1.13
BPacr	1.67
GLPa	1.61
BPacd	1.41
Hcr	0.79
BFcr	0.74
BPtr	2.11
BPacd	0.93
HFcr	0.71

Bone Element: Cervical Vertebra
Age: Adult

vdD codes	Measurement in cm.
H	1.66
PL	1.62
BPacr	1.49
GLPa	2.12
BPacd	1.64
Hcr	0.51
BFcr	0.89
BPtr	2.39
BPcd	0.90
HFcr	0.82

Bone Element: Thoracic Vertebra
Age: Adult

vdD codes	Measurement in cm.
PL	1.01
GLPa	1.59
BPacr	1.34
BPacd	0.67
BPcr	1.19
HFcr	0.67
BPcd	1.17
HFcd	0.59
H	3.19

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

LAMBASTADIR (cont.)		
Bone Element: Thoracic Vertebra		
Age: Adult		
vdD codes		Measurement in cm.
PL		0.99
GLPa		1.55
BPacr		0.68
BPacd		0.49
BPcr		0.97
HFcr		0.58
BPcd		1.19
HFcd		0.58
H		1.82
Bone Element: Thoracic Vertebra		
Age: Adult		
vdD codes		Measurement in cm.
PL		0.97
GLPa	1.33	
BPacr		0.69
BPacd		0.51
BPcr		0.95
HFcr		0.59
BPcd		1.00
HFcd		0.61
Bone Element: Thoracic Vertebra		
Age: Adult		
vdD codes		Measurement in cm.
PL		1.07
GLPa		1.60
BPcr		1.55
BPacd		1.05
BPcr		0.88
HFcr		0.65
BPcd		1.14
HFcd		0.61
H		3.44

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

LAMBASTADIR (cont.)
Bone Element: Thoracic Vertebra
Age: Adult

vdD codes	Measurement in cm.
PL	0.95
GLPa	1.29
BPacr	1.38
BPacd	0.55
BPcr	0.95
HFcr	0.61
BPcd	1.16
HFcd	0.57
H	2.68

Bone Element: Thoracic Vertebra
Age: Adult

vdD codes	Measurement in cm.
PL	0.96
GLPa	1.28
BPacr	0.75
BPacd	0.55
BPcr	0.91
HFcr	0.60
BPcd	1.10
HFcd	0.59
H	2.99

Bone Element: Thoracic Vertebra
Age: Adult

vdD codes	Measurement in cm.
PL	1.00
GLPa	1.40
BPcr	0.75
BPacd	0.53
BPcr	0.95
HFcr	0.58
BPcd	1.08
HFcd	0.59
H	2.19

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and > 300.

LAMBASTADIR (cont.)	
Bone Element: Thoracic Vertebra	
Age: Adult	
vdD codes	Measurement in cm.
PL	0.97
GLPa	1.29
BPacr	0.93
BPacd	0.59
BPcr	1.05
HFcr	0.59
BPcd	1.13
HFcd	0.60
H	3.13
Species: Gadus morhua	
Bone Element: Maxillary	
Age: Adult	
Morales & Rosenlund 1979 codes (M&R codes)	Measurement in mm.
1	84.80
2	52.88
Bone Element: Maxillary	
Age: Adult	
M&R codes	Measurement in mm.
1	77.02
2	44.26
Bone Element: Maxillary	
Age: Adult	
M&R codes	Measurement in mm.
1	77.60
2	49.10
Bone Element: Parasphenoid	
Age: Adult	
M&R codes	Measurement in mm.
1	51.53
2	26.84

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Table 4.2 (cont.) _ Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

MELHOLAR, HRAFNKELSDALUR, FJOTSDALUR, NORDUR-MULASYSLA	
Dating: 12th century, pre-1104	
Species: Equus caballus	
Bone Element: Tibia	
Age: Adult, 24+ months	
vdD codes	Measurement in cm.
SD	3.17
Bd	5.85
Species: Ovis/Capra	
Bone Element: Mandible	
Age: Adult	
vdD codes	Measurement in cm.
3	4.50
15a	2.72
15b	1.80
Bone Element: Mandible	
Age: Adult	
vdD codes	Measurement in cm.
7	6.40
8	4.48
9	3.11
15a	3.52
15b	2.10
15c	1.73
Bone Element: Mandible	
Age: Adult	
vdD codes	Measurement in cm.
15a	2.82
15b	1.66
Bone Element: Mandible	
Age: Adult	
vdD codes	Measurement in cm.
9	2.06
15b	2.30

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

MELHOLAR (cont.)
Bone Element: Mandible
Age: Adult

vdD codes	Measurement in cm.
7	6.60
8	4.55
9	2.37
15a	3.82
15b	2.25
15c	1.61

Bone Element: Mandible
Age: Adult

vdD codes	Measurement in cm.
7	5.78
8	4.82
9	1.95
15a	3.92
15b	2.81
15c	1.76

Bone Element: Mandible
Age: Adult

vdD code	Measurement in cm.
8	4.75
15a	3.79

Bone Element: Mandible
Age: Adult

vdD codes	Measurement in cm.
7	6.71
8	3.21
9	4.51
15a	3.76
15b	2.54
15c	2.08

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes with NISP < 100 and TNB > 300.

MELHOLAR (cont.)	
Bone Element: Radius	
Age: Adult, 36-42 months	
vdD codes	Measurement in cm.
Bp	2.65
BFp	2.51
GL	14.64
Bd	2.59
BFd	2.25
Bone Element: Metacarpus	
Age: Adult, 24+ months	
vdD codes	Measurement in cm.
Bp	2.35
GL	13.72
SD	1.74
DD	1.20
Bd	2.96
Bone Element: Metacarpus	
Age: Adult, 24+ months	
vdD codes	Measurement in cm.
DD	1.15
Bd	2.77
Bone Element: Metacarpus	
Age: Adult, 24+ months	
vdD codes	Measurement in cm.
Bd	2.51
Bone Element: Metacarpus	
Age: Adult, 24+ months	
vdD codes	Measurement in cm.
Bd	2.72
Bone Element: Metatarsus	
Age: Adult, 24+ months	
vdD codes	Measurement in cm.
Bd	2.37
Bone Element: Metatarsus	
Age: Adult, 24+ months	
vdD codes	Measurement in cm.
Bp	2.20

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

MELHOLAR (cont.)	
SD	1.37
ROFUNUM (HRAUN), VESTMANNAEYJAR	
Dating: Medieval ?	
Species: Equus caballus	
Bone Element: carpal/tarsal	
Age: Adult	
vdD codes	Measurement in cm.
GB	4.56
Bone Element: Phalanx I	
Age: Adult, 15+ months	
vdD codes	Measurement in cm.
Bp	4.66
GL	8.00
SD	3.81
Bd	4.13
Species: Bos taurus	
Bone Element: Humerus	
Age: Adult, 48+ months	
vdD codes	Measurement in cm.
Bd	6.98
Bone Element: Astragalus	
Age: Adult	
vdD codes	Measurement in cm.
GL1	6.39
GLm	5.72
Dl	3.41
Dm	3.07
Bd	4.04
Species: Sus scrofa	
Bone Element: Humerus	
Age: Adult, 18+ months	
vdD codes	Measurement in cm.
Bd	3.34

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

ROFUTIUM (cont.)
Species: Ovis aries
Bone Element: Humerus
Age: Adult, 42+ months

vdD codes	Measurement in cm.
Bd	2.94
BT	2.88

Bone Element: Humerus
Age: Adult, 42+ months

vdD codes	Measurement in cm.
Bd	3.02

Bone Element: Calcaneus
Age: Adult, 36+ months

vdD codes	Measurement in cm.
GL	5.70
GB	1.64

Bone Element: Calcaneus
Age: Adult, 36+ months

vdD codes	Measurement in cm.
GL	6.32
GB	1.88

Bone Element: Astragalus
Age: Adult

vdD codes	Measurement in cm.
GL1	3.00
GLm	3.05
D1	1.90
Dm	1.75
Bd	2.12

Bone Element: Astragalus
Age: Adult

vdD codes	Measurement in cm.
GL1	2.81
GLm	2.94
D1	1.64
Dm	1.55
Bd	1.81

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

ROFUHUM (cont.)
Bone Element: Astragalus
Age: Adult

vdD codes	Measurement in cm.
GL1	2.99
GLm	2.89
D1	1.69
Dm	1.74
Bd	1.96

Species: Felis catus
Age: Adult
Bone Element: Ulna
Age: Adult, 15+ months

vdD codes	Measurement in cm.
LO	0.98
DPA	1.02
SDO	0.82
BPC	0.78

SKALHOLT, BISKUPSTUNGNAHREPPUR, ARNESSYSLA
Dating: 18th-19th century
Species: Equus caballus
Bone Element: Metapodial Fragment
Age: Adult

vdD codes	Measurement in cm.
SD	3.01

Bone Element: Phalanx I
Age: Adult

vdD codes	Measurement in cm.
SD	3.44

Species: Bos taurus
Bone Element: Distal Tibia
Age: Mature Adult, 24-30+ months

vdD codes	Measurement in cm.
Bd	5.31

Bone Element: Proximal Ulna
Age: Mature Adult, 42-48+ months

vdD codes	Measurements in cm.
LO	8.34
DPA	5.99

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Table 4.2 (cont.) - Osteometrics for Icelandic archaeofauna with sample sizes of NISP < 100 and TNB > 300.

SEALHOLT (cont.)
Bone Element: Proximal Radius
Age: Mature Adult, 42-48+ months, the proximal radius is joined to the proximal ulna recorded above

vdD codes	Measurement in cm.
BFp	6.65

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Table 4.3 - Summary of Icelandic archaeofauna with sample sizes of NISP < 100 and/or TNB < 300.

	NISP
BAEGISSTADIR: NISP = 5, TNF = 3, TNB = 8	
Mammalia:	
Ovis/Capra	2
Medium terrestrial mammal	3
Aves:	
Gallus gallus	1
Anas crecca	2
DRANGAR: NISP = 1, TNF = 0, TNB = 1[70]	
Mammalia:	
Ursus maritimus	1
ELDVORP: NISP = 64, TNF = 44, TNB = 108	
Mammalia:	
Bos taurus	1
Ovis aries	10
Ovis/Capra	53
Medium terrestrial mammal	44
ESJUBERG: NISP = 62, TNF = 51, TNB = 113	
Mammalia:	
Equus caballus	3
Bos taurus	19
Ovis/Capra	39
Alopex alopex	1
Large terrestrial mammal	15
Medium terrestrial mammal	36

---

70. The partial skeleton consists of 1 atlas, 1 cervical vertebra, 4 thoracic vertebrae, 1 lumbar vertebra, 2 rib fragments and 1 femur.

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Table 4.3 (cont.) - Summary of Icelandic archaeofauna with sample sizes of NISP < 100 and/or TNB > 300.

GRUNNASUNDNES: NISP = 1, TNF = 0, TNB = 1	
Mammalia:	
Bos taurus	1
HAUKADALUR: NISP = 5, TNF = 1, TNB = 6	
Mammalia:	
Bos taurus	1
Ovis aries	2
Ovis/Capra	2
Pisces:	1
HELLISANDUR: NISP = 2, TNF = 0, TNB = 2	
Pisces:	
Gadus morhua	2
HERGRANES: No materials recovered	
Mammalia:	
Ovis/Capra	+
HOLAR: NISP = 62, TNF = 25, TNB = 87	
Mammalia:	
Bos taurus	29
Ovis/Capra	33
Large terrestrial mammal	4
Medium terrestrial mammal	14
Aves:	4
Pisces:	3

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Table 4.3 (cont.) - Summary of Icelandic archaeofauna with sample sizes of NISP < 100 and/or TNB > 300.

KOLHOLTSHELLIR: NISP = 1, TNF = 0, TNB = 1	
Mammalia:	
Equus caballus	1
LAMBASTADIR: NISP = 35, TNF = 13, TNB= 48	
Mammalia:	
Bos taurus	1
Ovis aries	3
Ovis/Capra	4
Alopex alopex	16
Aves:	4
Pisces:	9
Gadus morhua	11
MELHOLAR: NISP = 26, TNF = 0, TNB = 26	
Mammalia:	
Equus caballus	1
Bos taurus	2
Ovis/Capra	23
MELSTADIR: NISP = 1, TNF = 0, TNB = 1	
Mammalia:	
Bos taurus	1

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Table 4.3 (cont.) - Summary of Icelandic archaeofauna with sample sizes of NISP < 100 and/or TNB > 300.

ROFUNUM: NISP = 81, TNF = 80, TNB = 161	
Mammalia:	
Equus caballus	2
Bos taurus	24
Sus scrofa	4
Ovis aries	7
Ovis/Capra	25
Canis familiaris	1
Felis catus	1
Phocidae	15
Large terrestrial mammal	15
Medium terrestrial mammal	14
Aves:	2
Pisces:	39
Molva molva	2
Mollusca:	10
REYKHOLT: NISP = 5, TNF = 0, TNB = 5	
Mammalia:	
Ovis/Capra	5
SKALHOLT: NISP = 8, TNF = 5, TNB = 13	
Mammalia:	
Equus caballus	2
Bos taurus	4
Ovis/Capra	1
Sus scrofa	1
Large terrestrial mammal	5

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Table 4.3 (cont.) - Summary of Icelandic archaeofauna with sample sizes of NISP < 100 and/or TNB > 300.

SUDURGATA 3-5: No materials recovered	
Pisces:	+
THINGNES: NISP = 0, TNF = 1, TNB = 1	
Mammalia:	
Medium terrestrial mammal	1
THORSTEINSSTADIR: NISP = 23, TNF = 14, TNB = 37	
Mammalia:	
Ovis aries	2
Ovis/Capra	8
Medium terrestrial mammal	14
Pisces:	
Gadidae	6
Mollusca:	
Bivalve sp.	7

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Table 4.4 - Osteometric data for the Adalstraeti 8 assemblage. All measurements are in cm. and follow von den Driesch (1976).

Species	Bone Element	von den Driesch codes	Age
Equus caballus	Metatarsus	GL - 2.51 Bp - 4.86 SD - 2.97 Bd - 4.74	Adult, 20+ months
	Metatarsus	GL - 21.99 GL1 - 21.39 L1 - 21.11 Bp - 5.28 Dp - 3.50 SD - 3.28 DD - 2.06 Bd - 4.87 Dd - 3.50	Adult, 20+ months
	Phalanx I	GL - 7.83 Bp - 5.39 SD - 3.19 Bd - 4.50	Adult, 15+ months
	Phalanx II	GL - 4.70 Bp - 5.09 SD - 4.17 Bd - 4.53	Adult, 15+ months
Bos taurus	Scapula	GLP - 6.29 SLC - 4.51 LG - 5.20 BG - 4.45	Adult
	Metacarpus	Bp - 4.56	Adult, 36+ months
Ovis/Capra	Maxilla	21 - 6.96 22 - 4.51 23 - 2.34	Adult

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Table 4.4 (cont.) - Osteometric data for the Adalstraeti 8 assemblage.

Ovis/Capra			
	Mandible	1 - 16.57 2 - 17.48 4 - 10.99 5 - 12.61 6 - 14.77 7 - 7.17 8 - 4.99 9 - 3.09 10 - L -- 2.31 B -- 0.86	Adult
	Mandible	1 - 16.99 2 - 17.38 3 - 4.88 4 - 11.07 5 - 11.52 6 - 14.10 7 - 7.38 8 - 4.86 9 - 2.44 10 - L -- 2.13 B -- 0.68 11 - 3.53 12 - 7.13 15a - 4.11 15b - 2.34 15c - 1.91	Adult
	Mandible	9 - 2.17 15c - 1.93	Adult
	Mandible	9 - 2.95 15c - 1.02	Adult
	Scapula	GLP - 3.34 LG - 2.62 BG - 1.99	Adult
	Humerus	Bd - 2.87	Adult, 28+ months
	Humerus	SD - 1.98 BT - 3.12	Adult, 28+ months

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Table 4.4 (cont.) - Osteometric data for the Adalstraeti 8 assemblage.

Ovis/Capra			
	Radius	Bp - 3.60 BFp - 3.47	Adult, 42+ months
	Radius	SD - 1.48 Bp - 2.89	Adult, 42+ months
	Ulna	BPC - 1.76	Adult, 42+ months
	Metacarpus	Bp - 2.40 SD - 1.48	Adult, 24+ months
	Metacarpus	Bp - 2.56	Adult, 24+ months
	Metacarpus	SD - 1.55 Bd - 2.70	Adult, 24+ months
	Metacarpus	Bp - 2.46 SD - 1.46	Adult, 24+ months
	Metacarpus	GL - 12.45 Bp - 2.11 SD - 1.22 Bd - 2.41	Adult, 24+ months
	Femur	Bp - 4.10 DC - 1.98	Adult, 42+ months
	Femur	Bp - 4.89 DC - 2.22	Adult, 42+ months
	Tibia	Bd - 2.89	Adult, 42+ months
	Tibia	Bd - 2.77	Adult, 42+ months
	Tibia	SD - 1.48 Bd - 2.71	Adult, 42+ months
	Tibia	SD - 1.66 Bd - 2.72	Adult, 42+ months

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Table 4.4 (cont.) - Osteometric data for the Adalstraeti 8 assemblage.

Ovis/Capra			
	Metatarsus	GL - 13.57 Bp - 2.02 SD - 1.24 Bd - 2.40	Adult, 28+ months
	Metatarsus	Bd - 2.72	Adult, 28+ months
	Metatarsus	GL - 15.98 Bp - 2.06	Adult, 28+ months
	Metatarsus	Bp - 2.14 SD - 1.12	Adult, 28+ months
	Calcaneus	GL - 6.45 GB - 2.00	Adult, 36+ months
	Calcaneus	GL - 5.71 GB - 2.10	Adult, 36+ months
	Astragalus	GL1 - 3.04 GLm - 2.93	Adult
	Astragalus	GL1 - 3.04 GLm - 2.93	Adult
Canis familairis	Mandible	11 - 3.18 12 - 2.92 14 - 1.75 20 - 1.56	Adult

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Table 4.5 - Summary of the Adalstraeti 8 archaeofauna.

Site Context	Taxon	NISP	TNF
NISP = 98, TNF = 159 , TNB = 257			
Unknown Context			
	Mammalia:		
	Equus caballus	2	-
	Bos taurus	1	-
	Canis familiaris	1	-
		4	-
Oskuhaugar, X12 Y12, (Rubbish Dump) "Bein Oskuh."			
	Mammalia:		
	Ovis/Capra	12	-
	Medium terrestrial mammal	-	7
	Pisces:	-	9
		12	16
"Bein 2 Oskuh."			
	Mammalia:		
	Bos taurus	2	-
	Ovis/Capra	12	-
	Large terrestrial mammal	-	1
	Medium terrestrial mammal	-	2
	Aves:	-	1
		14	4

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Table 4.5 (cont.) - Summary of the Adalstraeti 8 archaeofauna.

"Bein 3 Oskuh."			
	Mammalia:		
	Equus caballus	1	-
	Ovis/Capra	8	-
	Aves:	-	1
	Pisces:	-	3
	Mollusca:	-	2
		9	6
"Bein 4 Oskuh."			
	Mammalia:		
	Bos taurus	1	-
	Ovis/Capra	6	-
		7	-
"Bein 5 Oskuh."			
	Mammalia:		
	Ovis/Capra	4	-
	Medium terrestrial mammal	-	14
	Pisces:	-	11
		4	25
"Bein 6 Oskuh."			
	Mammalia:		
	Bos taurus	2	-
	Ovis/Capra	4	-
	Phocidae	1	-
	Large terrestrial mammal	-	6
	Medium terrestrial mammal	-	9
	Aves:	-	5
	Pices:	-	62
	Mollusca:	-	5
		7	87

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Table 4.5 (cont.) - Summary of the Adalstraeti 8 archaeofauna.

X3 Y14			
	Mammalia:		
	Medium terrestrial mammal	-	7
		-	7
X8-9			
	Mammalia:		
	Ovis/Capra	2	-
		2	-
X10 Y12			
	Mammalia:		
	Ovis/Capra	1	-
	Medium terrestrial mammal	-	2
		1	2
X10 Y13.5			
	Mammalia:		
	Ovis/Capra	6	-
	Medium terrestrial mammal	-	1
		6	1
X10 Y14			
	Mammalia:		
	Ovis/Capra	1	-
		1	-
X14 Y2			
	Mammalia:		
	Ovis/Capra	2	-
	Medium terrestrial mammal	-	1
		2	1

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Table 4.5 (cont.) - Summary of the Adalstraeti 8 archaeofauna.

X14 Y7			
	Mammalia:		
	Ovis/Capra	1	-
		1	-
X14.5 Y4-7			
	Mammalia:		
	Ovis/Capra	7	-
	Large terrestrial mammal	-	1
	Medium terrestrial mammal	-	6
		7	7
X30-36 Y0-5			
	Mammalia:		
	Bos taurus	7	-
	Ovis/Capra	4	-
	Pisces:	-	1
		11	1
X30 Y11			
	Mammalia:		
	Ovis/Capra	1	-
		1	-
X30-40 Y5			
	Mammalia:		
	Ovis/Capra	1	-
		1	-
X39 Y2			
	Mammalia:		
	Ovis/Capra	2	-
		2	-

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Table 4.5 (cont.) - Summary of the Adalstraeti 8 archaeofauna.

X39 Y15			
	Mammalia:		
	Ovis/Capra	3	-
	Aves:	-	1
		3	1
X40			
	Mammalia:		
	Ovis/Capra	3	-
	Medium terrestrial mammal	-	1
		3	1

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Table 4.6 - Osteometric data for the Fornusandar 2 (FO II) assemblage. All measurements are in cm. and follow von den Driesch (1976).

Species	Bone Element	von den Driech codes	Age
Bos taurus	Metacarpus	Bd - 5.54	Adult >18 months
	Astragalus	GL1 - 4.29 GLm - 3.87 Bd - 2.66 Dm - 1.94 D1 - 2.25	Adult >6 months
	Cervical Vertebra	BFcr - 3.88 HFcr - 3.68	Adult 60+ months
Ovis/Capra	Humerus	SD - 1.47	Adult
	Humerus	Bd - 2.55 BT - 2.41	10 months
	Cervical Vertebra	BPacr - 5.98 GLPa - 4.84	Adult
	Lumbar Vertebra	BFcr - 2.C0 Hfcr - 1.64	Adult
Phoca groenlandicus (Note: measurements follow Spiess and Hedden 1983).			
	Ulna	P17 - 3.31 P18 - 1.81 P19 - 1.01	-
	Radius	P14 - 2.10	-

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Table 4.7 - Summary of Fornusandar 2 (FO II) archaeofauna.

Taxon	NISP	TNF
NISP = 95, TNF = 1,732, TNB = 1,827		
Mammalia:		
Equus caballus	17	-
Bos taurus	29	-
Ovis/Capra	27	-
Phocidae	12	-
Phoca groenlandicus	3	-
Cetacea	3	-
Large terrestrial mammal	-	13
Medium terrestrial mammal	-	64
Terrestrial mammal.	-	1,645
Marine mammal	-	10
Pisces:		
Gadidae	3	-
Gadus morhua	1	-
	95	1,732

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Table 4.8 - Summary of the Gammel-Grimsstadir archaeofauna.

Taxon	NISP	TNF
NISP = 515, TNF = 230, TNB = 745		
Mammalia:		
Equus caballus	18	-
Bos taurus	38	-
Ovis aries	120	-
Capra hircus	3	-
Ovis/Capra	327	-
Rangifer tarandus	2	-
Phocidae	5	-
Phoca groenlandicus	2	-
Large terrestrial mammal	-	24
Medium terrestrial mammal	-	206
	515	230

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Table 4.9 - Summary of the Hakonarstadir archaeofauna.

Taxon	NISP	TNF
NISP = 124, TNF = 62, TNB = 186		
Mammalia:		
Equus caballus	2	-
Bos taurus	10	-
Ovis aries	26	-
Capra hircus	2	-
Ovis/Capra	80	-
Sus scrofa	1	-
Large terrestrial mammal	-	7
Medium terrestrial mammal	-	55
Aves:		
Anseriformes	1	-
Fratercula arctica	1	-
Pisces:		
Gadus morhua	1	-
	124	62

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Table 4.10 - Summary of the Hofsstadir archaeofauna.

Taxon	NISP	TNF
NISP = 345, TNF = 89,306, TNB = 89,651		
Mammalia:		
Sus scrofa	8	-
Ovis aries	15	-
Ovis/Capra	322	-
Medium terrestrial mammal	-	89,306
	345	89,306

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Table 4.11 - Osteometric data for the Nyibaer assemblage. All measurements are in cm. and follow von den Driesch (1976).

Species	Bone Element	von den Driesch codes	Age
Equus caballus	Femur	SD - 4.17 Bd - 8.16	Adult, 42+ months
	Phalanx II	GL - 4.68 Bp - 5.14 SD - 4.25 Bd - 4.75 Dp - 3.37 BFp - 4.28	Adult, 15+ months
	Lumbar Vertebra	HFcd - 2.30	Adult
Bos taurus	Scapula	SLC - 5.01	Adult
	Tibia	Dd - 3.44 Bd - 4.84	Adult, 48+ months
	Tibia	Dd - 5.66 Bd - 4.24	Adult, 48+ months
	Phalanx I	GL - 5.09 Bp - 2.50 SD - 2.02 Bd - 2.30	Adult, 24+ months
Ovis aries	Metacarpus	Bp - 2.43 Dp - 1.65 Bd - 2.46 GL - 13.84 SD - 1.52	Adult, 30+ months
	Metacarpus	Bp - 2.15 Dp - 1.64 Bd - 2.50 GL - 12.61 SD - 1.29	Adult, 30+ months

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Table 4.11 (cont.) - Osteometric data for the Nyibaer assemblage.

Ovis aries			
	Metacarpus	Bp - 1.99 Dp - 1.46	Adult, 30+ months
	Metatarsus	Bp - 1.99 Bd - 2.18 GL - 13.64 SD - 1.24	Adult, 30+ months
	Metatarsus	Bp - 2.19 SD - 1.33	Adult, 30+ months
	Metatarsus	Bp - 2.19 Bd - 2.51 GL - 15.15 SD - 1.40	Adult, 30+ months
Ovis/Capra	Tibia	Dd - 1.85	Adult, 30+ months
	Tibia	Dd - 1.81 Bd - 2.15	Adult, 30+ months

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Table 4.12 - Summary of the Nyibaer archaeofauna.

Taxon	NISP	TNF
NISP = 68, TNF = 111, TNB = 179		
Mammalia:		
Equus caballus	4	-
Bos taurus	5	-
Ovis aries	4	-
Ovis/Capra	31	-
Cetacea	6	-
Cetacea, Mysticeti sp.	3	-
Large terrestrial mammal	-	4
Medium terrestrial mammal	-	38
Aves:	-	4
Sula bassana	3	-
Anas platyrhynchos	1	-
Pisces:	-	65
Gadidae	5	-
Gadus morhua	5	-
Pleurotremata sp.	1	-
	68	111

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Table 4.13 - Osteometric data for the Vilhjalmsson samples from Stong. All measurements are in c. and follow von den Driesch (1976).

Species	Bone Element	von den Driesch codes	Age
Ovis/Capra (Prunta 10, Sample 10, Pr.10 5.8.86 in filling between house 1 and 2, X51.56, Y97.01 (Sj), level 189.33)	Metatarsus	Bd - 2.53	Adult, 28+ months

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Table 4.14 - Summary of the Stong archaeofauna.

Taxon	NISP	TNF
NISP = 158, TNF = 35, TNB = 243		
Degerbol samples		
Mammalia:		
Equus caballus	3	-
Bos taurus	23	-
Ovis aries	91	-
Sus scrofa	1	-
Aves:		
Anser anser	4	-
	122	-
Vilhjalmsson samples		
Prov: Sample 1 and 2, Lower Midden Area, screen finds.		
Mammalia:		
Ovis/Capra	23	-
Medium terrestrial mammal	-	52
Aves:	-	12
	23	64
Prov: Pruta 3, Sample 3, Pr. 3.		
Mammalia:		
Ovis/Capra	2	-
	2	-

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Table 4.14 (cont.) - Summary of the Stong archaeofauna.

Prov: Sample 4, Pr. 4, found in first meter of overburden.		
Mammalia:		
Bos taurus	1	-
Ovis/Capra	1	-
Medium terrestrial mammal	-	1
	2	1
Prov: Pruta 5, Sample 5, Pr. 5, surface collection, turf blow out 10 meters in front of structure 1.		
Mammalia:		
Ovis aries	5	-
Ovis/Capra	1	-
Medium terrestrial mammal	-	2
	6	2
Prov: sample 6, Pr. 6, 1.8.86, in fillings between house 1 and 2 (in unit Sj), Level 189.44		
Mammalia:		
Medium terrestrial mammal	-	8
	-	8
Prov: Sample 7, Pr. 7, 2.8.80, outside walls of house 1 and 2, X 50.80, Y 95.80, Level 189.59		
Mammalia:		
Medium terrestrial mammal	-	1
	-	1
Prov: sample 8, Pr.8, 3.8.86, fillings between house 7 and 2 (Sj), X 51.80, Y 98.45, Level 189.45		
Mammalia:		
Medium terrestrial mammal	-	2
	-	2

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Table 4.14 (cont.) - Summary of the Stong archaeofauna.

Prov: Sample 9, Pr. 9, 3.8.86, on top of the older house LSI. X 47.20, Y 96.90, Level 189.25.

Mammalia:		
Ovis/Capra	1	-
	1	-

Prov: Pruta 10, Sample 10, Pr. 10, 5.8.86, in filling between house 1 and 2, X 51.56, Y 97.01 (Sj), level 189.33.

Mammalia:		
Ovis/Capra	1	-
	1	-

Prov: Sample 11, Pr. 11, 11.8.86, On floor in smithy (the older house - house 2), X49.15, Y 96.85.

Mammalia:		
Ovis/Capra	1	-
Medium terrestrial mammal	-	7
	1	7

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Table 5.1 - NISP table for the 1958 "pit-like" feature sample from the Adalbol site, Hrafnkelsdalur, Fljotsdalhreppur, Nordur-Mulasysla, Eastern Iceland.

ADALBOL	Iceland	Date:	1360		
1989 Qbase version	UNIT	Constr. trench below = 1158 asn			
FILE: Adalbol.WQ2 3/28/96					
Taxon	NISP	% of whole	% of group		
DOMESTICATES					
Bos taurus	47	4.76	4.92		
Equus caballus	1	0.10	0.10		
Canis familiaris		0.00	0.00		
Sus scrofa		0.00	0.00		
Ovis aries	162	16.41	16.96		
Capra hircus	2	0.20	0.21		
Ovis/Capra sp.	743	75.28	77.80		
Total Ovis/Capra	907	91.89	94.97		
Total Domesticates	955	96.76			
SEALS					
Phoca vitulina		0.00	ERR	P. vit.	
Pagophilus groenlandicus		0.00	ERR	P.groen.	
Large seal		0.00	ERR	L. seal	
Phocid sp.		0.00			
Total Phocid	0	0.00			0
CETACEA					
Great whale		0.00	ERR		
Small whale/porpoise		0.00	ERR		
Cetacea sp.		0.00	ERR		
Total Cetacea	0	0.00			
OTHER MAMMALS					
Alopex lagopus	1	0.10			
Ursus maritimus		0.00			
Rangifer tarandus		0.00			
Total Other Mammals	1	0.10			
BIRDS					
Wildfowl - sea birds		0.00	0.00	seabird	
Wildfowl - land birds		0.00	0.00	land bird	
Domestic fowl	27	2.74	100.00	Dom. fowl	
Bird sp.		0.00			27
Total Birds	27	2.74			
FISH					
Gadus morhua	1	0.10	100.00		
Other Fish		0.00	0.00		
Fish sp.	3	0.30			1
Total Fish	4	0.41			
MOLLUSCA					
Mollusca sp.		0.00			
Total Mollusca	0	0.00			
TOTAL NISP =	987	100.00			

Major Taxa Relative Percent	NISP	%
Cattle	47	4.77
Caprines	907	91.99
Horse	1	0.10
Seals	0	0.00
Cetacea	0	0.00
Birds	27	2.74
Fish	4	0.41
sum of major groups	986	

Ratios		
Cattle : Caprine	1 to	19.30
Cattle : Horse	1 to	0.02
Cattle : Dogs	1 to	0.00
Goat : Sheep	1 to	81.00
Domestic Mammal : Ident.Fish	1 to	0.00
Domestic Mammal : Seals	1 to	0.00
Domestic Mammal : Birds	1 to	0.03
Domestic Fowl : Wildfowl	1 to	0.00

NISP	987
TNF	
large mammal	3
medium mammal	501
Unidentified Scrap	240
Assemblage Total	1737
% identified	80.44
total L & M mammal	510
ratio M : L mammal	55.67
L&M mammal : tot.Pisces	127.50

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Table 5.2 - NISP table for the Herjolfsdalur site on the island of Heimey, Vestmannaeyjar, Southern Iceland (data is drawn from Hermanns-Audardottir 1989:121-126).

HERJOLFSDALUR	Area:		Date:	1989			
	UNIT	WHOLE SITE			Major Taxa Relative Percent		
File HERJOLFSWQ2							
Taxon	NISP	% of Assem.	% of group			NISP	%
DOMESTICATES							
Bos taurus	131	11.62	45.02				
Equus caballus	1	0.09	0.34		Cattle	131	11.59
Canis familiaris		0.00	0.00		Caprines	141	12.48
Sus scrofa	18	1.57	6.19		Horse	1	0.09
Ovis aries		0.00	0.00		Seals	7	0.62
Capra hircus		0.00	0.00		Cetacea	3	0.27
Ovis/Capra sp.	141	12.28	48.45		Birds	825	73.01
					Fish	22	1.95
Total Ovis/Capra	141	12.28	48.45				
					Mammals Relative %		
Total Domesticates	291	25.35			Cattle	131	46.95
SEALS					Caprines	141	50.54
Phoca vitulina	2	0.17	100.00	P. vit.	Horse		0.00
Pagophilus groenlandicus		0.00	0.00	P. groen.	Seals	7	2.51
Large seal		0.00	0.00	L. seal	Cetacea		0.00
Phocid sp.	5	0.44					
Total Phocid	7	0.61			Ratios		
CETACEA							
Great whale		0.00	0.00		Cattle : Caprine	1 to	1.08
Small whale/porpoise		0.00	0.00				
Cetacea sp.	3	0.26	100.00		Cattle : Horse	1 to	0.01
Total Cetacea	3	0.26			Cattle : Dogs	1 to	0.00
OTHER MAMMALS							
Vulpes lagopus		0.00			Goat : Sheep	1 to	ERR
Ursus maritimus		0.00					
Rangifer tarandus		0.00			Domestic Mammal : Ident.Fish	1 to	0.03
Total Other Mammals	1	0.09			Domestic Mammal : Seals	1 to	0.02
BIRDS							
Anas gracilis	1	0.09	0.20	Amsorni	Domestic Mammal : Birds	1 to	2.84
Anas rasmata	1	0.09	66.20	seaourd			
Anatae	14	1.22	0.20	Dom. fowl	Domestic Fowl : Wildfowl	1 to	0.14
Anas sage	56	4.88	66.00	Anas			
Fratercula arctica	753	65.59	13.79	Bird sp.	NISP	1280	
Bird sp.	132	11.50			Mammalian INF	562	
Total Birds	957	71.66			Assemblage Total	1842	
FISH							
Gadus morhua	6	0.52	46.67				
Melanogrammus aeglefinus	1	0.09	11.11		% Identified	69.49	
Molva molva	2	0.17	22.22				
Pisces sp.	3	0.26					
Total Fish	22	1.92					
MOLLUSCA							
Mollusca sp.		0.00					
Total Mollusca	0	0.00					
TOTAL NISP =	1280	100.00					

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Table 5.3 - NISP table for the Tjarnargata 4 site located in downtown Reykjavik. The table was constructed from the correspondence of Magnus Degerbol to Finnur Gudmundsson in 1954.

[illegible]								
[illegible]	[illegible]		Data	[illegible]				
[illegible]	[illegible]		Phase [illegible] Series A & B			Weights		
Degerbol 1954 group	Datum Phase Level [illegible]					Relative Percent		
Taxon	%SP	% of whole	% of group				%SP	%
DOMESTICATES								
Bos taurus	18	41.89	64.55	100		Cattle	1.8	42.47
Ovis/Capra	4	9.77	14.12	12		Caprines	55	1.31
Equus caballus		0.00	0.00	13		Horse	4	.83
Sus scrofa	3	6.00	6.66	104		Seals	1	.21
Canis familiaris		0.00	0.00	5		Cetacea	3	1.42
Gallus gallus		0.00	0.00	6		Birds	300	62.24
[illegible]	55	1.64	27.78	5		Fish	11	2.28
Total Ovis/Capra	55	1.64	27.78					
Total Domesticates	98	38.30						
SEALS								
Phoca vitulina		0.19	10.00					
Halichoerus grypus/Pagophilus groenlandicus		0.00	0.00					
Large seal		0.00	0.00			Sum of major groups	482	
Phocidae		0.00						
Total Phocids		0.19				Ratios		
CETACEA								
Small whale	3	.58	10.00			Cattle Caprine	0	1.6
Medium whale/Porpoise		0.00	0.00					
Whale/Cetacea		0.00	0.00			Cattle Horse	4.5	1.4
Total Cetacea	3	.58				Cattle Dogs	18	1.3
OTHER MAMMALS								
Alopex lagopus		0.00				Goat Sheep	0	ERR
Lepus timidus		0.00						
Unidentified Mammals	4	.77				Domestic Mammal Plant Fish	4.5	1.16
Total Other Mammals	4	.77				Domestic Mammal Seals	4.5	1.21
BIRDS								
Anser albifrons	299	57.83	99.67			Domestic Mammal Birds	4.5	52
Anser anser	1	0.19	0.33					
Other Anser		0.00	0.00			Domestic Fowl Anadrom	0	ERR
Duck		0.00		300				
Total Birds	300	58.03				%SP	51.7	
Fish						Undetermined Scrap	na	
Gadus morhua	1	.19	100.00			% identified	100.00	
Pleuronectes flesus		0.00	0.00			large mammal	na	
Cod		0.00				medium mammal	na	
Total Fish	11	2.13				Total L & M mammal	0	
MOLLUSCA						Ratio M L mammal	ERR	
Mytilus edulis						L&M mammal Not Pisces	0.00	
Total Mollusca		0.00						
TOTAL %SP =	51.7	100.00						

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Table 5.4 - NISP table for the Tjarnargata 4 site. The table is based upon the author's analysis of the Tjarnargata 4 assemblage.

File TJRNISP3 [illegible] Page 1 of 3

TJARNARGATA 4 Iceland Date 1994

UNIT SITE COLLECTION

Taxon	NISP	% of whole	% of group		Major Taxa Relative Percent	NISP	%
DOMESTICATES							
Bos taurus	152	23.64	56.09				
Equus caballus	3	0.47	1.11		Cattle	152	35.00
Canis familiaris		0.00	0.00		Caprines	78	12.43
Sus scrofa	38	5.91	14.02		Horse	3	0.69
Ovis aries	19	2.95	7.01		Pigs	38	8.75
Capra hircus		0.00	0.00		Seals	5	0.82
Ovis/Capra sp.	59	9.18	21.77		Cetacea	4	0.96
					Birds	317	52.14
Total Ovis/Capra	78	12.13	28.78		Fish	11	1.81
Total Domesticates	271	42.15					
SEALS							
Phoca vitulina	2	0.31	100.00	P. vit.			
Pagophilus groenlandicus		0.00	0.00	P. groen.			
Large seal		0.00	0.00	L. seal	sum of major groups	906	
Phocid sp.	3	0.47					
Total Phocid	5	0.78			Ratios		
CETACEA							
Balaenoptera sp.	1	0.16	25.00		Cattle : Caprine	1.95	4.51
Small Artiodactyla		0.00	0.00				
Cetacea sp.	3	0.47	75.00		Cattle : Horse	1.95	0.02
Total Cetacea	4	0.62			Cattle : Dogs	1.95	0.00
OTHER MAMMALS							
Alces alces		0.00			Goat : Sheep	1.95	ERR
Ursus maritimus		0.00					
Vulpes vulpes	3	0.47			Domestic Mammal : Identified Fish	1.95	0.04
Total Other Mammals	3	0.47			Domestic Mammal : Seals	1.95	0.02
BIRDS							
Wildfowl : sea birds	317	49.30	100.00	seabird	Domestic Mammal : Birds	1.95	1.17
Wildfowl : land birds		0.00	0.00	land bird			
Domestic fowl		0.00	0.00	Dom. fowl	Domestic Fowl : Wildfowl	1.95	ERR
Bird sp.		0.00		317			
Total Birds	317	49.30			NISP	643	
FISH					TNF	185	
Gadus morhua	11	1.71	100.00		Assemblage Total	828	
Salmo sp.		0.00	0.00				
Other Fish		0.00	0.00		% Identified	77.66	
Fish sp.		0.00		11			
Total Fish	11	1.71			TNF Categories		
MOLLUSCA					large mammal	147	
Mollusca sp.	32	4.98			medium mammal	32	
					small mammal	0	
Total Mollusca	32	4.98			Unidentified Scrap	6	
TOTAL NISP =	643	100.00			total L & M mammal	179	
					ratio M : L mammal	0.22	
					L&M mammal : tot.Pieces	16.27	

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Table 5.5 - The mammalian taxonomic assignments for the Tjarnargata 4 archaeofauna.

TJARNARGATA 4		File: TJRNISP3.WQ2 2/22/96 Iceland Date: UNIT: SITE COLLECTION		Page 2 of 3 1944
Taxon		NISP	% of whole	% of group
DOMESTICATES				
Bos taurus	cattle	152	23.64	56.09
Equus caballus	horse	3	0.47	1.11
Canis familaris	dog		0.00	0.00
Sus scrofa	pig	38	5.91	14.02
Ovis aries	sheep	19	2.95	7.01
Capra hircus	goat		0.00	0.00
Ovis/Capra sp.	caprine sp.	59	9.18	21.77
total Ovis/Capra	all caprines	78	12.13	28.78
total Domesticates		271	42.15	
SEALS				
Phoca vitulina	harbor seal	2	0.31	
Phocid sp.	seal sp.	3	0.47	
total Phocid		5	0.78	
WHALES				
Balenoptera sp. (borealis?)	set ?	1	0.16	
Cetacea sp.	whale sp.	3	0.47	
total Cetacea		4	0.62	
OTHER MAMMALS				
Odobenus rosmarus	walrus	3	0.47	
total Other Mammals		3	0.47	
BIRDS				
Pinguinus impennis		75	11.66	
Uria sp. (lomvia?)		225	34.99	
Fratercula arctica		15	2.33	
Larus glaucescens		2	0.31	
		317	49.30	
FISH				
Gadus morhua	Atlantic cod	11	1.71	
	Total Fish	11	1.71	
MOLLUSCA				
Mollusca sp.	Shellfish	32	4.98	
Total Mollusca		32	4.98	
	TOTAL NISP =	643	101.71	

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Table 5.6 - The avian taxonomic assignments for the Tjarnargata 4 archaeofauna.

TJARNARGATA 4 File: TJRNISP3.WQ2
BIRDS 2/22/96 Page 3 of 3

	NISP	MNI	% of Identified Birds (NISP)
SEA BIRDS			
Alcidae			
Auks			
Pinguinis impennis Great Auk	75		23.66
Uria sp. (lomvia?) Murre or Guillemot	225		70.98
Fratercula arctica Puffin	15		4.73
Laridae			
Gulls			
Larus glaucescens Glaucous Gull	2		0.63
TOTALS	317	0	

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Table 5.7 - The summary statistics and skeletal element distribution for the great auk, (*Pinguinus impennis*), from the Tjarnargata 4 site.

Quattrocchi 3.0 McGovern & Amorosi 1989

Family	Alcidae
Taxon	Pinguinus impennis L.
Site	Tjarnargata 4
Date	1944
Unit	all
Strat Unit	Both Series A & B
Depth	"Peat Layer", 202-383 cm BGS
A.U.	
File	TJRGRAUK.WQ2 2.22.96

SUMMARY STATISTICS			Qbone 3.0
NISP total	75		
RF mean	3.59	non zero entries	58.00
RF Stand. Dev.	1.36	Sum of RF	34.36
RF Coeff. of Var.	230.02	Quartile Break	14.50
		ARF mean	
Maximum RF (MNI)	7.00	Hatchlings. NN	0
Minimum RF	3.00	% hatchling	3.00
NISP MNI Ratio	10.71		

ELEMENT DISTRIBUTION

	Relative % (RF)	RF
cranial	2.91	1.00
wing	90.22	23.50
thorax	17.06	5.86
thigh	2.91	1.00
hindlimb	8.73	3.00

TAPHONOMIC MEASURES

CHEWING			
Total chewed	0		
% chewed	0.00		
Number of whole Long Bones		34	
Percent of whole Long bones		37.33	%
Number of Burned Bones		0.00	
Percent of Burned Bones		0.00	%

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Table 5.8 - The summary statistics and skeletal element distribution for the murre species, (*Uria sp.*), from the Tjarnargata 4 site.

Quattrocchi & McGovern & Arnorsson 1989

FAMILY	Alcidae
Taxon	Uria sp. (lomvia ?)
Site	Tjarnargata 4
Date	1944
Unit	all
Strat Unit	Both Series A & B
Depth	"Peat Layer" 202-383 cm BGS
A U	
File	TJURIA.WQ2 2.22.96

SUMMARY STATISTICS			Cbone 3.0
NISP total	225		
RF mean	2.34	non zero entries	58.00
RF Stand. Dev	5.12	Sum of RF	135.60
RF Coeff. of Var	218.97	Quartile Break	1.50
		ARF mean	
Maximum RF ("MNI")	23.00	Hatchlings.NN	0
Minimum RF	0.00	% hatchling	0.00
NISP MNI Ratio	9.78		

ELEMENT DISTRIBUTION

	Relative % (RF)	RF
cranial	41.67	56.50
wing	22.86	67.50
thorax	4.13	5.60
thigh	0.37	0.50
lwr hindlimb	4.06	5.50

TAPHONOMIC MEASURES

CHEWING		
Total chewed	0	
% chewed	0.00	
Number of whole Long Bones	120	
Percent of whole Long bones	53.33	%
Number of Burned Bones	0.00	
Percent of Burned Bones	0.00	%

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Table 5.9 - Summary statistics of the osteometric data for the great auk mandible sample from the Tjarnargata 4 site.

	METRICS (after Von den Dreisch 1976)	
Taxon	Pinguinus impennis L.	
Element	Mandible	adult only
Site	TJARNARGATA 4	
Date	1944	
Unit	all	
Strat. Unit	Both Series A & B	
Depth	"Peat Layer" 202-383 cm BGS	
File	GRAUKMAN.WQ2 3/4/96 1 of 2	

TJARNARGATA 4, REYKJAVIK, ICELAND		Date: 1st Sigma AD 778-984, 689-97
Greatest length (GL)		
GL mean	142.50	
GL Stand. Deviation	ERR	
GL CV	ERR	
Number of Specimens	1 00	
Range Maximum	142.50	
Range Minumum	142.50	
Length of Symphysis (LS)		
LS mean	25 71	
LS Stand Deviation	ERR	
LS CV	ERR	
Number of Specimens	1 00	
Range Maximum	25 71	
Range Minumum	25 71	

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Table 5.10 - Osteometric data for the great auk mandible sample from the Tjarnargata 4 site.

FILE: GRAUKMAN.WQ2 3/4/96 2 OF 2

Tjarnargata 4, Mandible specimen #	prov	GL	Measurements in mm. LS
Pi 8		142.5	25.71

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Table 5.11 - Summary statistics of the osteometric data for the great auk scapula sample from the Tjarnargata 4 site.

	METRICS (after Von den Dreisch 1976)	
Taxon	Pinguinus impennis L.	
Element	Scapula	adult only
Site	TJARNARGATA 4	
Date	1944	
Unit	all	
Strat. Unit	Both Series A & B	
Depth	"Peat Layer", 202-383 cm BGS	
File	SCAPGAUK.WQ2 3/6/96 1 of 2	

TJARNARGATA 4, REYKJAVIK, ICELAND		Date: 1st Sigma AD 778-984, 689-97
Greatest Length (GL)		
GL mean	ERR	
GL Stand. Deviation	ERR	
GL CV	ERR	
Number of Specimens	0.00	
Range Maximum	ERR	
Range Minumum	ERR	
Greatest Cranial Diagonal (Dic)		
Dic mean	16.70	
Dic Stand. Deviation	ERR	
Dic CV	ERR	
Number of Specimens	1.00	
Range Maximum	16.70	
Range Minumum	16.70	

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Table 5.12 - Osteometric data for the great auk scapula sample from the Tjarnargata 4 site.

FILE: SCAPGAUK.WQ2 3/6/96 2 OF 2

Tjarnargata 4, Scapula specimen #	prov	GL	Measurements in m Dic
Pi71			16.7

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Table 5.13 - Summary statistics of the osteometric data for the great auk coracoid sample from the Tjarnargata 4 site.

	METRICS (after Von den Dreisch 1976)	
Taxon	Pinguinus impennis L.	
Element	Coracoid	adult only
Site	TJARNARGATA 4	
Date	1944	
Unit	all	
Strat. Unit	Both Series A & B	
Depth	'Peat Layer' 202-383 cm BGS	
File	CORGRAUK.WQ2 3/6/96 1 of 3	

TJARNARGATA 4, REYKJAVIK, ICELAND		Date: 1st Sigma AD 778-984, 689-978	
Greatest Length (GL)		Greatest Basal Length (Bb)	
GL mean	64.74	Bb mean	28.43
GL Stand. Deviation	1.91	Bb Stand. Deviation	ERR
GL CV	2.80	Bb CV	ERR
Number of Specimens	2.00	Number of Specimens	1.00
Range Maximum	66.02	Range Maximum	28.43
Range Minumum	63.46	Range Minumum	28.43
Medial Length (Lm)		Br. of Facies art. basalaris (BF)	
Lm mean	61.91	BF mean	24.34
Lm Stand. Deviation	ERR	BF Stand. Deviation	ERR
Lm CV	ERR	BF CV	ERR
Number of Specimens	1.00	Number of Specimens	1.00
Range Maximum	61.91	Range Maximum	24.34
Range Minumum	61.91	Range Minumum	24.34

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Table 5.14 - Comparative coracoid osteometric data from Funk Island located off the NE coastal tip of Newfoundland, Canada and West Greenland.

File: CORGRAUK.WQ2 3/6/96 2 of 3

FUNK ISLAND, NEWFOUNDLAND, CANADA			
GL Mean	58.90	|	Date: AD.1500-1600
Number of Specimens	50	|	(Meldgaard 1988: 164)
Range Maximum	63	|	NOTE:Sample was derived from an 1887
Range Minimum	54	|	surface collection from Funk Island,
		|	now curated at the NMNH.

WEST GREENLAND (MELDGAARD 1988: 164)			
GL Mean	58.00	|	Date: AD.1350-1800
Number of Specimens	5	|	
Range Maximum	60	|	
Range Minimum	53	|	

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Table 5.15 - Osteometric data for the great auk coracoid sample from the Tjarnargata 4 site.

FILE: CORGRAUK.WQ2 3/6/96 2 OF 3
Measurement in mm.
Tjarnargata 4, Coracoid

specimen #	prov	GL	Lm	Bb	BF
Pi46		66.02	61.91	28.43	24.34
Pi47		63.46			

Note: The Zoological Museum (ZM) has three specimens belonging to this sample. These include a humerus, a radius and ulna. These remains are reported in Meldgaard (1988: 164).

Meldgaard, M.
1988 The Great Auk, PINGUINUS IMPPENNIS (L.) in Greenland. HISTORICAL BIOLOGY (1:145-178).

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Table 5.16 - Summary statistics of the osteometric data for the great auk humeri sample from the Tjarnargata 4 site.

	METRICS (after Von den Dreisch 1976)	
Taxon	Pinguinus impennis L.	
Element	Humerus	adult only
Site	TJARNARGATA 4	
Date	1944	
Unit	all	
Strat Unit	Both Series A & B	
Depth	"Peat Layer". 202-383 cm BGS	
File	GRAUKMET WQ2 2/28/96 1 of 25	

TJARNARGATA 4. REYKJAVIK. ICELAND		Date: 1st Sigma AD.778-984, 689-97	
Greatest length (GL)		Sm. Br. of Corpus (SC)	
GL mean	103.47	SC mean	11.42
GL Stand. Deviation	2.67	SC Stand. Deviation	0.96
GL CV	2.58	SC CV	8.38
Number of Specimens	5.00	Number of Specimens	14.00
Range Maximum	107.98	Range Maximum	12.75
Range Minumum	101.61	Range Minumum	9.53
Greatest Br. Prox. End (Bp)		Greatest Br. Distal End (Bd)	
Bp mean	24.29	Bd mean	15.27
Bp Stand. Deviation	0.81	Bd Stand. Deviation	0.76
Bp CV	3.35	Bd CV	4.96
Number of Specimens	4.00	Number of Specimens	18.00
Range Maximum	25.18	Range Maximum	16.14
Range Minumum	23.26	Range Minumum	14.06

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Table 5.17 - Comparative humeri osteometric data from Funk Island, Ormond Florida and West Greenland.

F e 3RAUKMET.WQ2 2 28 96 2 2F 25

FUNK SLAND, NEWFOUNDLAND CANADA		Date AD 1500-1800	
Greatest ength (GL)		Sm Br of Corpus (SC)	
GL mean	104.10	SC mean	11.74
GL Stand. Deviation	3.33	SC Stand. Deviation	0.88
GL CV	3.20	SC CV	7.46
Number of Specimens	569.00	Number of Specimens	799.00
Range Maximum	115.20	Range Maximum	13.97
Range Minumum	94.72	Range Minumum	8.81
Greatest Br Prox End (Bp)		Greatest Br Distal End (Bd)	
Bp mean	24.67	Bd mean	14.48
Bp Stand. Deviation	1.14	Bd Stand. Deviation	0.89
Bp CV	4.63	Bd CV	6.13
Number of Specimens	628.00	Number of Specimens	639.00
Range Maximum	28.65	Range Maximum	16.77
Range Minumum	20.77	Range Minumum	11.44
Meldgaard (1988: 164)			
GL Mean	104	Note Sample was derived from 1887	
Number of Specimens	58	surface collection from Funk Island, now	
Range Maximum	111	curated at the NMNH	
Range Minimum	99		
ORMOND FLORIDA USA		Date Early Holocene ?	
Greatest ength (GL)		Sm Br of Corpus (SC)	
GL mean	105.04	SC mean	11.16
GL Stand. Deviation	ERR	SC Stand. Deviation	ERR
GL CV	ERR	SC CV	ERR
Number of Specimens	1.00	Number of Specimens	1.00
Range Maximum	105.04	Range Maximum	11.16
Range Minumum	105.04	Range Minumum	11.16
Greatest Br Prox End (Bp)		Greatest Br Distal End (Bd)	
Bp mean	25.78	Bd mean	15.19
Bp Stand. Deviation	ERR	Bd Stand. Deviation	ERR
Bp CV	ERR	Bd CV	ERR
Number of Specimens	1.00	Number of Specimens	1.00
Range Maximum	25.78	Range Maximum	15.19
Range Minumum	25.78	Range Minumum	15.19

WEST GREENLAND (MELDAGAARD 1988:164)		Date AD 1350-1800
GL Mean	104	
Number of Specimens	14	
Range Maximum	109	
Range Minimum	100	

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Table 5.18 - Osteometric data for the great auk humeri sample from the Tjarnargata 4 site.

FILE GRAUKMET NQ2 2 28 96 3 OF 25

Tjarnargata 4 specimen #	Humerus prov.	Measurements in mm. GL	Bo	SC	Bd
Pi1 - L	A Series	101 61	24 1	10 27	14 06
Pi2 - L	A Series	103 97	23.26	9.53	14 15
Pi30 - R		101 9	25 18	10 48	14.06
Pi31 - R				11 89	16 13
Pi32 - R				10 9	15.74
Pi33 - R				11 27	15 94
Pi34 - R				11 81	15 47
Pi35 - R					15.64
Pi36 - R					15 28
Pi37 - R					16.06
Pi38 - L					15.57
Pi39 - L				11 57	14 87
Pi40 - L				12.61	16.14
Pi41 - L				11 77	15.63
Pi42 - L				12 22	15 90
Pi43 - L				12.75	15.54
Pi44 - L				12.27	14.14
Pi45 - L		107 98	24 61	10.54	14 57
ZM. Denmark		102			

Note. The Zoological Museum (ZM) has three specimens belonging to this sample. These include a humerus, a radius and ulna. These remains are reported in Meldgaard (1988: 164).

Meldgaard, M.
1988 The Great Auk, PINGUINUS IMPENNIS (L.) in Greenland.
HISTORICAL BIOLOGY (1 145-178)

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Table 5.19 - Summary statistics of the osteometric data for the great auk radii sample from the Tjarnargata 4 site.

	METRICS (after Von den Dreisch 1976)	
Taxon	Pinguinus impennis L.	
Element	Radius	adult only
Site	TJARNARGATA 4	
Date	1944	
Unit	all	
Strat. Unit	Both Series A & B	
Depth	'Peat Layer'. 202-383 cm BGS	
File	RADGRAUK.WQ2 3/6/96 1 of 3	

TJARNARGATA 4 REYKJAVIK, ICELAND		Date: 1st Sigma AD.778-984, 689-978	
Greatest length (GL)		Breadth of Distal End (Bd)	
GL mean	56.88	Bd mean	6.51
GL Stand. Deviation	2.20	Bd Stand. Deviation	0.36
GL CV	3.86	Bd CV	5.47
Number of Specimens	12.00	Number of Specimens	11.00
Range Maximum	60.48	Range Maximum	6.97
Range Minumum	54.10	Range Minumum	5.57
Sm. Br. of the Corpus (SC)			
SC mean	6.00		
SC Stand. Deviation	0.52		
SC CV	8.73		
Number of Specimens	11.00		
Range Maximum	7.05		
Range Minumum	5.28		

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Table 5.20 - Comparative radii osteoemtric data from Funk Island and West Greenland.

File RADGRAUK NQ2 3 6 96 2 of 3

FUNK ISLAND, NEWFOUNDLAND, CANADA		
GL Mean	55.40	Date: AD 1500-1800
Number of Specimens	50	Meldgaard 1988: 164)
Range Maximum	60	NOTE:Sample was derived from an 1887
Range Minimum	52	surface collection from Funk Island.
		now curated at the NMNH.

WEST GREENLAND MELDGAARD 1988: 164)		
GL Mean	54.00	Date: AD 1350-1800
Number of Specimens	4	
Range Maximum	57	
Range Minimum	52	

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Table 5.21 - Osteometric data for the great auk radii sample from the Tjarnargata 4 site.

FILE RADGRAUK MQ2 3 6 96 3 OF 3

Tjarnargata 4 specimen #	Radius prov	Measurements in mm. GL	SC	Bd
Pi58		60 33	6 29	6.74
Pi59		54 35	6 45	6 36
Pi60		56 07	6 23	6 7
Pi61		56 77	5 4	6 53
Pi62		55 18	5 48	5.57
Pi63		57 98	7 05	6.74
Pi64		54.9	5.69	6.42
Pi65		54 1	5 28	6.34
Pi66		60 48	6 24	6.56
Pi69		58 63	5 95	6.87
Pi70		55 81	5 99	6.73
ZM Denmark		58		

Note. The Zoological Museum (ZM) has three specimens belonging to this sample. These include a numerus, a radius and ulna. These remains are reported in Meldgaard (1988: 164).

Meldgaard, M.
1988 The Great Auk, PINGUINUS IMPENNIS (L.) in Greenland. HISTORICAL BIOLOGY (1 145-178).

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Table 5.22 - Summary statistics for the great auk ulnae sample from the Tjarnargata 4 site.

	METRICS (after Von den Dreisch 1976)	
Taxon	Pinguinus impennis L.	
Element	Ulna	adult only
Site	TJARNARGATA 4	
Date	1944	
Unit	all	
Strat. Unit	Both Series A & B	
Depth	'Peat Layer' 202-383 cm BGS	
File	ULNAGRAU WQ2 3,4/96 1 of 3	

TJARNARGATA 4, REYKJAVIK, ICELAND		Date: 1st Sigma AD 778-984, 689-978	
Greatest length (GL)		Sm. Br. of Corpus (SC)	
GL mean	57.71	SC mean	4.44
GL Stand. Deviation	2.34	SC Stand. Deviation	0.29
GL CV	4.05	SC CV	6.51
Number of Specimens	12.00	Number of Specimens	11.00
Range Maximum	61.80	Range Maximum	5.01
Range Minumum	54.41	Range Minumum	4.01
Greatest Br. Prox. End (Bp)		Greatest Dia. of Distal End (Did)	
Bp mean	10.38	Did mean	10.17
Bp Stand. Deviation	0.75	Did Stand. Deviation	0.44
Bp CV	7.21	Did CV	4.29
Number of Specimens	11.00	Number of Specimens	11.00
Range Maximum	12.29	Range Maximum	10.86
Range Minumum	9.54	Range Minumum	9.43
Greatest Dia. of Prox. End (Dip)			
Dip Mean	16.48		
Dip Stand. Deviation	0.74		
Dip CV	4.47		
Number of Specimens	11.00		
Range Maximum	17.21		
Range Minimum	15.13		

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Table 5.23 - Comparative data for the great auk ulnae sample from Funk Island and West Greenland.

File: ULNGRAU.WQ2 3/4/96 3 of 3

FUNK ISLAND, NEWFOUNDLAND, CANADA		Date: AD. 1500-1800
GL Mean	55.4	(Meldgaard 1988: 164)
Number of Specimen	50	
Range Maximum	60	NOTE: Sample was derived from 1887
Range Minimum	52	surface collection from Funk Island,
		now curated at NMNH.

WEST GREENLAND (Meldgaard 1988: 164)		Date: AD. 1350-1800
GL Mean	55.90	
Number of Specimen	7	
Range Maximum	59	
Range Minimum	54	

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Table 5.24 - Osteometric data for the great auk ulnae sample from the Tjarnargata 4 site.

FILE: ULNAGRAU NO2 3 4 96 2 OF 3

Tjarnargata 4 Ulna specimen #	prov	Measurements in mm. GL	Dip	Bp	SC	Dd
Pi49		55 05	15.64	9 54	4 43	9 43
Pi50		59.34	16.55	10.45	5 01	10 55
Pi51		57 26	16 71	10.3	4 33	10 38
Pi52		61 8	17 21	12.29	4 7	10 96
Pi53		58.3	17.15	10.45	4.45	10.37
Pi54		59 15	17	10 33	4 14	9 83
Pi55		60 01	15.13	10.01	4 76	10 42
Pi56		59 34	17 04	10.86	4 01	10 07
Pi57		56.27	16 7	10.41	4.36	10.46
Pi67		54.41	16.78	9.58	4 36	9 94
Pi68		54.63	15.41	9.92	4 24	9.65
ZM, Denmark		57				

Note: The Zoological Museum (ZM) has three specimens belonging to this sample. These include a humerus, a radius and ulna. These remains are reported in Meldgaard (1988: 164).

Meldgaard, M.
1988 The Great Auk, PINGUINUS IMPPENNIS (L.) in Greenland. HISTORICAL BIOLOGY (1 :45-178).

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Table 5.25 - Summary statistics for the great auk carpometacarpi sample from the Tjarnargata 4 site.

	METRICS (after Von den Dreisch 1976)
Taxon	Pinguinus impennis L.
Element	Carpometcarpus adult only
Site	TJARNARGATA 4
Date	1944
Unit	all
Strat. Unit	Both Series A & B
Depth	'Peat Layer' 202-383 cm BGS
File	CARPGAUK.WQ2 3/6/96 1 of 2

TJARNARGATA 4, REYKJAVIK, ICELAND		Date: 1st Sigma AD 778-984, 689-978	
Greatest length (GL)		Greatest Br. of Prox. End (Bp)	
GL mean	43.73	Bp mean	12.94
GL Stand. Deviation	1.53	Bp Stand. Deviation	0.79
GL CV	3.50	Bp CV	6.08
Number of Specimens	4.00	Number of Specimens	4.00
Range Maximum	45.40	Range Maximum	14.00
Range Minumum	41.78	Range Minumum	12.12
Length of MC II (L)		Diagonal of Distal End (Did)	
L mean	42.60	Did mean	8.53
L Stand. Deviation	1.72	Did Stand. Deviation	0.47
L CV	4.04	Did CV	5.47
Number of Specimens	4.00	Number of Specimens	4.00
Range Maximum	44.64	Range Maximum	8.99
Range Minumum	40.47	Range Minumum	8.05

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Table 5.26 - Osteometric data for the great auk carpometacarpi sample from the Tjarnargata 4 site.

FILE: CARPGAUK.WQ2 3/4/96 2 OF 2

Tjarnargata 4, Carpometacarpus specimen #	prov	GL	Measurements in mm. L	Bp	Did
Pi72		43.42	42.33	12.92	8.87
Pi73		45.4	44.64	14	8.99
Pi74		41.78	40.47	12.12	8.22
Pi75		44.3	42.97	12.7	8.05

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Table 5.27 - Summary statistics for the great auk thoracic vertebrae sample from the Tjarnargata 4 site.

Site	TJARNARGATA 4
Date	944
Unit	1
Strat Unit	Sq m Units A & B
Depth	Feat Layer 4.4-383 cm BGS
File	VERTBACK.WQ2 3-4-96 11:12

TJARNARGATA 4 REYKJAVIK ICELAND	
Physiological Unit Body PL	
PL Mean	94
PL Standard Deviation	1 56
PL CV	1 76
Number of Specimens	1 11
Range Maximum	4 96
Range Minimum	87

Greatest Br across P arm plan SPa	
SPa Mean	1 76
SPa Standard Deviation	96
SPa CV	4 65
Number of Specimens	1 10
Range Maximum	1 96
Range Minimum	1 58

Greatest Br across P arm plan SPacc	
SPacc Mean	1 15
SPacc Standard Deviation	65
SPacc CV	5 34
Number of Specmens	1 10
Range Maximum	1 18
Range Minimum	1 19

Greatest Br across P arm plan SPacc1	
SPacc1 Mean	1 99
SPacc1 Standard Deviation	1 54
SPacc1 CV	5 14
Number of Specimens	1 10
Range Maximum	1 48
Range Minimum	1 49

Greatest Br across P arm plan SPr	
SPr Mean	27 18
SPr Standard Deviation	ERR
SPr CV	ERR
Number of Specimen	10
Range Maximum	27 18
Range Minimum	27 18

Greatest Br across P arm plan mPa	
mPa Mean	1 92
mPa Standard Deviation	11
mPa CV	10
Number of Specimens	1 10
Range Maximum	1 19
Range Minimum	1 33

Greatest Br across P arm plan mPacc	
mPacc Mean	1 33
mPacc Standard Deviation	1
mPacc CV	80
Number of Specimens	1 10
Range Maximum	1 37
Range Minimum	1 1

Greatest Weight Pm	
Pm Mean	23 6
Pm Standard Deviation	ERR
Pm CV	ERR
Number of Specimens	10
Range Maximum	23 6
Range Minimum	23 6

Weight of Vertebral Assemblage	
Mean	7 44
Standard Deviation	3 79
CV	52 18
Number of Specimens	1 30
Range Maximum	1 30
Range Minimum	1 33

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Table 5.28 - Osteometric data for the great auk thoracic vertebrae sample from the Tjarnargata 4 site.

FILE: VERTGAUK.WQ2 3/6/96 2 OF 2

Tjarnargata 4, Thoracic Vertebra Measurements in mm.

specimen #	prov	PL	GLPa	BPacr	BPacd	BPtr
Pi5		11.37	14.81	9.19	9.12	27.08
Pi7		12.46	14.38	10.17	8.28	
Pi8		11.68	14.96	11.08	9.28	

specimen #	prov	BFcr	BFcd	HFcr	HFcd	H	H2
Pi5		8.72	8.58	7.09	10.31		8.32
Pi7		9.11	8.74	6.33	9.55		10.3
Pi8		9.12	9.27	7.03	8.14	23.16	3.03

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Table 5.29 - Summary statistics for the great auk sacrum sample from the Tjarnargata 4 site.

	METRICS (after Von den Dreisch 1976)	
Taxon	Pinguinus impennis L.	
Element	Sacrum	adult only
Site	TJARNARGATA 4	
Date	1944	
Unit	all	
Strat. Unit	Both Series A & B	
Depth	"Peat Layer", 202-383 cm BGS	
File	GAUKSAC.WQ2 3/6/96 1 of 2	

TJARNARGATA 4, REYKJAVIK, ICELAND		Date: 1st Sigma AD.778-984, 689-97
Greatest Length (LV)		
LV mean	95.80	
LV Stand. Deviation	ERR	
LV CV	ERR	
Number of Specimens	1.00	
Range Maximum	95.80	
Range Minumum	95.80	

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Table 5.30 - Osteometric data for the great auk sacrum sample from the Tjarnargata 4 site.

FILE: GAUKSAC.WQ2 3/6/96 2 OF 2

Tjarnargata 4, Sacrum specimen #	prov	LV	Measurements in m
Pi4		95.8	

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Table 5.31 - Summary statistics for the great auk femora sample from the Tjarnargata 4 site.

Taxon	[illegible]
Element	Femur
Site	TJARNARGATA 4
Date	[illegible]
Unit	[illegible]
Stratum	Sum Series A & B
Depth	[illegible]
Fig	[illegible]

TJARNARGATA 4 [illegible] DELANC		Date Cal Sigma AD [illegible]
Greatest Depth Bd		Greatest Br Distal End Bd
Bd Mean	[illegible]	Bd Mean	[illegible]
Bd Standard Deviation	[illegible]	Bd Standard Deviation	[illegible]
Bd CV	[illegible]	Bd CV	[illegible]
Number of Specimens	[illegible]	Number of Specimens	[illegible]
Range Maximum	[illegible]	Range Maximum	[illegible]
Range Minimum	[illegible]	Range Minimum	[illegible]
Medial Length Lm		Greatest Depth Distal End Dd
Lm Mean	[illegible]	Dd Mean	[illegible]
Lm Standard Deviation	[illegible]	Dd Standard Deviation	[illegible]
Lm CV	[illegible]	Dd CV	[illegible]
Number of Specimens	[illegible]	Number of Specimens	[illegible]
Range Maximum	[illegible]	Range Maximum	[illegible]
Range Minimum	[illegible]	Range Minimum	[illegible]

Greatest Br Prox End Bd	
Bd Mean	[illegible]
Bd Standard Deviation	[illegible]
Bd CV	[illegible]
Number of Specimens	[illegible]
Range Maximum	[illegible]
Range Minimum	[illegible]

Greatest Depth of Prox End Dd	
Dd Mean	[illegible]
Dd Standard Deviation	[illegible]
Dd CV	[illegible]
Number of Specimens	[illegible]
Range Maximum	[illegible]
Range Minimum	[illegible]

Smallest Distal End SC	
SC Mean	[illegible]
SC Standard Deviation	[illegible]
SC CV	[illegible]
Number of Specimens	[illegible]
Range Maximum	[illegible]
Range Minimum	[illegible]

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Table 5.32 - Comparative osteometric femora data from Funk Island and West Greenland.

File: FEMGRAUK.WQ2 3/6/95 2 of 2

FUNK ISLAND, NEWFOUNDLAND, CANADA			Date: AD.1500-1800
GL Mean	73	|	(Meldgaard 1988: 164)
Number of Specimens	50	|	NOTE:Sample was derived from an 1887
Range Maximum	79	|	surface collection from Funk Island,
Range Minimum	68	|	now curated at the NMNH.
WEST GREENLAND (MELDGAARD 1988: 164)			
GL Mean	69	|	Date: AD.1350-1800
Number of Specimens	2	|	
Range Maximum	71	|	
Range Minimum	67	|	

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Table 5.33 - Osteometric data for the great auk femora sample from the Tjarnargata 4 site.

FILE FEMGRAUK NQ2 3.6.96 2 OF 3

Tjarnargata 4 Femur — Measurements in mm.

specimen #	prov	GL	Lm	Bp	Dp	SC
Pi22		74.6	72.43	16.48	11.71	6.90
Pi23				14.77	11.18	6.57

specimen #	prov	Bd	Dd
Pi22		15.54	14.51
Pi23			

Note: The Zoological Museum (ZM) has three specimens belonging to this sample. These include a numerus, a radius and ulna. These remains are reported in Meldgaard (1988: 164).

Meldgaard, M.
1988 The Great Auk, PINGUINUS IMPENNIS (L.) in Greenland. HISTORICAL BIOLOGY (1: 145-178).

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Table 5.34 - Summary statistics for the great auk tibiotarsi sample from the Tjarnargata 4 site.

	METRICS (after Von den Dreisch 1976)	
Taxon	Pinguinus impennis L.	
Element	Tibiotarsus	adult only
Site	TJARNARGATA 4	
Date	1944	
Unit	all	
Strat Unit	Both Series A & B	
Depth	"Peat Layer" 202-383 cm BGS	
File	TBGRAUK.WQ2 3/6/96 1 of 2	

TJARNARGATA 4, REYKJAVIK, ICELAND		Date: 1st Sigma AD 778-984, 689-978	
Smallest Br. of Corpus (SC)		Greatest Br. Distal End (Bd)	
SC mean	6.76	Bd mean	12.25
SC Stand. Deviation	0.39	Bd Stand. Deviation	0.56
SC CV	5.70	Bd CV	4.56
Number of Specimens	5.00	Number of Specimens	2.00
Range Maximum	7.23	Range Maximum	12.64
Range Minumum	6.19	Range Minumum	11.85
Depth of Distal End (Dd)			
Dd mean	11.85		
Dd Stand. Deviation	0.20		
Dd CV	1.67		
Number of Specimens	2.00		
Range Maximum	11.99		
Range Minumum	11.71		

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Table 5.35 - Osteoemtric data for the great auk tibiotarsi sample from the Tjarnargata 4 site.

FILE: TIBGRAUK.WQ2 3/6/96 2 OF 2
Measurement in mm.
Tjarnargata 4, Tibiotarsus

specimen #	prov	SC	Bd	Dd
Pi24		6.19	12.64	11.99
Pi25		6.93	11.85	11.71
Pi27		7.23		
Pi28		6.64		
Pi29		6.83		

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Table 5.36 - Summary statistics for the great auk phalanx I sample from the Tjarnargata 4 site.

	METRICS (after Von den Dreisch 1976)
Taxon	Pinguinus impennis L.
Element	Phalanx I adult only
Site	TJARNARGATA 4
Date	1944
Unit	all
Strat. Unit	Both Series A & B
Depth	'Peat Layer' 202-383 cm BGS
File	PHIGRAUK.WQ2 3/6/96 1 of 2

TJARNARGATA 4 REYKJAVIK, ICELAND		Date: 1st Sigma AD 778-984, 689-978	
Greatest Length (GL)		Length art. surface to art. surf. (L)	
GL mean	21.62	L mean	20.22
GL Stand. Deviation	ERR	L Stand. Deviation	ERR
GL CV	ERR	L CV	ERR
Number of Specimens	1.00	Number of Specimens	1.00
Range Maximum	21.62	Range Maximum	20.22
Range Minumum	21.62	Range Minumum	20.22

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Table 5.37 - Osteometric data for great auk phalanx I sample from the Tjarnargata 4 site.

FILE: PHIGRAUK.WQ2 3/6/96 2 OF 2
Measurement in mm.
Tjarnargata 4, Phalanx I

specimen #	prov	GL	L
Pi48		21.62	20.22

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Table 5.38 - Osteometric data for the 1986 materials collected from the Hjallholl site's western erosion face. Measurements are in cm. and follow von den Dreisch (1976).

Species	Bone Element	Measurement	Age
Ovis/Capra	Scapula	SLC-2.18	Adult,
	Scapula	SLC-2.04	Adult,
	Tibia	Bd-2.66	Adult,
	Calcaneus	GL-6.59 GB-1.75	Adult,

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Table 5.39 - Summary of the 1986 materials collected from the Hjallholl site's western erosion face.

Species	NISP	TNF
NISP = 8, TNF = 12, TNB = 20		
Mammalia:		
Ovis/Capra	8	-
Medium terrestrial mammal	-	12
	8	12

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Figure 5.40 - The 1987 core test results from the Hjallholl site. All measurements are in meters below the 1987 ground surface (BGS).

Depth	Comment
Core #1	
0.00-0.10	Turf root zone.
0.10-0.28	Reddish brown soil with organics composed of bone and charcoal.
0.28-0.94	Dark brown peat ash with organics composed of bone, charcoal, and some iron fragments.
0.94-0.96	Possible unidentified tephra?
0.96-1.00	Dark brown peat ash, limit of the core, not cultural stratigraphy.
Core #2	
0.00-0.12	Turf root zone.
0.12-0.26	Reddish brown soil with organics composed of charcoal. Limit of the core, due to hitting a rock, not the limit of the cultural stratigraphy.
Core #3	
0.00-0.20	Turf root zone.
0.20-0.60	Reddish brown soil with organics composed of bone, charcoal and iron fragments.
0.60-0.70	Structural turf.
0.70-1.20	Brown to reddish brown burnt peat ash with organics composed of charcoal and wood fragments. Limit of the core due to hitting a rock not the limit of the cultural stratigraphy.

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Table 5.40 (cont.) - The 1987 core test results from the Hjallholl site.

Depth	Comment
Core #4	
0.00-0.10	Turf root zone.
0.10-0.30	Light brown soil with organics composed of charcoal.
0.30-0.52	Dark brown soil with organics composed of charcoal. Limit of the core due to hitting a rock not the limit of the cultural stratigraphy.
Core #5	
0.00-0.12	Turf root zone.
0.12-0.20	Light brown soil with organics composed of charcoal. Limit of the core due to hitting a rock not the limit of the cultural stratigraphy.
Core #6	
0.00-0.10	Turf root zone.
0.10-0.26	Light brown soil with organics. Limit of the core due to hitting a rock not the limit of the cultural stratigraphy.
Core #7	
0.00-0.12	Turf root zone.
0.12-0.26	Light brown soil with organics composed of charcoal. Limit of the core was due to hitting a rock not the cultural stratigraphy.

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Table 5.41 - List of the Stratigraphic Units for the Hjallholl site. All depths are measured in meters below the 1987 ground surface (BGS), and taken from the southern profile of F8 and G8.

SU/AU	Depth (BGS)	pH

AU 1: Probable Date ca. AD. 1100-1400

1 F8, 0.00-0.44
G8, 0.00-0.20

Grass root zone, the stratum was disturbed by a concrete footing for a radio mast in the northeast corner of grid unit G10. The shallowest depth for this stratum was found atop the concrete footing. Along the north-south axis, running through grid units F8-10, was a first course of a remnant stone wall (see Figure 5.26-5.27).

2 F8, 0.44-0.65
G8, 0.20-0.35

Burnt pinkish-orange peat ash. The stratum contained flecks of charcoal (approximately the size of an American quarter) and fragmentary animal bone. The peat ash covers over the stone wall course which starts approximately 0.45 BGS in grid unit F8. Recovered in this stratum was a worn copper-alloy coin which is typologically consistent with Medieval coins dating approximately AD.1100-1400. The stratum was interpreted as a peat ash dump used to grade over the first course of the stone wall.

3 F8, 0.65-0.70
G8, 0.35-0.36

A sandy sub-strat. containing numerous fragments of animal bone and charcoal. The stratum had a burnt appearance and the charcoal contained macro-plants fossils (twigs, possibly willow). The animal bone was varied in preservation, some being unmodified others being calcine white fragments. The stratum was interpreted as a dump of burnt organics used as a fill layer, which in conjunction with SU 2 and 4 was placed atop the stone wall first encountered in SU 1 in order to make a level surface.

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Table 5.41 (cont.) List of the Stratigraphic Units for the Hjallholl site.

SU/AU	Depth	pH
4	F8, 0.45-0.60	

A lens of burnt, orange peat ash occurring only in grid unit F8. This small lens acts as an interface between SU 4 and 5. The stratum is interpreted as a burnt peat ash dump.

AU2: -

5 F8, 0.70-0.90
G8, 0.36-0.75

This stratum consisted of the first course of stones and fragmentary structural turf packed around the stones. The upper interface of SU 5 exhibited a discontinuous edge with SU 3 in grid unit G8. The structural turf encountered in SU 5 was laid out in a "herring bone" pattern. Large rounded stone cobbles also were encountered, serving as a buttresses for the structural turf. The stratum is interpreted as the first course of a stone and turf wall that was partly disturbed in grid unit G8.

6 F8, 0.70-0.90
G8, 0.65-0.95

This stratigraphic unit is contained within SU 5. It consists of two loose blocks of structural turf (Figure 5.24) which abut against SU 7 and are above SU 8. The turf blocks seem to serve as additional buttresses to the stone and turf wall. The blocks are interpreted as part of a wall collapse of SU 5.

7 G8, 0.75-0.95

This stratum represents the second wall course of the stone and turf wall seen in SU 5. This course had large, well rounded stone cobbles and a definite stacking pattern could be observed with the structural turf. These stones also served as a buttress to the structural turf.

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Table 5.41 (cont.) - List of the Stratigraphic Units for the Hjallholl site.

SU/AU	Depth	pH
8	F8, 0.90-1.00 G8, 0.75-1.10	

The last course of the stone and turf wall as seen in SU 5 and 7. This stratum sat atop a pinkish burnt peat ash (SU 9). No definite turf stacking pattern could be observed. The wall stones consisted of large and well rounded cobbles.

AU 3: - Probable Viking period date

9 F8, 1.00-1.53
G8, 1.03-1.10

A thick stratum of burnt, pinkish peat ash sitting directly below SU 8. In grid units F 8 and G 8, this stratum sits atop SU 11 (a peat ash with silt) and SU 12 (a silt layer). This layer served as a grading fill upon which the stone and turf wall of AU 1 was built. Recovered in this stratum was a non-diagnostic lead fragment (No.30).

10 F8, 1.35-2.36

A hearth situated in grid units F9 and G9 (see Figures 5.31-5.32). The stones around SU 10 are situated horizontally. The hearth contained numerous organics, mostly composed of fish bones and charcoal with plant-macro fossils. The degree of bone preservation is fair. An iron fragment (No. 31) was recovered in this stratum.

AU 4: - Probable Viking period date

11 F8, 1.40-1.60

A turbated stratum that was intermixed with burnt peat ash and river or stream silt. There was a very noticeable texture difference between SU 10 and SU 11. This stratum was interpreted as a turbated fill layer serving to grade or level the interface between AU 3 and AU 4.

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Table 5.41 (cont.) - List of the Stratigraphic Units for the Hjallholl site.

AU/SU	Depth	pH
12	F8, 1.60+	

A culturally sterile stratum consisting of a river silt, most likely forming an early Holocene river terrace. Just below this depth a rounded river pebble was encountered.

13	Approx. 2.00+	

A set of two large rounded stone cobbles were encountered (see Figure 5.24) which were situated under SU 10 (the hearth). These stones were interpreted as the last remnant of a stone wall. There was no evidence of any structural turf.

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Table 5.42 - NISP table for the Hjallholl archaeofauna recovered from Test Cut #1.

HJALLHOLL — Date
UNIT ENTIRE ASSEMBLAGE
FILE NAME HJALLHOL.WQ2

Taxon	NISP	% of whole	% of group	
DOMESTICATES				
Bos taurus	9	0.36	1.00	
Equus caballus	29	1.15	12.39	
Canis familiaris		0.00	0.00	
Sus scrofa	1	0.04	0.44	
Ovis aries		0.00	0.00	
Capra hircus		0.00	0.00	
Ovis/Capra sp.	186	7.41	82.67	
total Ovis/Capra	186	7.41	82.67	
total Domesticates	225	8.96		
SEALS				
Phoca vitulina		0.00	ERR	P. vit.
Pagophilus groenlandicus		0.00	ERR	P. groen.
Large seal		0.00	ERR	L. seal
Phocid sp.	6	0.24		
total Phocid	6	0.24		0
CETACEA				
Great whale		0.00	0.00	
Small whale/porpoise		0.00	0.00	
Cetacea sp.	90	3.58	100.00	
total Cetacea	90	3.58		
OTHER MAMMALS				
Alopex lagopus		0.00		
Ursus maritimus		0.00		
Rangifer tarandus		0.00		
total Other Mammals	0	0.00		
BIRDS				
Wildfowl - sea birds		0.00	ERR	seabird
Wildfowl - land birds		0.00	ERR	land bird
Domestic fowl		0.00	ERR	Dom. fowl
Bird sp.	30	1.19		0
Total Birds	30	1.19		
FISH				
Gadus morhua		0.00	ERR	
Salmo sp.		0.00	ERR	
Other Fish		0.00	ERR	
Fish sp.	2160	86.02		0
Total Fish	2160	86.02		
MOLLUSCA				
Mollusca sp.		0.00		
Total Mollusca	0	0.00		
TOTAL NISP =	2511	100.00		

Major Taxa Relative Percent

	NISP	%
Cattle	9	0.36
Caprines	186	7.41
Horse	29	1.16
Seals	6	0.24
Cetacea	90	3.59
Birds	30	1.20
Fish	2160	86.06

Mammals Relative %

Cattle	9	2.91
Caprines	186	58.13
Horse	29	9.06
Seals	6	1.88
Cetacea	90	28.13

Ratios

Cattle Caprine	1 to	20.67
Cattle Horse	1 to	3.22
Cattle Dogs	1 to	0.00
Goat Sheep	1 to	ERR
Domestic Mammal Ident.Fish	1 to	0.00
Domestic Mammal Seals	1 to	0.03
Domestic Mammal Birds	1 to	0.13
Domestic Fowl Wildfowl	1 to	ERR

NISP	2511
Unidentified Scrap	568
% Identified	74.31
large mammal	24
medium mammal	311
small mammal	33
total L & M mammal	335
ratio M L mammal	33.79
L&M mammal tot.Pisces	0.39

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Table 5.43 - NISP table for the Hjallholl archaeofauna for AU 1, recovered from Test Cut # 1, tentatively dated between AD. 1100-1400.

HJALLHOLL Iceland Date 1987
UNIT AU 1 AD 1100-1400
FILE NAME: HJALLAU1 AQ1 v2.1 95

Taxon	NISP	% of whole	% of group	
DOMESTICATES				
Bos taurus	7	0.39	0.56	
Equus caballus	0	0.00	0.00	
Canis familiaris	0	0.00	0.00	
Sus scrofa	1	0.06	0.08	
Ovis aries	0	0.00	0.00	
Capra hircus	0	0.00	0.00	
Ovis/Capra sp	44	2.20	92.16	
total Ovis/Capra	44	2.20	92.16	
total Domesticates	52	2.84		
SEALS				
Phoca vitulina	0	0.00	ERR	P. vit.
Pagophilus groenlandicus	0	0.00	ERR	P. groen.
Large seal	0	0.00	ERR	L. seal
Phocid sp	6	0.33		
			0	
total Phocid	6	0.33		
CETACEA				
Great whale	0	0.00	0.00	
Small whale/porpoise	0	0.00	0.00	
Cetacea sp	74	4.09	100.00	
total Cetacea	74	4.09		
OTHER MAMMALS				
Alopex lagopus	0	0.00		
Ursus maritimus	0	0.00		
Rangifer tarandus	0	0.00		
total Other Mammals	0	0.00		
BIRDS				
Wildfowl - sea birds	0	0.00	ERR	seabird
Wildfowl - land birds	0	0.00	ERR	land bird
Domestic fowl	0	0.00	ERR	Dom. fowl
Bird sp	4	0.22	0	
Total Birds	4	0.22		
FISH				
Gadus morhua	0	0.00	ERR	
Salmo sp	0	0.00	ERR	
Other Fish	0	0.00	ERR	
Fish sp	1622	89.71	0	
Total Fish	1622	89.71		
MOLLUSCA				
Mollusca sp	0	0.00		
Total Molluscs	0	0.00		
TOTAL NISP =	1808	100.00		

Major Taxa
Relative Percent

	NISP	%
Cattle	7	0.39
Caprines	94	5.20
Horse	0	0.00
Seals	6	0.33
Cetacea	74	4.10
Birds	4	0.22
Fish	1622	89.76
Mammals Relative %		
Cattle	7	3.67
Caprines	44	51.93
Horse	0	0.00
Seals	6	3.31
Cetacea	74	40.88

Ratios

Cattle : Caprine	1 to	13.43
Cattle : Horse	1 to	0.00
Cattle : Dogs	1 to	0.00
Goat : Sheep	1 to	ERR
Domestic Mammal : Ident.Fish	1 to	0.00
Domestic Mammal : Seals	1 to	0.06
Domestic Mammal : Birds	1 to	0.04
Domestic Fowl : Wildfowl	1 to	ERR

NISP	1808
Unidentified Scrap	471
% Identified	79.33
large mammal	22
medium mammal	437
small mammal	12
total L & M mammal	459
ratio M : L mammal	19.86
L&M mammal : tot.Pisces	0.28

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Table 5.44 - NISP table for the Hjallholl archaeofauna for AU 2, recovered from Test Cut #1.

Taxon	NISP	% of whole	% of group
DOMESTICATES			
Bos taurus			
Equus caballus			
Canis familiaris			
Sus scrofa			
Ovis aries			
Capra hircus			
Ovis/Capra sp	30	22.56	100.00
Total Ovis/Capra	30	22.56	100.00
Total Domesticates	30	22.56	
SEALS			
Phoca vitulina			ERR P vit.
Pagophilus groenlandicus			ERR P groen
Large seal			ERR L seal
Phocid sp			
Total Phocid			
CETACEA			
Great whale			
Small whale/porpoise			
Cetacea sp	1	0.75	100.00
Total Cetacea	1	0.75	
OTHER MAMMALS			
Alopex lagopus			
Ursus maritimus			
Rangifer tarandus			
Total Other Mammals	0	0.00	
BIRDS			
Wildfowl - sea birds			ERR seabird
Wildfowl - land birds			ERR land bird
Domestic fowl			ERR Dom. fowl
Bird sp			
Total Birds			
FISH			
Gadus morhua			ERR
Salmo sp			ERR
Other Fish			ERR
Fish sp	44	33.08	
Total Fish	44	33.08	
MOLLUSCA			
Mollusca sp			
Total Mollusca			
TOTAL NISP =	133	100.00	

Major Taxa Relative Percent	NISP	%
Cattle	0	0.00
Caprines	30	22.56
Horse	0	0.00
Seals	0	0.00
Cetacea	1	0.75
Birds	8	6.02
Fish	44	33.08
Mammals Relative %		
Cattle	0	0.00
Caprines	30	46.77
Horse	0	0.00
Seals	0	0.00
Cetacea	1	1.23

Ratios		
Cattle : Caprine	1 to	ERR
Cattle : Horse	1 to	ERR
Cattle : Dogs	1 to	ERR
Goat : Sheep	1 to	ERR
Domestic Mammal : Ident.Fish	1 to	0.68
Domestic Mammal : Seals	1 to	0.00
Domestic Mammal : Birds	1 to	0.27
Domestic Fowl : Wildfowl	1 to	ERR

NISP	133
Unidentified Scrap	46
% Identified	34.08
large mammal	
medium mammal	96
small mammal	
total L & M mammal	96
ratio M : L mammal	ERR
L&M mammal : tot.Pisces	1.02

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Table 5.45 – NISP table for the Hjallholl archaeofauna for AU3, recovered from Test Cut #1.

Taxon	NISP	% relative	% of group		Major Taxa Relative Percent	NISP	
DOMESTICATES							
Bos taurus	2	0.36	2.32				
Equus caballus	29	5.44	40.85		Cattle	2	0.38
Canis familiaris		0	0.00		Caprines	40	7.50
Sus scrofa		0.00	0.00		Horse	29	5.44
Ovis aries		0.00	0.00		Seals	1	0.19
Capra hircus		0.00	0.00		Cetacea	15	2.81
Ovis/Capra sp	40	7.50	56.34		Birds	9	1.69
					Fish	436	82.18
Total Ovis Capra	40	7.50	56.34				
					Mammals Relative %		
Total Domesticates	71	13.32			Cattle	2	2.33
SEALS					Caprines	40	46.51
Phoca vitulina		0.00	ERR	P vit.	Horse	29	33.72
Pagophilus groenlandicus		0.00	ERR	P groen.	Seals	1	1.00
Large seal		0.00	ERR	L seal	Cetacea	15	17.44
Phocid sp		0.00		0			
Total Phocid	1	0.00			Ratios		
CETACEA							
Great whale		0.00	0.00		Cattle Caprine	1 to	20.00
Small whale porpoise		0.00	0.00				
Cetacea sp	15	2.81	100.00		Cattle Horse	1 to	14.50
Total Cetacea	15	2.81			Cattle Dogs	1 to	0.00
OTHER MAMMALS							
Alopex lagopus		0.00			Goat Sheep	1 to	ERR
Ursus maritimus		0.00					
Rangifer tarandus		0.00			Domestic Mammal Ident.Fish	1 to	0.00
Total Other Mammals	1	0.00			Domestic Mammal Seals	1 to	0.00
BIRDS							
Wildfowl sea birds		0.00	ERR	seabird	Domestic Mammal Birds	1 to	0.13
Wildfowl land birds		0.00	ERR	land bird			
Domestic fowl		0.00	ERR	Dom. fowl	Domestic Fowl Wildfowl	1 to	ERR
Bird sp	9	1.69		0			
Total Birds	9	1.69			NISP	533	
FISH					Unidentified Scrap	228	
Gadus morhua		0.00	ERR		% Identified	70.41	
Salmo sp		0.00	ERR		large mammal	2	
Other Fish		0.00	ERR		medium mammal	212	
Fish sp	436	82.18		0	small mammal	21	
Total Fish	436	82.18			total L & M mammal	221	
MOLLUSCA					ratio M L mammal	109.50	
Mollusca sp		0.00			L&M mammal /tot.Pisces	0.50	
Total Mollusca	0	0.00					
TOTAL NISP =	533	100.00					

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Table 5.46 - List of Stratigraphic Units for the Midbaer site's (4505-1) surhey pit (mound "a.").

SU/AU	Relative Depth B.G.S.	pH
AU 3: ca. AD. 1600-1700		
1	0-10cm.	5.75
Turf root zone with brown soil accumulation with charcoal bits.		
2	10-15	5.25
Dark grey peat ash deposit with numerous bird and fish remains. Stratum interpreted as a hearth cleaning dump.		
3	ca. 20	
Discontinuous lens of grey-yellow burnt peat ash. The stratum is thin and spotty and is interpreted as a hearth cleaning dump.		
4	ca. 30	
Discontinuous yellow burnt peat ash lens. Stratum is interpreted as a hearth cleaning dump.		
5	20-40	6.75
Brown earth with numerous animal bones (mammal, bird, fish and mollusks). The bone concentration was dense with little soil; the stratum was not compacted.		
6 & 7	35-45	6.75
Two very similar burnt peat ash strata that contained numerous fire cracked rock and charcoal. Interpreted as a hearth cleaning.		
8	45-60	6.75
A loosely textured, moist, dark brown mottled burnt peat ash deposit containing numerous animal bone and wood chips. Interpreted as domestic refuse.		
9	60-70	6.75
Medium dark brown-grey peat ash deposit with a high density of animal bone and some fire cracked rock. Interpreted as domestic refuse.		

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Table 5.46 (cont.) - List of Stratigraphic Units for the Midbaer site's (4505-1) surhey pit (mound "a.").

SU/AU	Relative Depth B.G.S.	pH	
10	50-65	6.75	A loosely textured grey peat ash layer with white and yellow patches. Stratum contains some fire cracked rock. Interpreted as a hearth cleaning dump.
11 & 12	60-70		Two very similar brown strata containing wood chips, charcoal and numerous bone fragments. Interpreted as domestic refuse.
13	65-70	6.75	High fired yellow peat ash deposit. Interpreted as a hearth cleaning dump.
14 & 15	70-90	6.50	Two very similar mottled strata containing numerous animal remains. These remains include a heavy concentration of fish bone with some mammal remains and small whelks (possibly derived from collected seaweed). Interpreted as domestic refuse.
AU2: ca. AD. 1400-1600			
16	100		Yellow-orange peat ash lens.
17	90-100	6.75	Very loose textured medium to light grey peat ash stratum with numerous burnt fish bone and shell. Interpreted as a hearth cleaning dump.
18 & 19	95-105	6.75	Two very loose textured dark to medium grey ash strata with shell. Interpreted as a hearth cleaning dump.
20 & 21	110-115	6.75	Two very loose textured strata with a density of animal remains and some charcoal. Interpreted as domestic refuse.
22-25	115-160	6.50	A set of strata that was more compact than the strata above. The strata had a medium dark brown color and some contained fire cracked rock. Interpreted as fire cracked rock.

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Table 5.46 (cont.) - List of Stratigraphic Units for the Midbaer site's (4505-1) surhey pit (mound "a.").

SU/AU	Relative Depth B.G.S.	pH	
26	155-160	6.75	Dark grey peat ash layer. Interpreted as a hearth cleaning dump.
27-28	170-185	6.00	Dark grey brown peat ash which contained numerous animal bone remains. Strata was water saturated. Interpreted as domestic refuse.
31	140-145	6.50	Dark grey peat ash stratum. Interpreted as a hearth cleaning dump.
AU 1: ca. AD. 1250-1400			
29-30, 32-33	180-225	6.00	Dark grey peat ash strata which contained numerous animal bone remains. Strata was water saturated. Interpreted as domestic refuse.

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Table 5.47 - Midbaer Shovel Test Descriptions.

Test	Depth	Comment
Shovel Test #1	0-39	Cultural deposits and brown earth.
	40-45	Layer of fire cracked rock.
	46-80	Cultural deposits and brown earth, limit of test.
Shovel Test #2	0-49	Brown earth with little or no cultural deposits.
	50-52	Layer of fire cracked rock with organic remains, limit of test due to the density of fire cracked rock.
Shovel Test #3	0-90	Mixed cultural deposits of burnt peat ash and midden materials. There was no indication of a fire cracked rock layer by the 40-50 cm. level. By 80 cm. the soil became wet to the touch; 90 cm. represents the limit of the shovel test.
Shovel Test #4	0-59	The entire test consisted of rich midden materials similar to the surhey pit strata. There was no indication of a fire cracked rock layer between 40-50 cm. 60-80. The soil became a moist mix of burnt peat ash and wood ash with bone materials.

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Table 5.48 - Summary statistics for Figure 5.59, the reconstructed lengths of the Atlantic Cod.

MIDBAER 1989 DATED C14
11-3-93
FISH LENGTH REGRESSIONS
FILENAME MDBCOORG.WQ1
au 2 CA 1400-1600 AU 3 ca.1500-1700
REGRESSED METRICS

AU	c.1400-1600	c.1600-1700		
PREMAXILLA			PREMAXILLA	
Number of Specimens	14	25	Number of Specimens	25
Mean	691.25	697.92	Mean	697.9237
Standard Deviation	151.13	146.89	Standard Deviation	146.3924
CV			CV	
Range - maximum	1024.99	984.24	Range - maximum	984.2393
Range - minimum	496.38	421.56	Range - minimum	421.5608
DENTARY "A"			DENTARY "A"	
Number of Specimens	10.00	14.00	Number of Specimens	14
Mean	620.55	553.95	Mean	553.9461
Standard Deviation	136.89	79.75	Standard Deviation	79.75424
CV			CV	
Range - maximum	916.52	695.34	Range - maximum	695.336
Range - minimum	442.90	447.70	Range - minimum	447.7034

AU	c.1400-1600 premaxilla	c.1400-1600 dentary	c.1600-1700 premaxilla	c.1600-17 dentary
Number of Specimens	14	10.00	25	14.00
Mean	691.25	620.65	697.92	553.95
Standard Deviation	151.13	136.89	146.89	79.75
CV				
Range - maximum	1024.99	916.52	984.24	695.34
Range - minimum	496.38	442.90	421.56	447.70

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Table 5.49 - NISP table for the Midbaer site.

MIDBAER	[illegible]	Date	1989		Midbaer All Layers		
Da Flatey	UNIT	A			Major Taxa		
All Unit A Combined	Filename	MDBall.sq1			Relative Percent		
Taxon	NISP	% of whole	% of group			NISP	%
DOMESTICATES							
Bos taurus	32	0.36	50.00				
Equus caballus		0.00	0.00		Cattle	32	0.41
Canis familiaris		0.00	0.00		Caprines	30	0.38
Sus scrofa	2	0.02	3.13		Horse	0	0.00
Ovis aries	4	0.04	6.25		Seals	148	1.88
Capra hircus		0.00	0.00		Cetacea	0	0.00
Ovis/Capra sp.	26	0.29	40.63		Birds	1629	20.71
					Fish	5840	74.22
total Ovis/Capra	30	0.33	46.88				
					Mammals Relative %		
total Domesticates	64	0.71			Cattle	32	51.24
SEALS					Caprines	30	48.29
Phoca vitulina	3	0.03	2.03	P. vit.	Horse		0.00
Pagophilus groenlandicus		0.00	0.00	P.groen.	Seals	148	70.48
Large seal		0.00	0.00	L. seal	Cetacea		0.00
Phocid sp.	145	1.62					
				3			
total Phocid	148	1.65			Ratios		
CETACEA							
Great whale		0.00	ERR		Cattle Caprine	1 to	1.04
Small whale.porpoise		0.00	ERR				
Cetacea sp.		0.00	ERR		Cattle Horse	1 to	0.00
total Cetacea	0	0.00			Cattle Dogs	1 to	0.00
OTHER MAMMALS							
Alopex lagopus		0.00			Goat Sheep	1 to	ERR
Ursus maritimus		0.00					
Rangifer tarandus		0.00			Domestic Mammal Ident.Fish	1 to	3.96
total Other Mammals	0	0.00			Domestic Mammal Seals	1 to	2.31
BIRDS							
Wildfowl sea birds		0.00	ERR	seabird	Domestic Mammal Birds	1 to	25.58
Wildfowl land birds		0.00	ERR	land bird			
Domestic fowl		0.00	ERR	Dom. fowl	Domestic Fowl Wildfowl	1 to	ERR
Bird sp.	1629	20.41		0			
					NISP	5961	
Total Birds	1629	20.41			Unidentified Scrap	1642	
FISH					% Identified	82.95	
Gadus morhua	255	3.20	100.00		large mammal	30	
Salmo sp.		0.00	0.00		medium mammal	136	
Other Fish		0.00	0.00		small mammal	1	
Fish sp.	5585	70.00		255	total L & M mammal	210	
					ratio M L mammal	0.20	
Total Fish	5840	95.17			L&M mammal tot.Pisces	0.04	
MOLLUSCA							
Mollusca sp.	1080	12.05					
Total Mollusca	1080	12.05					
TOTAL NISP =	8961	100.00					

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Table 5.50 - NISP table for the Midbaer site, AU 1.

MIDBAER
LOWER LAYERS AU 1

Taxon	NISP	% of whole	% of group	
DOMESTICATES				
Bos taurus	3	1.14	50.00	
Equus caballus		0.00	0.00	
Canis familiaris		0.00	0.00	
Sus scrofa		0.00	0.00	
Ovis aries	1	0.57	25.00	
Capra hircus		0.00	0.00	
Ovis/Capra sp.	1	0.57	25.00	
total Ovis/Capra	3	1.14	50.00	
total Domesticates	16	2.28		
SEALS				
Phoca vitulina	2	0.29	100.00	P. vit.
Pagophilus groenlandicus		0.00	0.00	P. groen.
Large seal		0.00	0.00	L. seal
Phocid sp.	41	5.83		
total Phocid	43	6.13		
CETACEA				
Great whale		0.00	ERR	
Small whale/porpoise		0.00	ERR	
Cetacea sp.		0.00	ERR	
total Cetacea	0	0.00		
OTHER MAMMALS				
Alopex lagopus		0.00		
Ursus maritimus		0.00		
Rangifer tarandus		0.00		
total Other Mammals	0	0.00		
BIRDS				
Wildfowl - sea birds		0.00	ERR	seabird
Wildfowl - land birds		0.00	ERR	land bird
Domestic fowl		0.00	ERR	Dom. fowl
Bird sp.	287	40.94		0
Total Birds	287	40.94		
FISH				
Gadus morhua		0.00	ERR	
Salmo sp.		0.00	ERR	
Other Fish		0.00	ERR	
Fish sp.	243	34.66		0
Total Fish	243	34.66		
MOLLUSCA				
Mollusca sp.	112	15.98		
Total Molluscs	112	15.98		
TOTAL NISP =	701	100.00		

Major Taxa
Relative Percent

	NISP	%
Cattle	3	1.36
Caprines	3	1.36
Horse	0	0.00
Seals	43	7.30
Cetacea	0	0.00
Birds	287	48.73
Fish	243	41.26

Mammals Relative %

Cattle	3	13.56
Caprines	3	13.56
Horse	0	0.00
Seals	43	72.88
Cetacea	0	0.00

Ratios

Cattle Caprine	1 to	1.00
Cattle Horse	1 to	0.00
Cattle Dogs	1 to	0.00
Goat Sheep	1 to	ERR
Domestic Mammal Ident.Fish	1 to	0.00
Domestic Mammal Seals	1 to	2.69
Domestic Mammal Birds	1 to	17.94
Domestic Fowl Wildfowl	1 to	ERR

NISP	701
Unidentified Scrap	455
% Identified	90.64
large mammal	5
medium mammal	26
small mammal	
total L & M mammal	31
ratio M : L mammal	5.20
L&M mammal : tot.Pisces	0.13

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Table 5.51 - NISP table for the Midbaer site, AU 2.

MIDBAER	Iceland		Date:	1999			
a Flatey	UNIT	AAU 2				Major Taxa	
MIDDLE LAYERS	Filename	MDB2WQ'				Relative Percent	
Taxon	NISP	% of sample		% of group			NISP	%
DOMESTICATES								
Bos taurus	16	0.56		9.20				
Equus caballus		0.00		0.00		Cattle	16	0.65
Canis familiaris		0.00		0.00		Caprines	10	0.40
Sus scrota	1	0.04		3.70		Horse	0	0.00
Ovis aries		0.00		0.00		Seals	78	3.16
Capra hircus		0.00		0.00		Cetacea	0	0.00
Ovis/Capra sp.	10	0.36		37.04		Birds	420	37.23
						Fish	1447	58.56
total Ovis/Capra	10	0.36		37.04				
						Mammals Relative %		
total Domesticates	27	0.97				Cattle	16	15.38
SEALS						Caprines	10	9.62
Phoca vitulina	1	0.04		100.00	P vit.	Horse	0	0.00
Pagophilus groenlandicus		0.00		0.00	P groen.	Seals	78	75.00
Large seal		0.00		0.00	L. seal	Cetacea	0	0.00
Phocid sp.	77	2.78						
					1			
total Phocid	78	2.82				Ratios		
CETACEA								
Great whale		0.00		ERR		Cattle Caprinae	1 to	1.63
Small whale/porpoise		0.00		ERR				
Cetacea sp		0.00		ERR		Cattle Horse	1 to	0.00
total Cetacea	0	0.00				Cattle Dogs	1 to	0.00
OTHER MAMMALS								
Alopex lagopus		0.00				Goat Sheep	1 to	ERR
Ursus maritimus		0.00						
Rangifer tarandus		0.00				Domestic Mammal Ident.Fish	1 to	0.00
total Other Mammals	1	0.00				Domestic Mammal Seals	1 to	2.89
BIRDS								
Wildfowl - sea birds		0.00	Egg shell	30.00	seabird	Domestic Mammal Birds	1 to	34.07
Wildfowl - land birds		0.00			land bird			
Domestic fowl		0.00			Dom. fowl	Domestic Fowl Wildfowl	1 to	ERR
Bird sp.	420	33.21			0			
						NISP	2770	
Total Birds	420	33.21				Unidentified Scrap	1286	
FISH						% Identified	68.97	
Gadus morhua		0.00		ERR		large mammal	13	
Salmo sp.		0.00		ERR		medium mammal	76	
Other Fish		0.00		ERR		small mammal	1	
Fish sp.	1447	57.24			0	total L & M mammal	89	
						ratio M L mammal	5.85	
Total Fish	1447	57.24				L&M mammal tot.Pisces	0.06	
MOLLUSCA								
Mollusca sp	298	10.76						
Total Mollusca	298	10.76						
TOTAL NISP =	2770	100.00						

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Table 5.52 - NISP table for the Midbaer site, AU 3.

MIDBAER			Date	
Phase	Unit	Level		
UPPER LAYERS	Filename	MDB3WQ		
Taxon	NISP	% of whole	% of group	
DOMESTICATES				
Bos taurus	9	0.17	40.91	
Equus caballus		0.00	0.00	
Canis familiaris		0.00	0.00	
Sus scrofa	1	0.02	4.55	
Ovis aries		0.00	0.00	
Capra hircus		0.00	0.00	
Ovis Capra sp	12	0.23	54.55	
total Ovis Capra	12	0.23	54.55	
total Domesticates	22	0.42		
SEALS				
Phoca vitulina		0.00	ERR	P vit.
Pagophilus groenlandicus		0.00	ERR	P groen.
Large seal		0.00	ERR	L seal
Phocid sp	24	0.46		
total Phocid	24	0.46		
CETACEA				
Great whale		0.00	ERR	
Small whale porpoise		0.00	ERR	
Cetacea sp		0.00	ERR	
total Cetacea	0	0.00		
OTHER MAMMALS				
Vulpes lagopus		0.00		
Ursus maritimus		0.00		
Rangifer tarandus		0.00		
total Other Mammals	0	0.00		
BIRDS				
Wildfowl sea birds		0.00	ERR	seabird
Wildfowl land birds		0.00	ERR	land bird
Domestic fowl		0.00	ERR	Dom. fow
Bird sp	542	10.37		
Total Birds	542	10.37		
FISH				
Gadus morhua	216	4.13	97.32	
Salmo sp.		0.00	0.00	
Other Fish	6	0.11	2.68	
Fish sp	3736	71.41		224
Total Fish	3960	75.70		
MOLLUSCA				
Mollusca sp.	584	11.16		
Total Mollusca	584	11.16		
TOTAL NISP =	5232	100.00		

Major Taxa Relative Percent	NISP	%
Cattle	9	0.19
Caprines	12	0.26
Horse	1	0.00
Seals	24	0.52
Cetacea	0	0.00
Birds	542	11.56
Fish	3960	84.52
Mammals Relative %		
Cattle	9	20.00
Caprines	12	26.67
Horse	1	2.22
Seals	24	53.33
Cetacea	0	0.00
Ratios		
Cattle Caprine	1 to	1.33
Cattle Horse	1 to	0.11
Cattle Dogs	1 to	0.00
Goat Sheep	1 to	ERR
Domestic Mammal Land	1 to	10.13
Domestic Mammal	1 to	1.69
Domestic Mammal	1 to	29.13
Domestic Fowl Wild	1 to	ERR
NISP	5232	
Unidentified Scrap	361	
% Identified	93.55	
large mammal	13	
medium mammal	76	
small mammal		
total L & M mammal	89	
ratio M L mammal	5.85	
L&M mammal totP	0.02	

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Table 5.53 - NISP table for the Midbaer site, AU 1 and 2.

MIDBAER		Date	
AU Filter	UNIT		
AU 1+2 All Medieval	Filename	MDB1&2.Aq	
Taxon	NISP	% of whole	% of group
DOMESTICATES			
Bos taurus	21	1.57	52.50
Equus caballus		0.00	0.00
Canis familiaris		0.00	0.00
Sus scrofa	1	0.13	2.50
Ovis aries	4	0.11	10.00
Capra hircus		0.00	0.00
Ovis/Capra sp	14	0.38	35.00
total Ovis/Capra	18	0.49	45.00
total Domesticates	40	1.08	
SEALS			
Phoca vitulina	3	0.08	100.00 P vit.
Pagophilus groenlandicus		0.00	0.00 P groen.
Large seal		0.00	0.00 L seal
Phocid sp	116	3.14	
total Phocid	116	3.14	
CETACEA			
Great whale		0.00	ERR
Small whale/porpoise		0.00	ERR
Cetacea sp		0.00	ERR
total Cetacea	0	0.00	
OTHER MAMMALS			
Alopex lagopus		0.00	
Ursus maritimus		0.00	
Rangifer tarandus		0.00	
total Other Mammals	0	0.00	
BIRDS			
Wildfowl sea birds		0.00	ERR seabird
Wildfowl land birds		0.00	ERR land bird
Domestic fowl		0.00	ERR Dom fowl
Bird sp	1197	31.90	
Total Birds	1197	31.90	
FISH			
Gadus morhua	37	1.00	100.00
Salmo sp		0.00	0.00
Other Fish		0.00	0.00
Fish sp	1538	40.97	37
Total Fish	1575	41.97	
MOLLUSCA			
Mollusca sp	495	13.40	
Total Mollusca	495	13.40	
TOTAL NISP =	3693	100.00	

Main Taxa Relative Percent	NISP	%
Cattle	21	0.56
Caprines	13	0.35
Horse	0	0.00
Seals	116	3.14
Cetacea	0	0.00
Birds	1197	32.41
Fish	1575	42.65
Mammals Relative %		
Cattle	21	13.21
Caprines	13	11.01
Horse		0.00
Seals	116	73.58
Cetacea		0.00
Ratios		
Cattle Caprine	1 to	1.62
Cattle Horse	1 to	0.00
Cattle Dogs	1 to	0.00
Goat Sheep	1 to	ERR
Domestic Mammal Ident.Fish	1 to	0.09
Domestic Mammal Seals	1 to	2.58
Domestic Mammal Birds	1 to	29.14
Domestic Fowl Wildfowl	1 to	ERR
NISP	3693	
Unidentified Scrap	1440	
% Identified	71.95	
large mammal	17	
medium mammal	107	
small mammal	1	
total L & M mammal	124	
ratio M : L mammal	9.29	
L&M mammal : totFishes	0.07	

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Table 5.54 - Osteometric data for the Nesstofa (Nes) 1985 samples.
Measurements are in cm. and follow von den Dreisch (1976).

Taxon	Element	Measurement	Age
Context: Bos taurus	Radius	SD-1.67	Neonatal, >6 months
Ovis/Capra	Scapula	SLC-2.09 GLP-2.24 LG -2.51 Bg -2.09	Adult
	Ulna	DPA-2.97 BPC-2.00	Adult, 42+ months
	Radius	BFd-2.63 Bd- 3.40	Adult, 42+ months
	Radius	Bd-3.05	Adult, 42+ months
	Metacarpus	GL-14.00 Bp- 2.50 SD- 1.61 Bd- 2.74	Adult, 24+ months
	Metatarsus	GL-15.02 Bp- 2.10 SD- 1.37 Bd- 2.77	Adult, 24+ months
	Metatarsus	GL-15.06 Bp- 2.20 SD- 1.48 Bd- 2.64	Adult, 24+ months
	Metatarsus	Bp-2.39 SD-1.48	Adult, 24+ months

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Table 5.54 (cont.) - Osteometric data for the Nesstofa (Nes) 1985 samples.

Taxon	Element	Measurement	Age
	Metatarsus	GL-14.05 Bp- 2.33 SD- 1.51 Bd- 2.61	Adult, 24+ months
	Metatarsus	GL-15.05 Bp- 2.35 SD- 1.50 Bd- 2.70	Adult, 24+ months
	Calcaneus	GL-6.14 GB-1.88	Adult, 36+ months
	Astragalus	GL1-3.05 GLm-2.84 D1 -1.71 Dm -1.93 Bd -2.03	Adult
	Astragalus	GL1-2.86 GLm-2.70 D1 -1.59 Dm -1.81 Bd -1.92	Adult
	Astragalus	GL1-3.12 GLm-2.97 D1 -1.85 Dm -1.80 Bd -2.03	Adult
	Phalanx II	GL-2.30 Bp-1.30 SD-1.10	Adult

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Table 5.54 (cont.) - Osteometric data for the Nesstofa (Nes) 1985 samples.

Taxon	Element	Measurement	Age
Context: Under the house floor			
Ovis/Capra	Scapula	GLP-3.63	Adult
	Radius	SD-1.90	Juvenile, <21 months
	Metacarpus	GL-14.11 Bp- 2.74 SD- 1.62 DD- 1.17 Bd- 2.95	Adult, 24+ months
	Innominate	LA-3.53	Adult, 42+ months
	Tibia	Bd-2.66 SD-1.55	Adult, 42+ months
	Metatarsus	GL-15.31 Bp- 2.21 SD- 1.37 DD- 1.19 Bd- 2.51	Adult, 28+ months
	Metatarsus	GL-14.52 Bp- 2.10 SD- 1.34 DD- 1.16 Bd- 2.56	Adult, 28+ months

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Table 5.55 - Summary of the 1985 materials from the interior of the Nesstofa (Nes) house.

Species	NISP	TNF
NISP = 38, TNF = 32, TNB = 70		
Context: -		
Mammalia:		
Bos taurus	1	-
Ovis aries	4	-
Ovis/Capra	12	-
Large terrestrial mammal	-	3
Medium terrestrial mammal	-	24
Aves:		
Stercorarius parasiticus	5	-
Larus argentatus	1	-
	23	27
Context: Under the house floor		
Mammalia:		
Ovis/Capra	13	-
Rattus norvegicus	1	-
Aves:	-	2
Larus sp.	1	-
Pisces:	-	3
	15	5

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Table 5.56 - NISP table for the Nesstofa site, NC trench, Stratigraphic Unit (SU) or Layer 2.

Nesstofa	Iceland	Date	1999	FILE NAME: NST99_DWQ1.xls
Settlement	NST	Midden Layer 2		Major Taxa
		Upper to 10th century		Relative Percent

Taxon	NISP	% of whole	% of group		Major Taxa Relative Percent	NISP	%
DOMESTICATES							
Bos taurus	24	0.42	61.54				
Equus caballus		0.00	0.00		Cattle	24	0.42
Canis familiaris		0.00	0.00		Caprines	15	0.27
Sus scrofa		0.00	0.00		Horse	0	0.00
Ovis aries		0.00	0.00		Seals	1	0.02
Capra hircus		0.00	0.00		Cetacea	0	0.00
Ovis/Capra sp	15	0.27	38.46		Birds	4	0.07
					Fish	5302	93.72
total Ovis/Capra	15	0.27	38.46		Mollusca	311	5.50
					Mammals Relative %		
total Domesticates	39	0.69			Cattle	24	60.00
SEALS					Caprines	15	37.50
Phoca vitulina		0.00	ERR	P vit.	Horse		0.00
Pagophilus groenlandicus		0.00	ERR	P groen.	Seals	1	2.50
Large seal		0.00	ERR	L seal	Cetacea		0.00
Phocid sp.	1	0.02					
				0			
total Phocid	1	0.02			Ratios		
CETACEA							
Great whale		0.00	ERR		Cattle Caprine	1 to	0.63
Small whale/porpoise		0.00	ERR				
Cetacea sp		0.00	ERR		Cattle Horse	1 to	0.00
total Cetacea	0	0.00			Cattle Dogs	1 to	0.00
OTHER MAMMALS							
Alopex lagopus		0.00			Goat Sheep	1 to	ERR
Ursus maritimus		0.00					
Rangifer tarandus		0.00			Domestic Mammal IdentFish	1 to	0.00
total Other Mammals	0	0.00			Domestic Mammal Seals	1 to	0.03
BIRDS							
Wildfowl sea birds		0.00	ERR	seabird	Domestic Mammal Birds	1 to	0.10
Wildfowl land birds		0.00	ERR	land bird			
Domestic fowl		0.00	ERR	Dom. fowl	Domestic Fowl Wildfowl	1 to	ERR
Bird sp	4	0.07		0			
					NISP	5657	
Total Birds	4	0.07			Unidentified Scrap	60	
FISH					% Identified	98.95	
Gadus morhua		0.00	ERR		large mammal	1	
Salmo sp.		0.00	ERR		medium mammal	34	
Other Fish		0.00	ERR		small mammal		
Fish sp	5302	93.72		0	total L & M mammal	35	
					ratio M L mammal	34.00	
Total Fish	5302	93.72			L&M mammal tot.Pisces	0.01	
MOLLUSCA							
Mollusca sp.	311	5.50					
Total Mollusca	311	5.50					
TOTAL NISP =	5657	100.00					

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Table 5.57 - NISP table for the Nesstofa site, NC trench, SU or Layer 3.

[illegible]	[illegible]	Date	[illegible]		FILE NAME: NST99_1.WQ1			
[illegible]	NIT	Midden, Layer 3			Major Taxa			
					Relative Percent			
Taxon	NISP	% Taxonomic	% Taxa group			NISP	%	
DOMESTICATES								
Bos taurus	5	2.11	71.43					
Equus caballus		0.00	0.00		Cattle	5	2.11	
Canis familiaris		0.00	0.00		Caprines	2	0.84	
Sus scrofa		0.00	0.00		Horse	0	0.00	
Ovis aries		0.00	0.00		Seals	0	0.00	
Capra hircus		0.00	0.00		Cetacea	0	0.00	
Ovis Capra sp	2	0.84	28.57		Birds	2	0.84	
					Fish	216	91.14	
total Ovis-Capra	2	0.84	28.57					
					Mammals Relative %			
total Domesticates	7	2.95			Cattle	5	71.43	
SEALS					Caprines	2	28.57	
Phoca vitulina		0.00	ERR	P vit.	Horse		0.00	
Pagophilus groenlandicus		0.00	ERR	P groen.	Seals	0	0.00	
Large seal		0.00	ERR	L seal	Cetacea		0.00	
Phocid sp.		0.00						
				0				
total Phocid	0	0.00			Ratios			
CETACEA								
Great whale		0.00	ERR		Cattle Caprine	1 to	0.40	
Small whale/porpoise		0.00	ERR					
[illegible] sp		0.00	ERR		Cattle Horse	1 to	0.00	
total Cetacea	0	0.00			Cattle Dogs	1 to	0.00	
OTHER MAMMALS								
Alopex lagopus		0.00			Goat Sheep	1 to	ERR	
Vulpes maritimus		0.00						
Rangifer tarandus		0.00			Domestic Mammal Ident.Fish	1 to	0.00	
total Other Mammals	0	0.00			Domestic Mammal Seals	1 to	0.00	
BIRDS								
Anatidae sea birds		0.00	ERR	seabird	Domestic Mammal Birds	1 to	0.29	
Anatidae land birds		0.00	ERR	land bird				
Domestic fowl		0.00	ERR	Dom. fowl	Domestic Fowl Wildfowl	1 to	ERR	
Bird sp	2	0.84		0				
Total Birds	2	0.84			NISP	237		
FISH					Unidentified Scrap	5		
Gadus morhua		0.00	ERR		% Identified	96.73		
Salmo sp		0.00	ERR		large mammal			
Other Fish		0.00	ERR		medium mammal	1		
Fish sp	216	91.14		0	small mammal			
Total Fish	216	91.14			total L & M mammal	1		
MOLLUSCA					ratio M L mammal	ERR		
Mollusca sp	12	5.06			L&M mammal tot.Pisces	0.00		
Total Mollusca	12	5.06						
TOTAL NISP =	237	100.00						

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Table 5.58 - NISP table for the Nesstofa site, NC trench, SU or Layer 5.

Taxon	NISP	% of whole	% of group
DOMESTICATES			
Bos taurus	19	1.91	31.67
Equus caballus		0.00	0.00
Canis familiaris		0.00	0.00
Sus scrofa		0.00	0.00
Ovis aries		0.00	0.00
Capra hircus		0.00	0.00
Ovis/Capra sp	41	4.11	68.33
total Ovis/Capra	41	4.11	68.33
total Domesticates	60	6.02	
SEALS			
Phoca vitulina		0.00	ERR P. vit.
Pagophilus groenlandicus		0.00	ERR P. groen.
Large seal		0.00	ERR L. seal
Phocid sp		0.00	
total Phocid	0	0.00	0
CETACEA			
Great whale		0.00	ERR
Small whale/porpoise		0.00	ERR
Cetacea sp		0.00	ERR
total Cetacea	0	0.00	
OTHER MAMMALS			
Vulpes lagopus		0.00	
Erignathus barbatus		0.00	
Rangifer tarandus		0.00	
total Other Mammals	0	0.00	
BIRDS			
Wildfowl - sea birds		0.00	ERR seabird
Wildfowl - land birds		0.00	ERR land bird
Domestic fowl		0.00	ERR Dom. fowl
Bird sp		0.00	0
Total Birds	0	0.00	
FISH			
Gadus morhua		0.00	ERR
Salmo sp		0.00	ERR
Other Fish		0.00	ERR
Fish sp	391	39.37	0
Total Fish	391	39.37	
MOLLUSCA			
Mollusca sp	40	4.01	
Total Mollusca	40	4.01	
TOTAL NISP =	497	100.00	

FILE NAME: NST_5AQ

Major Taxa Relative Percent

	NISP	%
Cattle	19	2.00
Caprines	41	4.31
Horse	0	0.00
Seals	0	0.00
Cetacea	0	0.00
Birds	0	0.00
Fish	391	43.09

Mammals Relative %

Cattle	19	31.67
Caprines	41	68.33
Horse		0.00
Seals	0	0.00
Cetacea		0.00

Ratios

Cattle : Caprine	1 to	2.16
Cattle : Horse	1 to	0.00
Cattle : Dogs	1 to	0.00
Goat : Sheep	1 to	ERR
Domestic Mammal : Ident.Fish	1 to	0.00
Domestic Mammal : Seals	1 to	0.00
Domestic Mammal : Birds	1 to	0.00
Domestic Fowl : Wildfowl	1 to	ERR

NISP	497
Unidentified Scrap	122
% Identified	59.10
large mammal	18
medium mammal	97
small mammal	
total L & M mammal	55
ratio M : L mammal	3.72
L&M mammal : tot.Pisces	0.10

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Table 5.59 - NISP table for the Nesstofa site, NC trench, SU or Layer 6.

[illegible]	[illegible]	Date:	[illegible]		FILE NAME: NST_[illegible]			
[illegible]	NIT	Midden, Layer 6			Major Taxa			
					Relative Percent			
[illegible]	NISP	% of whole		% of group			NISP	%
MESTICATES								
[illegible]aurus		0.00		0.00				
[illegible]aas [illegible]aballus		0.00		0.00	Cattle		0	0.00
[illegible] familiaris		0.00		0.00	Caprines		3	2.19
[illegible]ota		0.00		0.00	Horse		0	0.00
[illegible]ates		0.00		0.00	Seals		0	0.00
[illegible]a hircus		0.00		0.00	Cetacea		0	0.00
[illegible]apra sp	3	1.72		100.00	Birds		1	0.73
					Fish		133	97.08
[illegible]tal Ovis-Capra	3	1.72		100.00				
					Mammals Relative %			
[illegible]tal Domesticates	3	1.72			Cattle		0	0.00
[illegible]					Caprines		3	100.00
[illegible]a vitulina		0.00		ERR P vit.	Horse			0.00
[illegible]philus groenlandicus		0.00		ERR P groen.	Seals		0	0.00
[illegible]gs seal		0.00		ERR L. seal	Cetacea			0.00
[illegible]id sp		0.00						
				0				
[illegible]total Phocid	0	0.00			Ratios			
[illegible]CEA								
[illegible]tal whale		0.00		ERR	Cattle Caprine		1 to	ERR
[illegible] whale porpoise		0.00		ERR				
[illegible]a sp		0.00		ERR	Cattle Horse		1 to	ERR
[illegible]tal Cetacea	0	0.00			Cattle Dogs		1 to	ERR
[illegible]ER MAMMALS								
[illegible]pus lagopus		0.00			Goat Sheep		1 to	ERR
[illegible] maritimus		0.00						
[illegible]ter arandus		0.00			Domestic Mammal Ident.Fish		1 to	0.00
[illegible]ther Mammals	0	0.00			Domestic Mammal Seals		1 to	0.00
[illegible]								
[illegible]ea birds		0.00		ERR seabird	Domestic Mammal Birds		1 to	0.33
[illegible]land birds		0.00		ERR land bird				
[illegible]l		0.00		ERR Dom. fowl	Domestic Fowl Wildfowl		1 to	ERR
[illegible]	1	0.57		0				
Total Birds	1	0.57			NISP		174	
[illegible]					Unidentified Scrap		0	
[illegible]macchua		0.00		ERR	% Identified		100.00	
[illegible] sp		0.00		ERR	large mammal			
[illegible] Fish		0.00		ERR	medium mammal			
[illegible] sp	133	76.44		0	small mammal			
					total L & M mammal		0	
Total Fish	133	76.44			ratio M L mammal		ERR	
[illegible]LLUSCA					L&M mammal tot.Pisces		0.00	
[illegible]ella sp	37	21.26						
Total Mollusca	37	21.26						
[illegible] NISP =	174	100.00						

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Table 5.60 - NISP table for the Nesstofa site, NC trench, SU or Layer 7.

Nesstofa — Date — FILE NAME: NST_NC_...
Settlarnarnes — Midden Layer 7 — Major Taxa Relative Percent

Taxon	NISP	% of whole	% of group			NISP	%
DOMESTICATES							
Bos taurus		0.00	0.00				
Equus caballus		0.00	0.00		Cattle	0	0.00
Canis familiaris		0.00	0.00		Caprines	5	5.07
Sus scrofa		0.00	0.00		Horse	0	0.00
Ovis aries		0.00	0.00		Seals	0	0.00
Capra hircus		0.00	0.00		Cetacea	0	0.00
Ovis/Capra sp	5	5.32	100.00		Birds	0	0.00
					Fish	54	54.33
total Ovis/Capra	5	5.32	100.00				
					Mammals Relative %		
total Domesticates	5	5.32			Cattle	0	0.00
SEALS					Caprines	5	100.00
Phoca vitulina		0.00	ERR	P. vit.	Horse		0.00
Pagophilus groenlandicus		0.00	ERR	P. groen.	Seals	0	0.00
Large seal		0.00	ERR	L. seal	Cetacea		0.00
Phocid sp.		0.00					
				0			
total Phocid	0	0.00			Ratios		
CETACEA							
Great whale		0.00	ERR		Cattle : Caprine	1 to	ERR
Small whale/porpoise		0.00	ERR				
Cetacea sp.		0.00	ERR		Cattle : Horse	1 to	ERR
total Cetacea	0	0.00			Cattle : Dogs	1 to	ERR
OTHER MAMMALS							
Alopex lagopus		0.00			Goat : Sheep	1 to	ERR
Ursus maritimus		0.00					
Rangifer tarandus		0.00			Domestic Mammal : Ident.Fish	1 to	0.00
total Other Mammals	0	0.00			Domestic Mammal : Seals	1 to	0.00
BIRDS							
Wildfowl : sea birds		0.00	ERR	seabird	Domestic Mammal : Birds	1 to	0.00
Wildfowl : land birds		0.00	ERR	land bird			
Domestic fowl		0.00	ERR	Dom. fowl	Domestic Fowl : Wildfowl	1 to	ERR
Bird sp		0.00		0			
Total Birds	0	0.00			NISP	95	
FISH					Unidentified Scrap	12	
Gadus morhua		0.00	ERR		% Identified	88.79	
Salmo sp.		0.00	ERR		large mammal		
Other Fish		0.00	ERR		medium mammal		
Fish sp	54	88.42		0	small mammal		
					total L & M mammal	0	
Total Fish	54	88.42			ratio M : L mammal	ERR	
MOLLUSCA					L&M mammal : tot.Pisces	0.00	
Mollusca sp	5	5.26					
Total Mollusca	5	5.26					
TOTAL NISP =	95	100.00					

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Table 5.61 - NISP table for the Nesstofa site, NC trench, SU or Layer 8.

[illegible]	[illegible]	Date	1986	FILE NAME: NST[illegible]
Northern Isles	UNIT	Midden Layer 8		Main Taxa
				Relative Percent

Taxon	NISP	% of whole	% of group			NISP	%
DOMESTICATES							
Bos taurus		0.00	0.00				
Equus caballus		0.00	0.00		Cattle	0	0.00
Canis familiaris		0.00	0.00		Caprines	3	2.94
Sus scrofa		0.00	0.00		Horse	0	0.00
Ovis aries		0.00	0.00		Seals	0	0.00
Capra hircus		0.00	0.00		Cetacea	0	0.00
Ovis/Capra sp.	3	2.94	100.00		Birds	0	0.00
					Fish	99	97.06
total Ovis/Capra	3	2.94	100.00				
					Mammals Relative %		
total Domesticates	3	2.94			Cattle	0	0.00
SEALS					Caprines	3	100.00
Phoca vitulina		0.00	ERR P vit.		Horse		0.00
Pagophilus groenlandicus		0.00	ERR P groen.		Seals	0	0.00
Large seal		0.00	ERR L. seal		Cetacea		0.00
Phocid sp		0.00					
				0			
total Phocid	0	0.00			Ratios		
CETACEA							
Great whale		0.00	ERR		Cattle Caprinae	1 to	ERR
Small whale porpoise		0.00	ERR				
Cetacea sp		0.00	ERR		Cattle Horse	1 to	ERR
total Cetacea	0	0.00			Cattle Dogs	1 to	ERR
OTHER MAMMALS							
Alopex lagopus		0.00			Goat Sheep	1 to	ERR
Ursus maritimus		0.00					
Rangifer tarandus		0.00			Domestic Mammal Ident.Fish	1 to	0.00
total Other Mammals	0	0.00			Domestic Mammal Seals	1 to	0.00
BIRDS							
Wildfowl - sea birds		0.00	ERR seabird		Domestic Mammal Birds	1 to	0.00
Wildfowl - land birds		0.00	ERR land bird				
Domestic fowl		0.00	ERR Dom. fowl		Domestic Fowl Wildfowl	1 to	ERR
Bird sp.		0.00		0			
					NISP	102	
Total Birds	0	0.00			Unidentified Scrap	8	
FISH					% Identified	92.73	
Gadus morhua		0.00	ERR		large mammal		
Salmo sp		0.00	ERR		medium mammal	1	
Other Fish		0.00	ERR		small mammal		
Fish sp.	99	97.06		0	total L & M mammal	1	
					ratio M L mammal	ERR	
Total Fish	99	97.06			L&M mammal tot.Pisces	0.01	
MOLLUSCA							
Mollusca sp		0.00					
Total Mollusca	0	0.00					
TOTAL NISP =	102	100.00					

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Table 5.62 - NISP table for the Nesstofa site, NC trench, SU or Layer 9.

... ta	...eland	Date	...ess	FILE NAME: NST_...WQ1 ...1205
...rnames	UNIT	Midden Layer 9		Major Taxa
				Relative Percent

... n	NISP	% of whole	% of group			NISP	%
MESTICATES							
...aurus	1	1.79	25.00				
...us caballus		.00	.00		Cattle	1	1.82
... familiaris		.00	.00		Caprinae	2	3.64
...ota	1	1.79	25.00		Horse	0	.00
...ries		.00	.00		Seals	0	.00
...a hircus		.00	.00		Cetacea	0	.00
... Capra sp	2	3.57	.00		Birds	1	1.82
					Fish	51	92.73
...tal Ovis Capra	2	3.57	50.00				
					Mammals Relative %		
...tal Domesticates	4	7.14			Cattle	1	33.33
ALS					Caprinae	2	66.67
...a vitulina		.00	ERR	P vit.	Horse	0	.00
...phalus groenlandicus		.00	ERR	P groen.	Seals	0	.00
...e seal		.00	ERR	L seal	Cetacea		.00
... sp		.00					
				0			
...tal Phocid	0	.00			Ratios		
ACEA							
...whale		.00	ERR		Cattle Caprine	1 to	2.00
...whale porpoise		.00	ERR				
... sp		.00	ERR		Cattle Horse	1 to	.00
...tal Cetacea	0	.00			Cattle Dogs	1 to	.00
...R MAMMALS							
...lagopus		.00			Goat Sheep	1 to	ERR
... maritimus		.00					
...ter tarandus		.00			Domestic Mammal Ident.Fish	1 to	.00
...tal Other Mammals	0	.00			Domestic Mammal Seals	1 to	.00
...S							
...wl sea birds		.00	ERR	seabird	Domestic Mammal Birds	1 to	0.25
...wl land birds		.00	ERR	land bird			
...stic fowl		.00	ERR	Dom. fowl	Domestic Fowl Wildfowl	1 to	ERR
... p	1	1.79		0			
					NISP	56	
Total Birds	1	1.79			Unidentified Scrap	0	
					% Identified	90.32	
...us morhua		.00	ERR		large mammal		
... sp		.00	ERR		medium mammal		
... Fish		.00	ERR		small mammal		
...	51	91.07		0	total L & M mammal	0	
					ratio M L mammal	ERR	
Total Fish	51	91.07			L&M mammal tot.Pisces	.00	
LLUSCA							
...ella sp		.00					
Total Mollusca	0	.00					
AL NISP =	56	100.00					

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Table 5.63 - NISP table for the Nesstofa site, NC trench, SU or Layer 10.

Nesstofa	Iceland	Date	1999	FILE NAME: NST_10.AQ1 +1395		
Settlements	UNIT	Midden Layer 10		Major Taxa		
				Relative Percent		
Taxon	NISP	% of whole	% of group		NISP	%
DOMESTICATES						
Bos taurus	3	1.32	60.00			
Equus caballus		0.00	0.00	Cattle	3	1.59
Canis familiaris		0.00	0.00	Caprines	*	3.70
Sus scrofa		0.00	0.00	Horse	0	0.00
Ovis aries		0.00	0.00	Seals	0	0.00
Capra hircus		0.00	0.00	Cetacea	0	0.00
Ovis/Capra sp	*	3.08	40.00	Birds	2	1.06
				Fish	177	93.65
Total Ovis/Capra	*	3.08	40.00			
				Mammals Relative %		
Total Domesticates	10	4.41		Cattle	3	50.00
SEALS				Caprines	*	40.00
Phoca vitulina		0.00	ERR	Horse		0.00
Pagophilus groenlandicus		0.00	ERR	Seals	0	0.00
Large seal		0.00	ERR	Cetacea		0.00
Phocid sp.		0.00				
total Phocid	0	0.00		Ratios		
CETACEA						
Great whale		0.00	ERR	Cattle Caprine	1 to	2.33
Small whale/porpoise		0.00	ERR			
Cetacea sp		0.00	ERR	Cattle Horse	1 to	0.00
total Cetacea	0	0.00		Cattle Dogs	1 to	0.00
OTHER MAMMALS						
Alopex lagopus		0.00		Goat Sheep	1 to	ERR
Ursus maritimus		0.00				
Rangifer tarandus		0.00		Domestic Mammal IdentFish	1 to	0.00
total Other Mammals	0	0.00		Domestic Mammal Seals	1 to	0.00
BIRDS						
Wildfowl sea birds		0.00	ERR	Domestic Mammal Birds	1 to	0.20
Wildfowl land birds		0.00	ERR			
Domestic fowl		0.00	ERR !	Domestic Fowl Wildfowl	1 to	ERR
Bird sp.	2	0.88				
				NISP	227	
Total Birds	2	0.88		Unidentified Scrap	10	
FISH				% Identified	95.78	
Gadus morhua		0.00	ERR	large mammal		
Salmo sp.		0.00	ERR	medium mammal		
Other Fish		0.00	ERR	small mammal		
Fish sp	177	77.97		total L & M mammal	0	
				ratio M L mammal	ERR	
Total Fish	177	77.97		L&M mammal tot.Pisces	0.00	
MOLLUSCA						
Mollusca sp.	38	16.74				
Total Mollusca	38	16.74				
TOTAL NISP =	227	100.00				

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Table 5.64 - NISP table for the Nesstofa site, NC trench, SU or Layer 11.

Nesst 11		Date		FILE NAME: NST99_11.WQ1
Settlements	UNIT	Midden Layer 11		Major Taxa
				Relative Percent
Taxon	NISP	% of whole	% of group	

					NISP	%
DOMESTICATES						
Bos taurus		0.00	ERR			
Equus caballus		0.00	ERR	Cattle	0	0
Canis familiaris		0.00	ERR	Caprines	0	0
Sus scrofa		0.00	ERR	Horse	0	0
Ovis aries		0.00	ERR	Seals	0	0
Capra hircus		0.00	ERR	Cetacea	0	0
Ovis/Capra sp		0.00	ERR	Birds	3	1
				Fish	204	84
total Ovis/Capra	0	0.00	ERR	Mollusca	34	14
				Mammals Relative %		
total Domesticates	0	0.00		Cattle	0	ER
SEALS				Caprines	0	ER
Phoca vitulina		0.00	ERR P vit.	Horse		ER
Pagophilus groenlandicus		0.00	ERR P groen.	Seals	0	ER
Large seal		0.00	ERR L. seal	Cetacea		ER
Phocid sp		0.00				
			0			
total Phocid	0	0.00		Ratios		
CETACEA						
Great whale		0.00	ERR	Cattle Caprine	1 to	ER
Small whale/porpoise		0.00	ERR			
Cetacea sp		0.00	ERR	Cattle Horse	1 to	ER
total Cetacea	0	0.00		Cattle Dogs	1 to	ER
OTHER MAMMALS						
Alopex lagopus		0.00		Goat Sheep	1 to	ER
Ursus maritimus		0.00				
Rangifer tarandus		0.00		Domestic Mammal Ident.Fish	1 to	ER
total Other Mammals	0	0.00		Domestic Mammal Seals	1 to	ER
BIRDS						
Wildfowl: sea birds		0.00	ERR seabird	Domestic Mammal Birds	1 to	ER
Wildfowl: land birds		0.00	ERR land bird			
Domestic fowl		0.00	ERR Dom. fowl	Domestic Fowl Wildfowl	1 to	ER
Bird sp	3	1.24	0			
				NISP	241	
Total Birds	3	1.24		Unidentified Scrap	3	
FISH				% Identified	99.79	
Gadus morhua		0.00	ERR	large mammal	4	
Salmo sp.		0.00	ERR	medium mammal	3	
Other Fish		0.00	ERR	small mammal		
Fish sp	204	84.65	0	total L & M mammal	7	
				ratio M : L mammal	0.75	
Total Fish	204	84.65		L&M mammal tot.Pisces	0.03	
MOLLUSCA						
Mollusca sp	34	14.11				
Total Mollusca	34	14.11				
TOTAL NISP =	241	100.00				

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Table 5.65 - NISP table for the Nesstofa site, NC trench, SU or Layer 12.

Taxon	NISP	% of whole	% of group
DOMESTICATES			
Bos taurus	[illegible]	[illegible]	29.41
Equus caballus	0	0.00	0.00
Canis familiaris	0	0.00	0.00
Sus scrofa	0	0.00	0.00
Ovis aries	0	0.00	0.00
Capra hircus	0	0.00	0.00
Ovis/Capra sp.	12	0.82	70.59
total Ovis/Capra	12	0.82	70.59
total Domesticates	17	1.16	
SEALS			
Phoca vitulina	0	0.00	ERR
Pagophilus groenlandicus	0	0.00	ERR
Large seal	0	0.00	ERR
Phocid sp	0	0.00	
total Phocid	0	0.00	
CETACEA			
Great whale	0	0.00	ERR
Small whale/porpoise	0	0.00	ERR
Cetacea sp	0	0.00	ERR
total Cetacea	0	0.00	
OTHER MAMMALS			
Alopex lagopus	0	0.00	
Ursus maritimus	0	0.00	
Rangifer tarandus	0	0.00	
total Other Mammals	0	0.00	
BIRDS			
Wildfowl - sea birds	0	0.00	ERR seabird
Wildfowl - land birds	0	0.00	ERR land bird
Domestic fowl	0	0.00	ERR Dom fowl
Bird sp	3	0.20	
Total Birds	3	0.20	
FISH			
Gadus morhua	0	0.00	ERR
Salmo sp	0	0.00	ERR
Other Fish	0	0.00	ERR
Fish sp	400	27.29	
Total Fish	400	27.29	
MOLLUSCA			
Mollusca sp	1046	71.35	
Total Mollusca	1046	71.35	
TOTAL NISP =	1466	100.00	

Taxon	NISP	%
Cattle	[illegible]	1.34
Caprines	12	0.82
Horse	0	0.00
Seals	0	0.00
Cetacea	0	0.00
Birds	3	0.20
Fish	400	27.29
Mollusca	1046	71.35
Mammals Relative %		
Cattle	[illegible]	29.41
Caprines	12	[illegible]
Horse		0.00
Seals	0	0.00
Cetacea		0.00

Ratios		
Cattle Caprine	1 to	2.8
Cattle Horse	1 to	0.0
Cattle Dogs	1 to	0.0
Goat Sheep	1 to	ERR
Domestic Mammal Ident.Fish	1 to	0.0
Domestic Mammal Seals	1 to	0.0
Domestic Mammal Birds	1 to	0.1
Domestic Fowl Wildfowl	1 to	ERR

NISP	1466
Unidentified Scrap	0
% Identified	47.34
large mammal	
medium mammal	4
small mammal	
total L & M mammal	4
ratio M L mammal	ERR
L&M mammal tot.Pisces	0.01

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Table 5.66 - Summary of the NISP recovered from the NC trench at the Nesstofa site. The listing is according to the Stratigraphic Unit or Layer designation.

NESSTOFA 1989 MIDDEN SAMPLE FILE NAME NSTSUMRY NOV 9 14:55 1CF4

SUMMARY OF IDENTIFIED SPECIMENS

LAYERS TAXA	2	3 4	5	6	7	8	9	10	11	12	TOTAL
DOMESTICATES											
Bos taurus	24	5	19				1	3		5	52
Sus scrofa							1				1
Ovis/Capra sp.	15	2	41	3	6	3	2	7		12	79
total Domesticates	39	7	60	3	6	3	4	10	0	17	132
SEALS											
Phocid sp.	1										1
BIRDS											
Bird sp.	4	2		1			1	2	3	3	13
FISH											
Fish sp.	5302	216	991	133	84	99	51	177	204	400	7157
MOLLUSCA											
Mollusca sp.	311	12	46	37	5			38	34	1046	483
TOTAL NISP =	5657	237	997	174	95	102	56	227	241	1483	7786
Ratios											
Cattle:Caprine	0.63	0.4	2.16	ERR	ERR	ERR	2	2.33	ERR	2.4	1.52
Fish: Domestic	136	30.9	14.9	44.3	14	33	12.8	17.7	ERR	23.5	54.2
Fish:Mollusca	17	18	19.4	3.59	16.8	ERR	ERR	4.66	6	0.38	14.8

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Table 5.67 - Summary of the NISP recovered from the NC trench at the Nesstofa site. The listing is according to the Analytic Unit.

NESSTOFA 1989 MIDDEN SAMPLE FILE NAME NSTSUMRY WQ1

SUMMARY OF IDENTIFIED SPECIMENS

LAYERS	Upper (A-E)	Middle (F-G)	Lower(I-N)
TAXA			
DOMESTICATES			
Bos taurus	29	19	9
Sus scrofa	0	0	1
Ovis/Capra sp	17	44	30
total Domesticates	46	63	40
SEALS			
Phocid sp.	1	0	0
BIRDS			
Bird sp.	6	1	9
FISH			
Fish sp.	5518	1024	1015
MOLLUSCA			
Mollusca sp.	323	83	1123
TOTAL NISP =	5894	1171	2187
ratios			
Cattle Caprine	0 59	2 32	3 33
Fish Domestic	119 96	16 25	25 38
Fish Mollusca	17 08	12.34	0 90

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Table 5.68 - List of the Stratigraphic Units found at the Akurvik site (4901-1), Arneshreppur, Strandasysla, northwestern Iceland.

List of Stratigraphic Units
Akurvik Arneshreppur Strandasysla NW Iceland

Table number (text) 1 Akurvik 1990 Excavations
for 1 ARCHAEOLOGY/ECONOMY PROJECT

Unit #	AU	UNITS	PROFILE	Munsell #	Description	Interpretation
1		mid 90	11 E/M 2	6.25	Living turf and roots 1990	modern surface w/ sterile drift sand
2		mid 90	11 E/M 2		Grey shell sand w/ faint bands of peat, old turf surf	Wind dep sand post occupational accumulation
3		mid 90	11 E/M 2		Thin dk brown black, w/ some charcoal flecks	Former turf surface, partly cultural?
4		mid 90	11 E/M 2		Grey shell sand	Natural wind deposit, sterile
5		mid 90	9 only E/M 2		Dk brown - black organic	Former turf surface, little cultural component
6		mid 90	9 only E/M 2		Grey shell sand	Natural wind deposit sterile
7		mid 90 mid 105	11 E/M 2	6.5 10YR 2.5/2	Dk med brown organic layer w/ fishbone & patches of orange brown peat ash. Runs the full length of the emerson face and appears in the 9 profile as well. Layer also in the source of the peat mold in the N section at 9 A100	A thin midden layer, probably deposited by structure A or roughly contemporary struct
8	Not assigned					
9	Not assigned					
10	Not assigned					
11		mid 90	11 E/M 2	6.5 7.5YR 6	Grey shell sand	Natural wind deposit sterile
12		mid 90	11 E/M 2		Dk brown organic horizon	Former turf surface, partly cultural?
13	Not assigned					
14		mid 90	9 only E/M 2		Grey shell sand	Natural wind deposit, sterile
15		mid 100	11 E/M 2	6.5 10YR 3/2	Densely packed bird, fish & mammal bone Med Brown sandy matrix 8m to fill 22	Midden spread from Structure I (1990 91)
16	Not assigned					
17	Not assigned					
18	Not assigned					
19	Not assigned					
20	Not assigned					
21	A 91 92		11 E/M 2	10YR 2.5/2	Compact layer of bone, charcoal peat ash & fire cracked rock. The surface extended ca. 20 cm into the A 91 unit	Possible surface outside Structure G or dump of fire-cleaning debris
22		640 105	11 E/M 2	6.25 10YR 4/1	Major deposit of bone, peat ash, charcoal & fire cracked rock. Extends across whole N profile then to the east of S 100	Midden, probably generated by Structure G
23		S R 96 96	11 E/M 2	6 10YR 3/6 to 3/4	Turf wall with sand lenses at the base of the layer	Wall of Structure F
24	Not assigned					
25	Not assigned					
26		N S 96 97	11 E/M 2	6.25 10YR N/4	Densely packed layer of fish and whale bone w/ peat ash	Fill of Structure F immediately after abandonment
27		640 91	11 E/M 2	7 10 YR 7/1	Grey shell sand	Sterile subsoil, penetrated by footings of Structure G
28	Not assigned					
29		A S 96 97	11.12 E/M 2	6 10YR N/8 & 7/8	Hard packed surface of peat ash & wood charcoal	Upper floor layer, Structure F
30		A S 96 97	11.12 E/M 2	6 10 YR 8/8	Hard packed surface of peat ash & wood charcoal	Lower Floor layer of Structure F

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Table 5.68 (cont.) - List of the Stratigraphic Units found at the Akurvik site (4901-1), Arneshrteppur, Strandasysla

List of Stratigraphic Units
Akurvik Arneshreppur, Strandasysla, NW Iceland

Site number 4901 1 Akurvik, 1990 Excavations
IT 11 AKVK PALEOECONOMY PROJECT

SU #	AU	UNITS	PROFILE	PLAN	pH	Munsell #	Description	Interpretation
11		11 8 95 97	11,12	EDM 2			Lens of sterile grey sand between floor layers 29 & 30	Drift sand deposited between occupation phases of Structure F
12		Not assigned						
13		11 99 100	11	EDM 2	8.75	10YR 8/1	Grey shell sand	Drift sand deposited between Structure F wall fall and the SU 22 midden flow
14		11 8 100 104	11	EDM 2			Thin (c. 3 cm maximum) layer of grey green pumice. Pieces are small ca. 2-4 mm, also ca. 1 cm long. They cover a natural sand surface which is truncated by the first known culture layer (SU 24) in R 100	Volcanic deposit, held identified as O 1362
15		11 8 100 108	11	EDM 2		10YR 7/2 - 7/6	Natural series of very similar med brown layers divided by layers of grey drift sand. Deposits are darker and more closely spaced than upper sand/turf layers, suggests a more stable beach dune environment in more distant past	Natural subsoil (sterile) predating occupation
16		8 100 110	11	EDM 2		10YR 2/1	Dark blackish ash. Tephra?	volcanic deposit
17		8 100 110	11	EDM 2		10YR 3/4	Grey green to yellow brown surface. Tephra?	possible volcanic deposit
18		890 91	11	EDM 2			Vertebra (lumbar) of a great whale, nearly complete. Buried into subsoil from level of SU's 38-40	Foundation footing for Structure G
19		890 91	11	EDM 2	8.75	10YR 6/6 6/8	Turf wall and wall fall, w/ grey sand attached to turves. Note association with whalebone frag's buried into SU 28	Collapsed wall (corner?) of structure generating SU 18, 21, 22 midden
20		891 92 93	11	EDM 2		10YR 2/1	Widespread wood charcoal layer, w/ bone & shell. Extends into fill of whalebone footing (SU 38)	Not in situ hearth, probably hearth cleaning
21		892 93	11	EDM 2	7	10YR 7/2	Medium-Light Grey Shell sand	Wind deposited sterile fill covers SU 13 & 22
22		1190 99	11	EDM 2		10YR 2/2	Dk. brown - black organic layer	Possibly cultural but more likely a natural loess turf surface
23		890 8100	11	EDM 2	8.5	10YR 7/1	Grey shell sand	wind deposited natural layer
24		891	11	EDM 2	8.75	10YR 3/4	Mottled peat ash & charcoal deposit	Possibly a bit of floor under SU 31 wall of Structure G, or empty part of the fill of the whalebone footing trench
25		8 90 91	11	EDM 2	8.5		Dk. Brown deposit with much fish bone	Midden
26		11 97		EDM 2	8	10YR 4/2	Fill of peat mold cutting through wall of	Intrusive peat mold turn around the SU 7 level

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Table 5.68 (cont.) - List of the Stratigraphic Units found at the Akurvik site (4901-1). Arneshreppur, Strandasysla.

NO TABLE

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Table 5.69 - Artifact inventory list for the Akurvik site.

SELECTED 1996												
0	1	2	3	4	5	6	7	8	9	10	11	
ARTIFACT UNIT		SQUARE	AB	SU	LEVEL	DATE	N	E	DEPTH	ARTIFACT	MAT	DESCR
A1		R93		21		7-21-10					FE	NAIL
A2		R93		15		7-21-10	1	60			BZ	SHEET
A3		R94		22		7-21-10					BZ	SHEET
A4		R93		22		7-24-10	0	55			BZ	OBJ
A5		R92		15		7-21-10	5	80			FE	NAIL
A6		R96		22		7-26-90					STONE	FLAKE
A7		Q97		22		7-26-90					FE	NAIL
A8		R97		22		7-26-90					FE	NAIL
A9		R97		22		7-26-90					FE	NAIL
A10		R98		26	FLOOR	7-27-90	4	30			FE	OBJ
A11		R91		22		7-27-90					FE	OBJ
A12		R91		22		7-27-90					FE	ROVE
A13		R92		22		7-27-90	51	54			FE	OBJ
A14		R92		21		7-27-90	11	21			FE	OBJ
A15		R90		22		7-28-90	0	35			WBONE	BLANK
A16		Q96		24		7-30-90					WBONE	BLANK

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Table 5.70 - Summary of the artifact categories recovered from the Akurvik site.

Aukurvik 1990		FINDS REGISTER	
4901-1	Arneshreppur		
TOTAL FINDS	16		
		%	
Iron	10	62.5	
Bronze	3	18.75	
Worked Bone	2	12.5	
		0	
		0	
Stone	1	6.25	
		% OF TOTAL	% OF GROUP
Fe			
nails	5	31.25	50.00
object	4	25	40.00
rove plate	1	6.25	10.00
TOTAL FE	10	62.5	
Worked Bone			
blank	2	12.5	100.00
TOTAL BONE	2	12.5	
Bz			
sheet metal	2	12.5	66.67
object	1	6.25	33.33
TOTAL BZ	3	18.75	
Stone			
flake	1	6.25	100.00
TOTAL STONE	1	6.25	

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Table 5.71 - The 1988 core test results from the Gjogur farm mound. All measurements are in meters below the 1988 ground surface (BGS).

Depth	Comment
Core #1	The core's location is 0.67 meters west from the column sample's datum.
0.00-0.16	- Mottled brown silty sandy soils.
0.16-0.20	- Limit of core was due to hitting structural turf.
Core #2	The core's location is 1.18 meters west from the column sample datum.
0.00-0.35	- Dark brown silty soil mixed with fragments of structural turf.
0.35-0.74	- Dark brown silty soil with numerous wood chips.
0.74-1.30	- Loose textured, water saturated dark brown soil. Limit of core reach, not of the cultural stratigraphy.
Core #3	The core's location is 1.60 meters west from the column sample datum.
0.00-0.25	- Moist, dark brown silty soil. Limit of the core due to hitting a rock.
Core #4	The core's location is 90 degrees south of core #3, and 0.74 meters distant from core #3.
0.00-0.32	- Dark brown silty soil with fragments of structural turf. Limit of core was due to hitting structural turf.

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Table 5.71 (cont.) - The 1988 core test results from the Gjogur farm mound.

Depth		Comment
Core #5	The core's location is 90 degrees north of core #1, and 0.81 meters distant from core #1.	
0.00-0.18		- Dark brown silty soil with fragments of structural turf. Limit of the core was due to hitting structural turf.
Core #6	This core's depth starts 1.80 meters BGS as seen from the East Wall profile of Figure 5.111.	
0.00-0.32	(1.80-2.12)	- Multiple dark brown silty soil strata.
0.32-1.17	(2.12-2.97)	- Dark brown silty fill.
1.17+	(2.97+)	- Rounded pebble gravel and sand, which represents the culturally sterile raised Holocene beach terrace.
Core #7	This core's depth starts 1.80 meters BGS as seen from the East Wall profile of Figure 5.111.	
0.00-0.38	(1.80-2.18)	- Mottled burnt peat ash.
0.38-0.42	(2.18-2.22)	- Mottled burnt peat ash with dark brown silty sand and fragments of fish bone.
0.42-0.66	(2.22-2.46)	- Dark brown silty sand with an organic smear that contained fish bone. Soil is extremely wet to the touch.
0.66+	(2.46+)	- Limit of core due to hitting a rock.

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5.72 - Artifact inventory list for the Gjogur site.

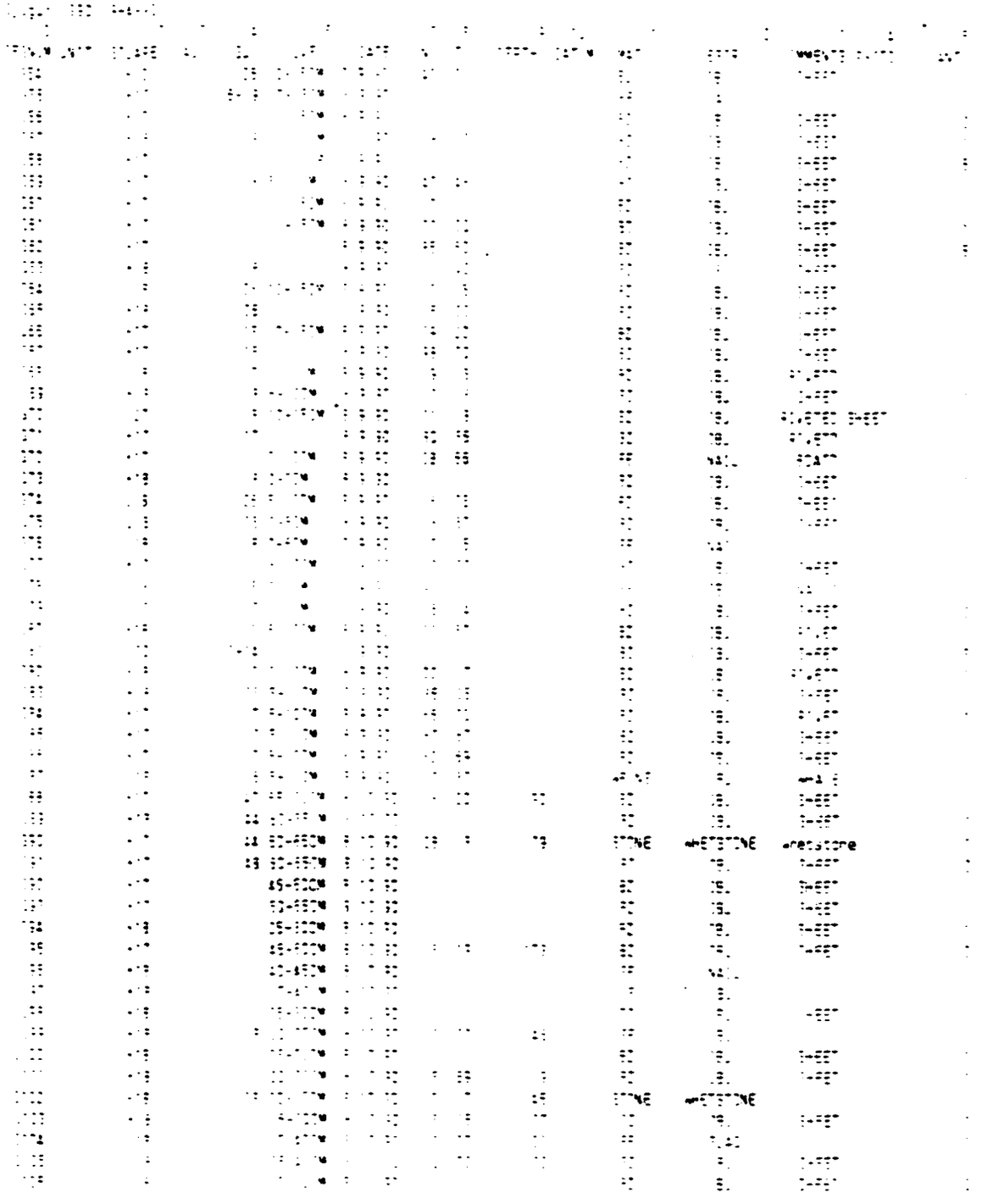

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Table 5.72 (cont.) - Artifact inventory list for the Gjogur site.

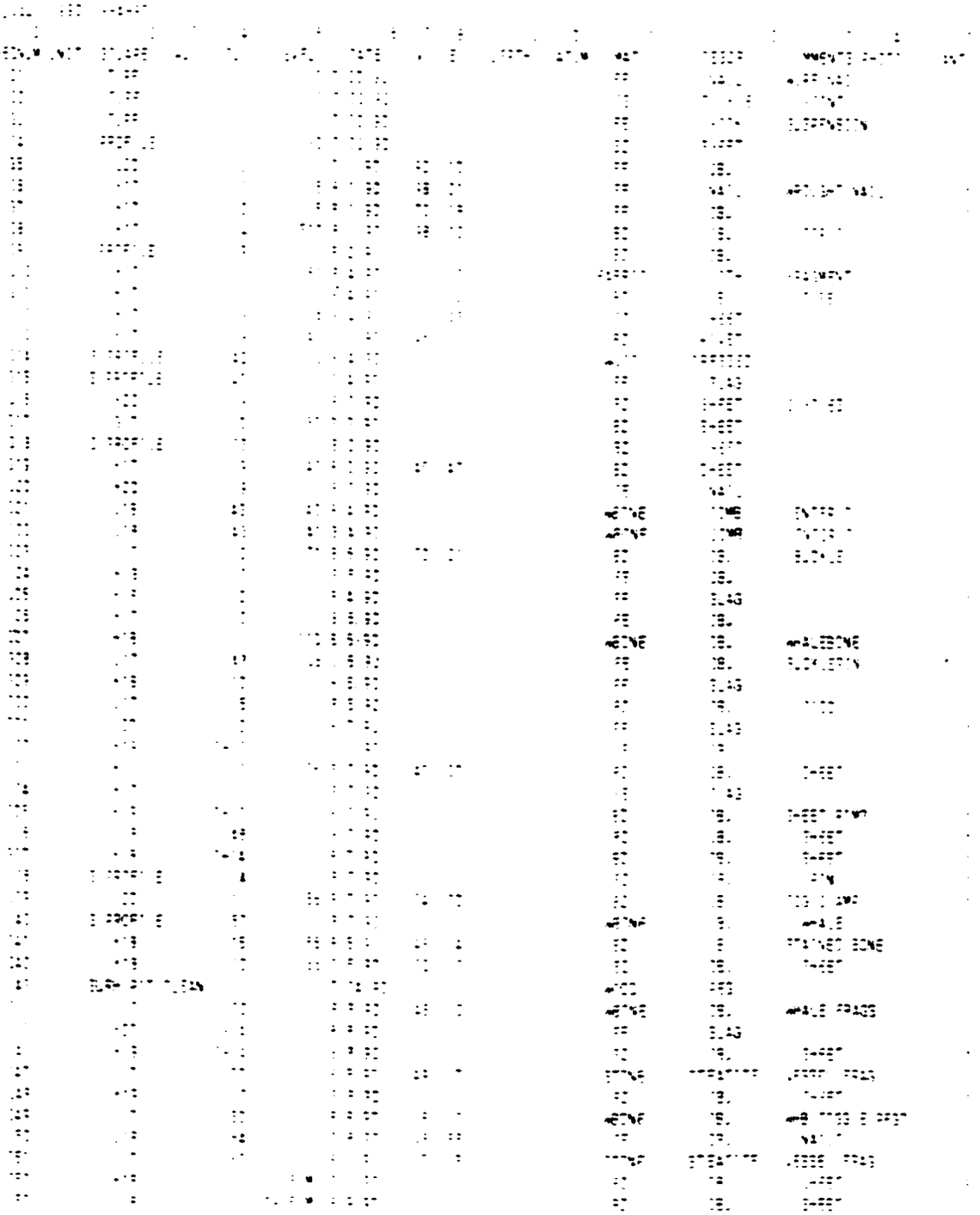

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Table 5.72 (cont.) - Artifact inventory list for the Gjogur site.

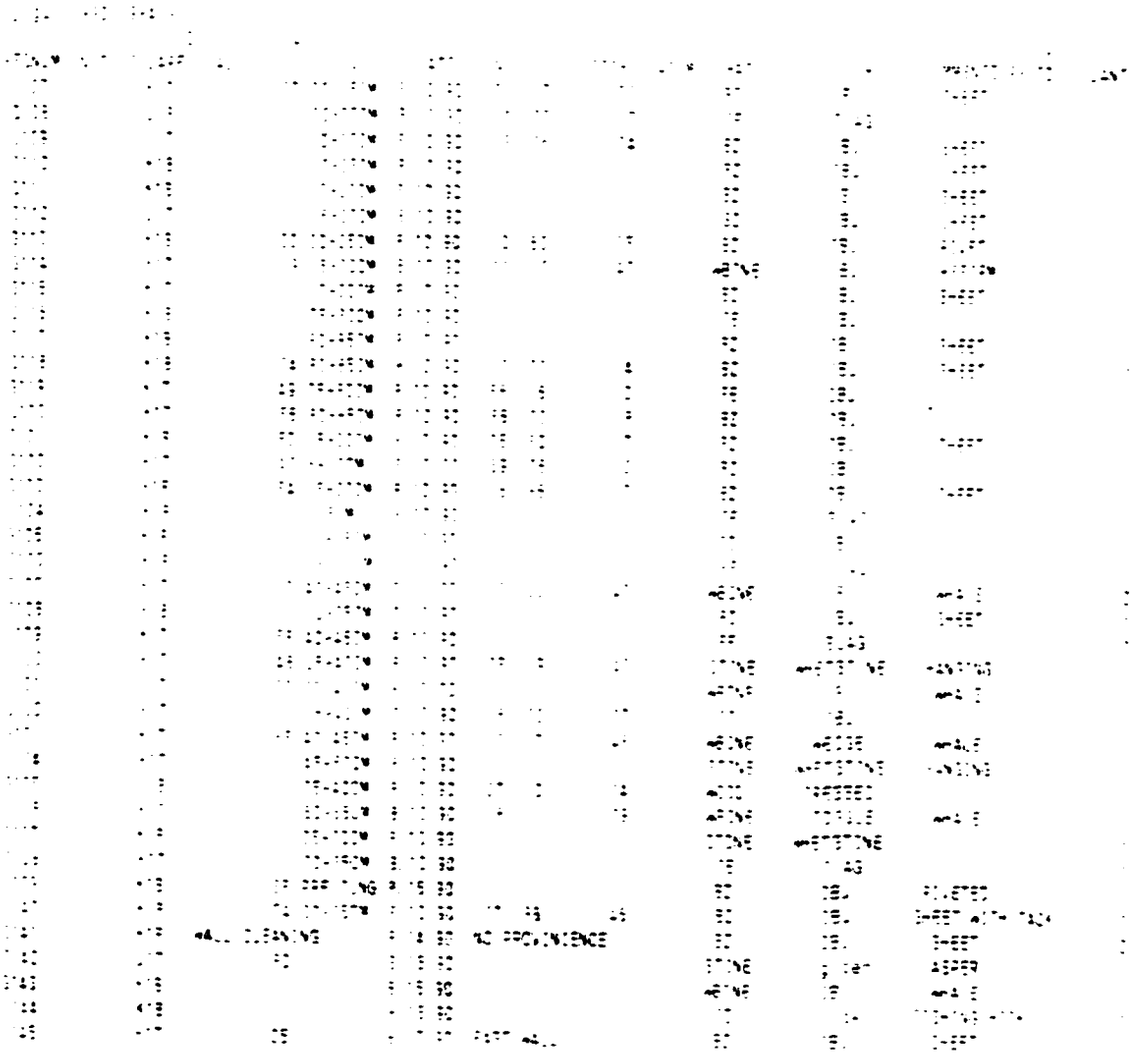

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Table 5.72 (cont.) - Artifact inventory list for the Gjogur site.

Gjogur 1990 9-4-90

0 REGNUM	1 UNIT	2 SQUARE	3 AU	4 SU	5 LEVEL	6 DATE	7 N	8 E	9 DEPTH	9 DATUM	10 MAT	11 DESCR	12 COMMENTS	13 PHOTO	15 QUANT
G54		K18		25	10-15CM	8/9/90	83	91			SZ	OBJ	SHEET		1
G55		K17		16-19	10-15CM	8/9/90					FE	NAIL			1
G56		K17			10-15CM	8/9/90					BZ	OBJ	SHEET		2
G57		K18		29	10-15CM	8/9/90	78	72			BZ	OBJ	SHEET		1
G58		K17			10-15CM	8/9/90					BZ	OBJ	SHEET		5
G59		K17		18	5-10CM	8/9/90	47	48			BZ	OBJ	SHEET		1
G60		K17			10-15CM	8/9/90	30	51			BZ	OBJ	SHEET		1
G61		K17			10-15CM	8/9/90	22	100			BZ	OBJ	SHEET		1
G62		K17		8		8/9/90	85	50			BZ	OBJ	SHEET		5
G63		K18		18		8/9/90	16	40			BZ	OBJ	SHEET		1
G64		J18		25	10-15CM	8/9/90	27	15			BZ	OBJ	SHEET		1
G65		K18		26		8/9/90	55	100			BZ	OBJ	SHEET		1
G66		K17		18	10-15CM	8/9/90	39	22			BZ	OBJ	SHEET		1
G67		K17		15		8/9/90	88	70			BZ	OBJ	SHEET		1
G68		K18		17	5-10CM	8/9/90	19	8			BZ	OBJ	RIVET?		1
G69		K18		18	5-10CM	8/9/90	22	8			BZ	OBJ	SHEET		1
G70		J27		18	10-15CM	8/9/90	21	8			BZ	OBJ	RIVETED SHEET		1
G71		K17		17		8/9/90	80	55			BZ	OBJ	RIVET?		1
G72		K17			5-10CM	8/9/90	38	56			FE	NAIL	BOAT?		1
G73		K18		18	0-5CM	8/9/90					BZ	OBJ	SHEET		1
G74		J18		26	5-10CM	8/9/90	6	36			SZ	OBJ	SHEET		1
G75		J18		26	0-5CM	8/9/90	5	57			BZ	OBJ	SHEET		1
G76		J18		18	0-5CM	8/9/90	16	25			FE	NAIL			1
G77		K17			5-10CM	8/9/90	100	100			BZ	OBJ	SHEET		1
G78		K19		19	0-5CM	8/9/90	86	13			FE	OBJ	NAIL?		1
G79		J19		17	0-5CM	8/9/90	16	4			BZ	OBJ	SHEET		2
G80		K18		25	5-10CM	8/9/90	100	50			BZ	OBJ	RIVET		1
G81		J20		13-14		8/9/90					BZ	OBJ	SHFET		5
G82		K18		18	5-10CM	8/9/90	100	17			SZ	OBJ	RIVET?		1
G83		K18		25	5-10CM	8/9/90	85	65			BZ	OBJ	SHEET		1
G84		K17		17	5-10CM	8/9/90	56	30			BZ	OBJ	RIVET		1
G85		K17		17	5-10CM	8/9/90	57	57			BZ	OBJ	SHEET		1
G86		K17		17	5-10CM	8/9/90	52	59			BZ	OBJ	SHEET		1
G87		J18		25	5-10CM	8/9/90	10	52			WSTONE	OBJ	WHALE		1
G88		K17		47	55-60CM	8/10/90	6	20	190		BZ	OBJ	SHEET		1
G89		K18		44	50-55CM	8/10/90					BZ	OBJ	SHEET		1
G90		K17		44	50-55CM	8/10/90	28	8	179		STONE	WHETSTONE	whetstone		1
G91		K17		46	60-65CM	8/10/90					BZ	OBJ	SHEET		2
G92		K17			45-50CM	8/10/90					BZ	OBJ	SHEET		1
G93		K17			50-55CM	8/10/90					BZ	OBJ	SHEET		1
G94		K18			25-30CM	8/10/90					BZ	OBJ	SHEET		1
G95		K17			45-50CM	8/10/90	5	13	173		BZ	OBJ	SHEET		2
G96		K19			40-45CM	8/10/90					FE	NAIL			1
G97		K19			25-30CM	8/10/90					FE	OBJ			1
G98		K19			25-30CM	8/10/90					BZ	OBJ	SHEET		1
G99		K19		33	30-35CM	8/10/90	1	99	125		FE	OBJ			1
G100		K18			25-30CM	8/10/90					BZ	OBJ	SHEET		1
G101		K18			30-35CM	8/10/90	15	59	119		BZ	OBJ	SHFET		1
G102		K18		38	30-35CM	8/10/90	5	1	145		STONE	WHETSTONE			1
G103		K18			25-30CM	8/10/90	5	35	137		BZ	OBJ	SHEET		1
G104		J18			35-40CM	8/10/90	10	98	127		FE	SLAG			1
G105		J19			35-40CM	8/10/90	13	82	122		BZ	OBJ	SHFET		1
G106		K19			25-30CM	8/10/90					BZ	OBJ	SHEET		3

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Table 5.73 - Summary of the artifact categories recovered from the Gjogur site.

Gjogur 4901-7 TOTAL FINDS	Arneshreppur 188	FINDS REGISTER %
Iron	47	25.00
Bronze	115	61.17
Worked Bone	14	7.45
		0.00
		0.00
		0.00
stone	8	4.26
fabric	1	0.53
wood	3	1.60

Fe	FE	Bz	BZ	Worked Bone	WBONE
nails	7	sheet metal	8	gamesman blank	0
object	14	object	106	comb frag.	2
rove plate	0	rivet	1	wedge	1
Sickle	1			toggle	1
hook	2			object	10
slag	23				

Wood	
Dressed	2
Pegs	1

Ceramic	CERAM	Stone	STONE	Fabric	
potsherd	0	strike-a-light	1	cloth fragment	1
pipe	0	whetstone	5		
obj	0	steatite	2		
		obj	0		

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ICELANDIC ZOOARCHAEOLOGY:

NEW DATA APPLIED TO ISSUES OF HISTORICAL ECOLOGY.

PALEOECONOMY AND GLOBAL CHANGE

by

THOMAS AMOROSI

VOLUME III

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1996

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Table 6.1. A Listing of the Bird Species present in the 1987-1988 faunal materials recovered from the Bessastadir site.

Taxon	NISP
ORDER GAVIIFORMES	
Gavia stelata - red-throated loon	2
ORDER PELECANIFORMES	
Phalacrocorax sp. - cormorant species	3
ORDER ANSERIFORMES (geese and ducks)	2
Branta sp. - goose species	2
Anser anser - graylag goose	6
Anatinae (marsh ducks)	10
Anas Platyrhynchos - mallard	18
Aythyinae (sea ducks)	
Somateria mollissima - common eider	12
Aytha sp. - sea duck species	4
ORDER GALLIFORMES	
Lagopus mutus - rock ptarmigan	8
ORDER CHARADRIIFORMES (shore birds)	
Haematopus ostralegus - oystercatcher	1
Scolopacidae (sandpipers)	
Arenaria interpres - ruddy turnstone	3
Laridae (gulls)	4
Larus argentatus - herring gull	3
Larus marinus - great black-backed gull	2
Alcidae (auks)	
Uria sp. - murre species	1
Fratercula arctica - atlantic puffin	2
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Table 6.2. A Listing of the species present in the 1989-1990 recovered from the Bessastadir site.

Taxon	NISP	TNF
DOMESTICATES		
Bos taurus - cattle	198	-
Equus caballus - horse	6	-
Canis familiaris - domestic dog	38	-
Sus scrofa - domestic pig	14	-
Ovis/Capra - caprine species	466	-
Total Domesticates	722	-
SEALS		
Phocidae	2	-
Phoca vitulina - common seal	1	-
Total Seal	3	-
CETACEA - whale species	1	-
OTHER MAMMALS		
Alopex lagopus - arctic fox	3	-
BIRD - bird species	34	-
PISCES - fish species	154	-
Gadidae - cod family	183	-
Gadus morhua - atlantic cod	23	-
Pleunronectidae - flat fish species	1	-
	361	-
MOLLUSCA	6	-
Mytilus edulis - blue mussel	2	-
	8	-
UNIDENTIFIDE BONE	-	108
Large Terrestrial Mammal Fragments	-	119
Medium Terrestrial Mammal Fragments	-	205
Medium Marine Mammal Fragments	-	1
	-	433

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Table 7.1 - The comparison of quantification measures used with the Granastadir archaeofauna.

GRANASTADIR
QUANTIFICATION MEASURES

		SITE CONTEXT						
		R3	R9A	R9C	R15	R16	Exterior	TOTAL
CATTLE								
	NISP	8	21	13	344	6	14	406
	MNI	0.5	1	2.5	11.5	1	0.5	14.5
	RF	0.02	0.08	0.07	1.81	0.02	0.02	2.02
	NISP/MNI	16	21	5.2	29.91	6	28	28

		R3	R9A	R9C	R15	R16	Exterior	TOTAL
CAPRINES								
	NISP	42	91	15	571	5	47	771
	MNI	1	4.5	1	24	1	2.42	27
	RF	0.08	0.42	0.08	2.92	0.02	0.14	3.66
	NISP/MNI	42	20.22	15	23.79	5	19.54	28.56

		R3	R9A	R9C	R15	R16	Exterior	TOTAL
CAPRINE/ CATTLE RATIO COMPARISONS								
BASED ON :	NISP	5.25	4.33	1.15	1.66	0.83	3.36	1.90
	MNI	2.00	4.50	0.40	2.09	1.00	4.84	1.86
	RF	4.00	5.25	1.14	1.61	1.00	7.00	1.81

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Table 7.2 - The NISP listing for the entire Granastadir archaeofauna. The table is also broken down by structure and room assignments (also see Figure 7.4).

GRANASTADIR

NUMBER OF IDENTIFIED SPECIMENS (NISP)

SPECIES PRESENT		SITE CONTEXT						
Scientific	English	R3	R9A	R9C	R15	R16	ALL Exterior	TOTAL
DOMESTIC MAMMALS								
Bos taurus dom.	cattle	8	21	13	344	6	14	406
Equus caballus	horse	3	3		43		5	54
Canis familiaris	dog							present
Sus scrofa	pig	2	1	4	72		11	90
Ovis aries	sheep	1	2		77			80
Capra hircus	goat				12			12
Ovis/Capra sp.	caprine	41	88	15	482	5	47	678
Mus sp.	mouse				3			3
CETACEA								
Cetacea sp.	Whale sp.				1			1
BIRDS								
Aves sp.	Bird	1	1	3	92			97
FISH								
Gadus morhua	cod		1		133			134
Selachii sp.	shark sp.							present
Salmo sp.	salmon				3			3
Gadid	cod family			3	72			75
MOLLUSCA								
Mollusca sp.	shellfish		15		7			22
TOTAL IDENTIFIED (NISP)		56	133	38	1341	11	77	1656
UNIDENTIFIED								
Terrestrial Mammals								
large		6	9	6	670	0	9	700
medium		458	318	17	1120	20	182	2115
UNIDENTIFIED BONE SCRAP		31	29	1	948	3	12	1024
TOTAL UNIDENTIFIED		495	356	24	2738	23	203	3839

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Table 7.3 - The NISP listing for the entire Granastadir archaeofauna.

TABLE 7.3

GRANASTADIR	Iceland 1987-90 Site Collection		
Taxon	NISP	% of whole	% of group
DOMESTICATES			
Bos taurus	406	24.50	30.73
Equus caballus	54	3.26	4.09
Sus scrofa	90	5.43	6.81
Ovis aries	80	4.83	6.06
Capra hircus	12	0.72	0.91
Ovis/Capra sp.	679	40.98	51.40
total Ovis/Capra	771	46.53	58.36
total Domesticates	1321	79.72	
CETACEA			
Cetacea sp.	1	0.06	
total Cetacea	1	0.06	
OTHER MAMMALS			
Mus sp.	3	0.18	
BIRDS			
Bird sp.	97	5.85	
Total Birds	97	5.85	
FISH			
Gadus morhua	134	8.09	62.91
Salmo sp.	3	0.18	1.41
Selachii sp.	1	0.06	0.47
Gadid sp.	75	4.53	35.21
Total Fish	213	12.85	
MOLLUSCA			
Mya sp.	15	0.91	
Mollusca sp.	7	0.42	
Total Mollusca	22	1.33	
TOTAL NISP =	1657	100.00	

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Table 7.4 - The taphonomic indicators for the Granastadir archaeofauna. Indicators are listed by structure and room designations.

GRANASTADIR
TAPHONOMIC INDICATORS

		SITE CONTEXT						
CATTLE		R3	R9A	R9C	R15	R16	ALL Exterior	TOTAL
	NISP	8	21	13	344	6	14	406
	TEETH AS % OF NISP	5.21	3.08	0	1.46	4.17	3.5	1.68
	CARNIVORE CHEWING %	0	0	0	0.29	0	0	0.25
	MEAN 100*(RF*DENSITY/NISP)	0.38	0.48	0.69	0.68	0.67	0.29	0.65
CAPRINES		R3	R9A	R9C	R15	R16	ALL Exterior	TOTAL
	NISP	42	91	15	571	5	47	771
	TEETH AS % OF NISP	2.55	1.97	0	1.66	3.54	5.14	2.09
	CARNIVORE CHEWING %	0	0	0	0.53	0	0	0.39
	MEAN 100*(RF*DENSITY/NISP)	0.28	0.63	0.67	0.67	0.40	0.45	0.63

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Table 7.5 - The meat utility indicators for the Granastadir archaeofauna. Indicators are listed by structure and room designations.

GRANASTADIR
MEAT UTILITY INDICATORS

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TABLE # 7.

SITE CONTEXT

CATTLE	R3	R9A	R9C	R15	R16	ALL Exterior	TOTAL
NISP	8	21	13	344	6	14	406
% OF SKELETON							
CRANIAL & HORNCORE	26.32	19.86	10	25.1	71.43	54	25.3
HINDQUARTER & FOREQUART	73.69	43.32	30	48.03	28.57	36.57	47.15
FEET & LOWER LIMBS	0	28.18	10	16.66	0	9.14	16.41
RATIO							
UPPER/LOWER LIMBS	-	1.54	3.00	2.88	-	4.00	2.87
UPPER LIMBS/CRANIAL	2.80	2.18	3.00	1.91	0.40	0.68	1.86
TOTAL							
RF*MGUI/NISP	5.02	10.43	16.31	12.95	10.64	1.79	12.35

CAPRINE	R3	R9A	R9C	R15	R16	ALL Exterior	TOTAL
NISP	42	91	15	571	5	47	771
% OF SKELETON							
CRANIAL & HORNCORE	26.82	26.58	24.64	32.70	100.00	27.34	31.77
HINDQUARTER & FOREQUART	54.00	53.96	57.96	47.91	0.00	65.63	49.45
FEET & LOWER LIMBS	19.19	10.01	12.42	15.10	0.00	7.03	14.16
RATIO							
UPPER/LOWER LIMBS	0.64	0.29	1.66	0.06	20.00	0.58	0.04
UPPER LIMBS/CRANIAL	2.01	2.03	2.33	1.47	0.00	2.40	1.56
TOTAL							
RF*MGUI/NISP	2.97	12.58	14.63	11.13	1.75	8.32	10.7

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Table 7.6 - The osteometiric summary for the cattle remains recovered from the Granastadir site. All measurements are in cm. and follow von den Driesch (1976).

GRANASTADIR
CATTLE BONE MEASUREMENT SUMMARY
(after Von Den Driesch 1976)

ELEMENT	MEASUREMENT	mean	sd	CV	n	maximum	minimum
Metatarsal	GL	189.8			1		
	Bp	42.05			1		
	Bd	46.22			1		
	SD	21.03			1		
Metacarpal	GL	176.27	3.87	2.19	3	178.5	171.8
	Bp	49.98	2.19	4.39	3	52.43	48.2
	Dp	29.91	1.82	6.23	3	31.2	27.63
	Bd	50.33	2.04	4.05	3	52.68	49.1
	SD	26.6	1.52	5.71	3	28.25	25.28
Calcaneus	GL	121.13	8.81	7.28	4	128.3	110
	GB	38.85	4.63	11.91	4	44.9	34.5
Phalanx I	GL	50.95	2.42	4.74	10	56	47.4
	Bp	25.35	1.07	4.21	10	26.8	24
	Bd	25.06	2.61	10.43	10	32.1	22.79
	SD	21.34	1.08	5.04	10	23.5	20.2
Tibia	Bd	60.4			1		

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Table 7.7 - The osteometic summary for the caprine remains recovered from the Granastadir site. All measurements are in cm. and follow von den Driesch (1976).

GRANASTADIR
CAPRINE BONE MEASUREMENT SUMMARY
(after Von Den Driesch 1976)

SPECIES	ELEMENT	MEASUREMENT	mean	sd	CV	n	maximum	minimum
Ovis aries	Metatarsal	GL	134.85	33.45	24.8	2	158.5	111.2
(sheep)		Bp	18.45	1.97	10.66	4	20	15.6
		Bd	25.18	1.14	4.53	3	26.4	24.14
		SD	14.21	0.64	4.5	3	14.8	13.53
Ovis aries	Metacarpal	GL	122.34	9.68	8.07	9	137.2	109.3
		Bp	21.06	1.38	6.54	10	23.4	18.6
		Dp	14.99	1.11	7.43	10	16.4	13.13
		Bd	24.41	2.86	11.7	11	29.05	21.6
		SD	12.97	1.04	8.03	10	15.1	11.8
Ovis aries	Humerus	BT	27.07			1		
		Bd	28.65	1.3	4.53	7	30.2	26.2
Ovis aries	Tibia	Bd	24.18	0.91	3.76	6	25.7	23.1
Ovis aries	Radius	GL	151.65	16.98	11.2	4	175.1	137.6
		Bp	28.44	2.52	8.86	9	33.9	24.9
		BFd	25.93	2.23	8.58	9	31	23.2
		Bd	27.49	1.94	7.05	4	30.3	26.04
		SD	15.26	1.49	9.76	5	17.5	13.9
Ovis aries	Phalanx I	GL	33.06	2.06	6.23	20	37.5	30
		Bp	11.28	1.05	9.27	20	14.6	9.5
		Bd	10.92	1.24	11.38	20	15	9.3
		SD	9.49	1.07	11.23	20	12.3	7.9
Capra hircus	Metacarpal	GL	100.25			1		
(goat)		Bp	23.8			1		
		Dp	16.4			1		
		Bd	27.6			1		
		SD	18.7			1		
Capra hircus	Radius							
		Bp	31.58	0.53	1.66	2	32.1	31.06
		BFp	29.33	0.27	0.92	2	29.6	29.06
	Phalanx I	GL	31.07			1		
		Bp	10.4			1		
		Bd	10.29			1		
		SD	8.8			1		

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Table 7.8 - The osteometric summary for the equine remains recovered from the Granastadir site. All measurements are in cm. and follow von den Driesch (1976).

GRANASTADIR
HORSE MEASUREMENTS

				MEASUREMENT (Von Den Driesch 1976) (in mm)				
CONTEXT			ELEMENT	Bd	SD	GL	Bp	Dp
F 250	R15	X 996 Y 976	Metatarsus III	45.68				
F 226	R15	X 995 Y 978	Metatarsus III	45.20				
F 229	R15	X 991 Y 978	Metatarsus III	44.70				
F 315	R15	X 993-41 Y 980	Metatarsus III	46.22				
F 126	R3	X 982 Y 974	Phalanx I	46.10	31.02	78.80		34.90
F 229	R15	X 991 Y 978	Phalanx I	43.50	30.90	75.40	52.04	37.60

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Table 7.9 - The osteometric summary for the porcine remains recovered from the Granastadir site. All measurements are in cm. and follow von den Driesch (1976).

GRANASTADIR
PIG BONE MEASUREMENTS
(after Von Den Dreisch 1976)

ELEMENT	MEASUREMENT		n
Metacarpal III	Bd	15.2	1
	B	11.5	1
	GL	67.3	1
	Bp	14.5	1
	L	13.6	1
Metacarpal IV	Bd	16.2	1
	B	12.8	1
	GL	67.9	1
	Bp	19.92	1
	L	15.6	1

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Table 8.1 - The taxonomic assignments for the Storaborg archaeofauna. Note there is a typographic error, the common name of odin's hen should be changed to water rail and domestic goose changed to greylag goose.

	SPECIES PRESENT
MAMMALIA	MAMMALS
Bos taurus domesticus	domestic cattle
Equus caballus domesticus	domestic horse
Canis familiaris	domestic dog
Sus scrofa domesticus	domestic pig
Ovis aries domesticus	domestic sheep
Capra hircus domesticus	domestic goat
Phoca vitulina	common (harbor) seal
Halichoerus grypus(?)	grey seal (possible)
Hyperoodon ampullatus	northern bottlenose whale
Cetacea gen. et sp.	unidentified whale sp.
Alopex lagopus	arctic fox
AVES	BIRDS
Uria sp.	guillemot
Fratercula arctica	puffin
Alca torda	razorbill
Larus hyperboreus hyperboreus	glaucous gull
Larus argentatus	herring gull
Larus marinus	great black-backed gull
Larus sp.	gull species
Fulmaris glacialis	fulmar
Stercorarius skua skua	skua
Stercorarius parasiticus	parasitic jaeger
Sula bassana	gannet
Branta leucopsis	barnacle goose
Branta sp.	wild goose species
Nyctea scandiaca	snowy owl
Rallus aquaticus	odin's hen
Anser anser domesticus	domestic goose
Gallus gallus	domestic chicken
PISCES	FISH
Gadus morhua	codfish
Pollachius virens	saithe (coalfish)
Molva molva	ling
Melanogrammus aeglefinus	haddock
Merlangius merlangius	whiting
MOLLUSCA	SHELLFISH
Mya truncata	clam
Mytilus edulis	mussel
Mollusca sp.	shellfish species

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Table 8.2 - The major taxa present in the Storaborg archaeofauna.

Table 1 Storaborg

Major Taxa
Relative Percent, Based on NISP
(major structural contexts only)

Period	Structure	Domesticates	Seals	Cetacea	Birds	Fish	Mollusca
ca. 1700–1300	H 7	8.25	0	0	0.09	91.21	0.45
	H 9	19.41	0	0	0.26	79.98	0.35
	H 14	21.63	0.06	0.02	0.47	74.69	3.09
ca. 1600–1700	H 9/14	18.61	0.04	0.04	0.49	79.96	0.86
ca. 1450–1600	H 17	12.62	0.05	0.05	0.74	86.1	0.44
	H 18	13.85	0.19	0	2.21	83.27	0.48
	H 19	11.7	0.15	0.03	2.31	85.69	0.13
DATA SUMMARY							
ca. 1700–1300	mean	16.43	0.02	0.01	0.27	81.96	1.30
	SD	7.17	0.03	0.01	0.19	8.44	1.55
	CV	43.64	173.21	173.21	69.64	10.29	119.84
ca. 1600–1700		18.61	0.04	0.04	0.49	79.96	0.86
ca. 1450–1600	mean	12.72	0.13	0.03	1.75	85.02	0.35
	SD	1.08	0.07	0.03	0.88	1.53	0.19
	CV	8.48	55.47	94.37	50.13	1.80	54.73
Total, All Periods							
	mean	15.15	0.07	0.02	0.94	82.99	0.83
	SD	4.33	0.07	0.02	0.93	5.35	1.02
	CV	31.85	104.33	104.08	98.60	6.45	123.16

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Table 8.3 - The relative percentage of domestic mammals present in the Storaborg archaeofauna.

Storaborg

Table 8.3

DOMESTIC ANIMALS, RELATIVE % BASED ON NISP
(major structural contexts only)

Period	Structure	Cattle	Caprine	Goat	Sheep	Horse	Dog	Pig
ca. 1700-1800	H 7	29.8	69.63	2.38	12.47	0.57	0	0
	H 9	36.16	63.69	1.79	10.71	0.45	0	0
	H 14	32.56	66.7	0.78	11.77	0.44	0	0.61
ca. 1600-1700	H9/14	34.43	63.82	1.34	14.69	0.38	0	0.38
ca. 1600-late 1400's	H 17	26.33	69.77	0	8.81	3.13	0.39	0.39
	H 18	29.15	67.62	0.97	15.87	0.71	0.06	2.46
	H 19	32.4	62.66	1.29	9.66	2.15	0.21	2.38
Data Summary								
ca. 1700-1800	mean	32.74	66.67	1.72	11.98	0.49	0.00	0.20
	SD	3.21	2.97	0.80	1.39	0.07	0.00	0.35
	CV	9.80	4.45	52.56	11.62	14.86	ERR	173.21
ca. 1600-1700		34.43	63.82	1.34	14.69	0.38	0	0.38
ca. 1600-late 1400's	mean	32.63	63.35	3.75	11.18	2.00	0.22	1.81
	SD	3.60	3.97	3.67	4.14	1.22	0.17	1.23
	CV	11.02	6.27	99.17	37.07	60.96	75.10	68.02
Total All Periods								
	mean	32.93	64.34	1.28	12.03	1.19	0.09	0.99
	SD	2.86	3.34	0.82	2.81	1.04	0.15	1.09
	CV	8.68	5.15	63.88	23.39	87.51	160.60	110.55

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Table 8.4 - The ratio data based upon the NISP counts.

Table 4 Storaborg

Ratio Data
Based on NISP
(major structural contexts only)

Period	Structure	Cattle : Caprine		Goat: Sheep		Domestic Mammals Identified Fish	
ca. 1700–1800	H 7	1 :	2.34	1 :	5.22	1 :	0.58
	H 9	1 :	1.75	1 :	6	1 :	0.18
	H 14	1 :	2.07	1 :	15	1 :	0.34
ca. 1600–1700	H 9/14	1 :	1.85	1 :	9.57	1 :	0.21
ca. 1450–1600	H 17	1 :	1.65	1 :	0	1 :	0.23
	H 18	1 :	2.32	1 :	16.33	1 :	0.23
	H 19	1 :	1.93	1 :	7.5	1 :	0.27
DATA SUMMARY							
ca. 1700–1800	mean		2.05		8.74		0.37
	SD		0.30		5.44		0.20
	CV		14.38		62.19		54.91
ca. 1600–1700			1.85		9.57		0.21
ca. 1450–1600	mean		1.97		7.94		0.24
	SD		0.34		8.17		0.02
	CV		17.11		102.90		9.49
Total, All Periods							
	mean		1.99		8.52		0.29
	SD		0.27		5.70		0.14
	CV		13.54		66.93		47.02

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Table 8.5 - The summary of the bird species present in the Storaborg archaeofauna.

Storaborg 1985 Summary of Bird Remains

Table 5

Bird Species Sorted by NISP

SPECIES	sp.total NISP	% of Wildfowl
Wildfowl		
Puffin	186	69.40
Guillemot/Murre	20	7.46
Gannet	12	4.48
Razorbill	9	3.36
Herring gull	9	3.36
Barnacle goose	8	2.99
Black-backed gull	6	2.24
Gull species	6	2.24
Great skua	5	1.87
Wild Goose sp.	2	0.75
Fulmar	1	0.37
Arctic skua	1	0.37
Glaucous gull	1	0.37
Snowy owl	1	0.37
Odin's hen	1	0.37
Total Wildfowl	268	
Domestic Fowl		% of Domestic Fowl
Domestic goose	205	90.31
Domestic chicken	22	9.69
Total Domestic fowl	227	

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Tables 8.6 - The relative percentage of fish species in the Storaborg archaeofauna.

Storaborg Upper Layers

Fish Relative Percentages
Based on NISP Counts

	H 7	H 9	H 14	Mean	SD	CV
SPECIES						
Cod	91.58	100	91.82	94.47	4.79	5.07
Saithe/Pollack	2.48	0	1.79	1.42	1.28	89.93
Ling	3.96	0	3.32	2.43	2.13	87.60
Haddock	1.98	0	3.07	1.68	1.56	92.46
Whiting	0	0	0	0.00	0.00	ERR
Fish Cranial to Body Proportions Based on NISP Counts						
% Total Cranial	94.12	85.16	90.95	90.08	4.54	5.04
% Total Vertebral	5.88	14.72	9.05	9.88	4.48	45.31
Observed Ident. Cran.: Vert.	1.06	3.17	0.83	1.69	1.29	76.47
"Natural" Ident. Cran.: Vert.	3.1	3.1	3.1			
Observed - "Natural"	-2.04	0.07	-2.27	-1.41		

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Table 8.7 - The relative percentage of fish species in structural phase, Hus 9/14.

Storaborg Middle Layers

Fish Relative Percentages
Based on NISP Counts

	H 9/14
SPECIES	
Cod	90.63
Saithe/Pollack	2.08
Ling	5.21
Haddock	0
Whiting	2.08

Fish Cranial to Body Proportions
Based on NISP Counts

% Total Cranial	88.19
% Total Vertebral	11.81
Observed	
Ident. Cran.: Vert.	2.29
"Natural"	
Ident. Cran.: Vert.	3.1
Observed - "Natural"	-0.81

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Table 8.8 - The relative percentage of fish species in structural phases, Hus 17, 18 and 19.

Storaborg Lower Layers

Fish Relative Percentages
Based on NISP Counts

	H 17	H 18	H 19	Mean	SD	CV
SPECIES						
Cod	94.17	92.94	91.34	92.82	1.42	1.53
Saithe/Pollack	3.33	5.08	4.72	4.38	0.92	21.12
Ling	0	0.85	0.79	0.55	0.47	86.78
Haddock	2.5	1.13	3.15	2.26	1.03	45.63
Whiting	0	0	0	0.00	0.00	ERR
Fish Cranial to Body Proportions Based on NISP Counts						
% Total Cranial	93.3	71.6	84.79	83.23	10.93	13.14
% Total Vertebral	6.7	28.4	15.21	16.77	10.93	65.20
Observed Ident. Cran.: Vert.	1.38	7.16	4.09	4.38	2.65	60.59
"Natural" Ident. Cran.: Vert.	3.1	3.1	3.1			
Observed - "Natural"	-1.22	4.06	0.99	1.28	2.65	207.70

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Table 8.9 - The skeletal element ranking of the caprine remains for Hus 7.

Storaborg H 7 Sheep & Goats Element Ranking

El._Code	RF	%of_MNI	%_RF_sum	Density	MGUI
MtU	7.00	100.00	6.57		
Clc	7.00	100.00	6.57	1.28	23.08
CalB	7.00	100.00	6.57	1.49	12.37
TiD	6.00	85.71	5.63	1.46	37.70
Ast	5.50	78.57	5.16	1.28	23.08
HcW	5.50	78.57	5.16		
MtP	5.00	71.43	4.69	1.33	15.77
HuD	4.00	57.14	3.75	1.41	32.79
Inm	3.50	50.00	3.28	1.52	81.50
At	3.00	42.86	2.82	1.45	18.68
Mn	3.00	42.86	2.82	1.55	11.65
Hy	3.00	42.86	2.82		31.95
FeP	3.00	42.86	2.82	1.29	80.58
RaS	3.00	42.86	2.82		
FeS	3.00	42.86	2.82		
UlP	3.00	42.86	2.82		
TiS	2.50	35.71	2.35		
HC	2.50	35.71	2.35		1.03
McP	2.50	35.71	2.35	1.25	10.11
MpD	2.25	32.14	2.11		
TiP	2.00	28.57	1.88	1.19	51.99
RaD	2.00	28.57	1.88	1.36	20.06
FeD	2.00	28.57	1.88	1.14	80.58
HuS	2.00	28.57	1.88		
Ax	2.00	28.57	1.88	1.38	18.86
MpS	1.50	21.43	1.41		
RaP	1.50	21.43	1.41	1.33	24.30
UlD	1.50	21.43	1.41		
In	1.17	16.67	1.09	2.00	
MxB	1.00	14.29	0.94	1.49	12.87
Sc	1.00	14.29	0.94	1.40	45.06
MvC	1.00	14.29	0.94	1.29	23.08
Cvo	0.80	11.43	0.75	1.26	55.33
HcD	0.50	7.14	0.47	1.28	8.45
HuP	0.50	7.14	0.47	0.87	37.28
McS	0.50	7.14	0.47		
Pfx	0.50	7.14	0.47	1.49	8.74
MtD	0.50	7.14	0.47	1.20	12.11

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Table 8.10 - The skeletal element ranking of the caprine remains for Hus 14.

Storaborg H 14 Sheep & Goats Element Ranking

El._Code	RF	%of_MNI	%_RF_sum	Density	MGUI
Mn	13.50	100.00	5.76	1.55	11.55
TiS	13.00	97.30	5.60		
Mcx	17.00	91.89	5.29		
MtD	16.00	86.49	4.98		
Fnm	14.00	75.68	4.36	1.52	81.50
FiD	13.50	72.97	4.20	1.46	27.70
CalB	13.00	70.27	4.05	1.49	12.87
Sc	13.00	70.27	4.05	1.40	45.06
RaS	13.00	70.27	4.05		
HuD	12.50	67.57	3.89	1.41	32.79
Ast	12.00	64.86	3.73	1.28	23.08
Clc	11.50	62.16	3.58	1.28	23.08
FeS	11.00	59.46	3.42		
FeP	11.00	59.46	3.42	1.29	80.58
RaP	9.00	48.65	2.80	1.33	24.30
McP	7.00	37.84	2.18	1.25	10.11
PSx	7.00	37.84	2.18	1.49	8.74
RaD	7.00	37.84	2.18	1.36	20.06
FeD	6.00	32.43	1.87	1.14	80.58
MtP	5.50	29.73	1.71	1.33	15.77
MxB	5.50	29.73	1.71	1.49	12.87
MpS	5.50	29.73	1.71		
RaW	5.50	29.73	1.71		
U1W	4.00	21.62	1.24		
CalC	4.00	21.62	1.24	1.49	12.87
C1D	3.50	18.92	1.09		
HuS	3.50	18.92	1.09		
TiP	3.50	18.92	1.09	1.19	51.99
Mo	3.33	18.02	1.04	2.00	
Lum	3.17	17.12	0.99	1.35	38.90
At	3.00	16.22	0.93	1.45	18.68
Ax	3.00	16.22	0.93	1.38	18.86
McS	3.00	16.22	0.93		
Hy	3.00	16.22	0.93		31.95
MtS	2.50	13.51	0.78		
U1P	2.50	13.51	0.78		
Cvo	2.40	12.97	0.75	1.26	55.33
McD	2.00	10.81	0.62	1.28	8.45

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Table 8.11 - The skeletal element ranking of the cattle remains for Hus 7.

Storaborg H 7 Cattle Element Ranking

El._Code	RF	%of_MNI	%_RF_sum	Density	MGUI
CalB	6.50	100.00	20.44	1.49	8.74
Inm	3.00	46.15	9.43	1.52	47.89
TiP	2.00	30.77	6.29	1.19	64.73
Mn	2.00	30.77	6.29	1.55	13.86
Ast	1.50	23.08	4.72	1.28	31.66
Mo	1.25	19.23	3.93	2.00	
RaW	1.00	15.38	3.14		
HuD	1.00	15.38	3.14	1.41	36.52
FeD	1.00	15.38	3.14	1.14	100.00
MpS	1.00	15.38	3.14		
HC	1.00	15.38	3.14		1.03
TiD	1.00	15.38	3.14	1.46	47.09
PMx	1.00	15.38	3.14	1.49	8.74
P2W	0.88	13.46	2.75	0.81	13.72
In	0.67	10.26	2.10	2.00	
Car	0.67	10.26	2.10	1.19	15.53
P1W	0.63	9.62	1.97	0.90	13.72
P3W	0.63	9.62	1.97	0.76	13.72
Cvo	0.60	9.23	1.89	1.26	35.71
Clc	0.50	7.69	1.57	1.28	31.66
Hy	0.50	7.69	1.57		16.37
U1P	0.50	7.69	1.57		
McW	0.50	7.69	1.57		
Sc	0.50	7.69	1.57	1.40	43.47
FeP	0.50	7.69	1.57	1.29	100.00
NvC	0.50	7.69	1.57	1.29	31.66
McW	0.50	7.69	1.57		
Lum	0.17	2.56	0.52	1.35	32.05
P1P	0.13	1.92	0.39	0.90	13.72
Tfrg	0.13	1.92	0.39	1.90	
Th	0.08	1.18	0.24	1.28	45.53
McD	0.00	0.00	0.00	1.28	10.50
P1D	0.00	0.00	0.00	0.90	13.72
U1W	0.00	0.00	0.00		
P1S	0.00	0.00	0.00	0.90	13.72
RaS	0.00	0.00	0.00		
At	0.00	0.00	0.00	1.45	9.79
McP	0.00	0.00	0.00	1.25	12.18

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Table 8.12 - The skeletal element ranking for the cattle remains for Hus 14.

Storaborg H 14 Cattle Element Ranking

El._Code	RF	%of_MNI	%_RF_sum	Density	MGUI
CalB	17.50	100.00	13.82	1.49	8.74
Inm	9.50	54.29	7.50	1.52	47.89
Mn	7.50	42.86	5.92	1.55	13.86
CalC	5.00	28.57	3.95	1.49	8.74
TiD	4.50	25.71	3.55	1.46	47.09
Ast	4.00	22.86	3.16	1.28	31.66
McW	4.00	22.86	3.16		
Sc	4.00	22.86	3.16	1.40	43.47
In	3.67	20.95	2.89	2.00	
HpD	3.00	17.14	2.37		
FeD	3.00	17.14	2.37	1.14	100.00
Ax	3.00	17.14	2.37	1.38	9.79
Clc	3.00	17.14	2.37	1.28	31.66
FeP	3.00	17.14	2.37	1.29	100.00
RaW	3.00	17.14	2.37		
HuD	3.00	17.14	2.37	1.41	36.52
P2W	2.63	15.00	2.07	0.81	13.72
U1W	2.50	14.29	1.97		
P3W	2.13	12.14	1.68	0.76	13.72
HC	2.00	11.43	1.58		1.03
MpS	2.00	11.43	1.58		
MtW	2.00	11.43	1.58		
HuS	2.00	11.43	1.58		
McP	2.00	11.43	1.58	1.25	12.18
Lum	2.00	11.43	1.58	1.35	32.05
MxB	2.00	11.43	1.58	1.49	8.74
P1W	1.88	10.71	1.43	0.90	13.72
TarO	1.67	9.52	1.32	1.29	31.66
PMx	1.50	8.57	1.18	1.49	8.74
Car	1.50	8.57	1.18	1.19	15.53
TiW	1.50	8.57	1.18		
RaP	1.50	8.57	1.18	1.33	26.64
HuW	1.50	8.57	1.18		
Ho	1.25	7.14	0.99	2.00	
Cvo	1.20	6.86	0.95	1.26	35.71
Th	1.15	6.59	0.91	1.28	45.53
McD	1.00	5.71	0.79	1.28	10.50
FeS	1.00	5.71	0.79		

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Table 8.13 - The summary statistics of the osteometric data for the sheep metacarpals from Hus 7, 9 and 14.

Storaborg Metrics Combined Upper Layers

METAPODIAL	METRICS
Taxon	Ovis aries
Element	Metacarple fully fused, adult only
Site	Storaborg
Date	1979-80
Unit	Upper Layers (UF,3,1a)
Strat. Unit	all
Depth	all
A.U.	all

SUMMARY STATISTICS			
Greatest Length		Medial Br./Length	
GL mean	129.32	MB/L mean	10.85
GL Stand. Deviation	8.13	MB/L Stand. Deviation	0.91
GL CV	6.26	MB/L CV	8.38
Number of Specimens	42.00	Number of Specimens	41.00
Range Maximum	148.22	Range Maximum	13.37
Range Minumum	116.13	Range Minumum	8.84
Greatest Prox. Br.		Dist. Br./Length	
GPrB mean	22.30	DB/L Mean	19.20
GPrB Stand. Deviation	1.37	DB/L Stnd. Deviation	0.95
GPrB CV	6.29	DB/L CV	4.40
Number of Specimens	45.00	Number of Specimens	41.00
Range Maximum	25.86	Range Maximum	21.11
Range Minumum	19.38	Range Minumum	17.17
Greatest Distal Br.			
GDB mean	24.38		
GDB Stand. Deviation	1.68		
GDB CV	6.76		
Number of Specimens	50.00		
Range Maximum	28.80		
Range Minumum	21.85		
Min. Medial Br.			
MB mean	14.09		
MB Stand. Deviation	1.38		
MB CV	9.81		
Number of Specimens	49.00		
Range Maximum	18.62		
Range Minumum	12.10		

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Table 8.14 - The summary statistics of the osteometric data for the sheep metacarpals from Hus 9/14.

Storaborg Metrics

METRICAL	METRICS	
Taxon	Ovis aries	
Element	Metacarple	fully fused, adult only
Site	Storaborg	
Date	1979-80	
Unit	H 9/14	
Strat. Unit	all	
Depth	all	
A.U.	all	

SUMMARY STATISTICS			
Greatest Length		Medial Br./Length	
GL mean	131.82	MB/L mean	10.28
GL Stand. Deviation	9.84	MB/L Stand. Deviation	0.73
GL CV	7.47	MB/L CV	7.12
Number of Specimens	6.00	Number of Specimens	6.00
Range Maximum	146.54	Range Maximum	10.99
Range Minumum	121.35	Range Minumum	9.37
Greatest Prox. Br.		Dist. Br. /Length	
GPrB mean	22.27	DB/L Mean	18.70
GPrB Stand. Deviation	1.86	DB/L Stnd. Deviation	1.18
GPrB CV	8.34	DB/L CV	6.33
Number of Specimens	6.00	Number of Specimens	6.00
Range Maximum	25.15	Range Maximum	20.33
Range Minumum	19.83	Range Minumum	17.07
Greatest Distal Br.			
DB mean	24.58		
DB Stand. Deviation	1.25		
DB CV	5.07		
Number of Specimens	6.00		
Range Maximum	26.25		
Range Minumum	23.22		
Min. Medial Br.			
MB mean	13.50		
MB Stand. Deviation	0.57		
MB CV	4.20		
Number of Specimens	6.00		
Range Maximum	14.38		
Range Minumum	12.65		

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Table 8.15 - The summary statistics of the osteometric data for the sheep metacarpals from Hus 17, 18 and 19.

Osteometric Metrics Combined Lower Layers

METAPODIAL	METRICS
Taxon	Ovis aries
Element	Metacarple fully fused, adult only
Site	Storaborg
Date	1981-1982
Unit	Lower Layers (HH17,18,19)
Strat. Unit	all
Depth	all
N.S.	all

SUMMARY STATISTICS	
Greatest Length	
GL mean	133.02
GL Stand. Deviation	6.56
GL CV	4.93
Number of Specimens	33.00
Range Maximum	148.40
Range Minumum	121.20
Greatest Prox. Br.	
GPrB mean	23.29
GPrB Stand. Deviation	1.43
GPrB CV	6.13
Number of Specimens	35.00
Range Maximum	26.90
Range Minumum	21.10
Greatest Distal Br.	
DB mean	25.56
DB Stand. Deviation	1.49
DB CV	5.84
Number of Specimens	38.00
Range Maximum	29.65
Range Minumum	23.30
Min. Medial Br.	
MB mean	14.33
MB Stand. Deviation	1.05
MB CV	7.34
Number of Specimens	38.00
Range Maximum	16.00
Range Minumum	11.70
Medial Br./Length	
MB/L mean	10.69
MB/L Stand. Deviation	0.58
MB/L CV	5.42
Number of Specimens	33.00
Range Maximum	11.72
Range Minumum	9.03
Dist. Br. /Length	
DB/L Mean	19.06
DB/L Stnd. Deviation	0.93
DB/L CV	4.88
Number of Specimens	33.00
Range Maximum	21.54
Range Minumum	17.07

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Table 8.16 - The summary statistics of the osteometric data for the sheep metatarsals from Hus 7, 9 and 14.

Storaborg, Feltis

METAPODIAL ARTICLE

Taxon	Ovis aries
Element	Metatarsal fully fused, adult only
Site	Storaborg
Date	
Unit	Upper Layers (H7,9,14)
Strat. Unit	all
Depth	all
Area	all

SUMMARY STATISTICS

Greatest Length	
GL mean	140.76
GL Stand. Deviation	10.46
GL CV	7.44
Number of Specimens	40.00
Range Maximum	165.00
Range Minumum	124.86

Greatest Prox. Br.	
GPrB mean	19.57
GPrB Stand. Deviation	1.93
GPrB CV	9.84
Number of Specimens	43.00
Range Maximum	23.47
Range Minumum	12.79

Greatest Distal Br.	
GDB mean	23.29
GDB Stand. Deviation	1.97
GDB CV	8.46
Number of Specimens	44.00
Range Maximum	28.24
Range Minumum	20.00

Min. Medial Br.	
MB mean	12.11
MB Stand. Deviation	1.03
MB CV	8.52
Number of Specimens	46.00
Range Maximum	14.44
Range Minumum	9.96

Medial Br./Length	
MB/L mean	8.59
MB/L Stand. Deviation	0.42
MB/L CV	4.83
Number of Specimens	37.00
Range Maximum	9.49
Range Minumum	7.83

Dist. Br. /Length	
DB/L Mean	16.36
DB/L Stnd. Deviation	0.89
DB/L CV	5.40
Number of Specimens	37.00
Range Maximum	18.39
Range Minumum	14.60

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Table 8.17 - The summary statistics of the osteometric data for the sheep metatarsals from Hus 9/14.

Osteometric Metrics

METAPODIAL	METRICS	
Taxon	Ovis aries	
Element	Metatarsal	fully fused, adult only
Site	Storaborg	
Date	1980	
Unit	H 9/14	
Strat. Unit	all	
Depth	all	
Area	all	

SUMMARY STATISTICS

Greatest Length		Medial Br. Length	
GL mean	148.79	MB/L mean	8.66
GL Stand. Deviation	11.22	MB/L Stand. Deviation	1.53
GL CV	7.54	MB/L CV	6.39
Number of Specimens	8.00	Number of Specimens	6.00
Range Maximum	164.21	Range Maximum	9.81
Range Minumum	134.18	Range Minumum	6.19
Greatest Prox. Br.		**Dist. Br. Length**	
GPrB mean	20.26	DB/L Mean	16.57
GPrB Stand. Deviation	2.99	DB/L Stnd. Deviation	0.47
GPrB CV	14.70	DB/L CV	2.84
Number of Specimens	8.00	Number of Specimens	6.00
Range Maximum	23.16	Range Maximum	17.43
Range Minumum	13.95	Range Minumum	16.00
Greatest Distal Br.			
GDB mean	24.46		
GDB Stand. Deviation	1.70		
GDB CV	6.95		
Number of Specimens	9.00		
Range Maximum	27.39		
Range Minumum	21.69		
Min. Medial Br.			
MB mean	12.91		
MB Stand. Deviation	1.60		
MB CV	12.39		
Number of Specimens	8.00		
Range Maximum	15.54		
Range Minumum	11.23		

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Table 8.18 - The summary statistics of the osteometric data for the sheep metatarsals from Hus 17, 18 and 19.

Statistical Profile Lower Layers Summary

Taxon	Ovis aries
Element	Metatarsal fully fused, adult only
Site	Storaborg
Date	1981-82
Unit	Lower Layers (H17,18,19)
Strat. Unit	all
Depth	all
M.C.	all

SUMMARY STATISTICS

Greatest Length		Medial Br./Length	
GL mean	144.64	MB/L mean	8.33
GL Stand. Deviation	7.33	MB/L Stand. Deviation	0.40
GL CV	5.06	MB/L CV	4.86
Number of Specimens	23.00	Number of Specimens	21.00
Range Maximum	157.14	Range Maximum	9.22
Range Minumum	132.81	Range Minumum	7.46
Greatest Prox. Br.		**Dist. Br. /Length**	
GPrB mean	23.76	DB/L Mean	16.70
GPrB Stand. Deviation	1.07	DB/L Stnd. Deviation	0.68
GPrB CV	5.14	DB/L CV	4.06
Number of Specimens	27.00	Number of Specimens	21.00
Range Maximum	22.40	Range Maximum	17.85
Range Minumum	18.10	Range Minumum	15.67
Greatest Distal Br.			
GDB mean	24.12		
GDB Stand. Deviation	0.94		
GDB CV	3.89		
Number of Specimens	28.00		
Range Maximum	26.19		
Range Minumum	22.30		
Min. Medial Br.			
MB mean	12.08		
MB Stand. Deviation	1.14		
MB CV	9.47		
Number of Specimens	31.00		
Range Maximum	14.91		
Range Minumum	8.90		

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Table 8.19 - The summary statistics for the sheep proximal metacarpals.

STORABORG Iceland	Sheep Metacarple Proximal Dimensions
Number of Specimens	93.00
Subadult	1.00
%	1.20
1.5 to 2 yrs	12.00
%	14.46
> 2 yrs	50.00
%	60.24
Mature Adult	18.00
%	21.69
Bp	
n	93.00
mean	2.30
SD	0.16
CV	7.06
Range Maximum	2.64
Range Minimum	1.78
Bd	
n	83.00
mean	1.53
SD	0.12
CV	7.76
Range Maximum	1.79
Range Minimum	1.12
Ratio Bp/Bd	
n	83.00
mean	1.50
SD	0.07
CV	4.67
Range Maximum	1.70
Range Minimum	1.33

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Table 8.20 - The summary statistics for the atlantic cod crania osteometric data.

Storaborg Fish Cranial Metrics H 18

Taxon	Gadus morhua Cod
Site	Storaborg
Date	1981
Unit	H 18
Strat.Unit	all
Depth	all
A.U.	all

Summary Statistics

VOMER	
Number of Specimens	11.00
Mean	27.45
Standard Deviation	3.00
CV	10.93
Range - maximum	32.70
Range - minimum	23.20
PREMAXILLA	
Number of Specimens	59.00
Mean	15.73
Standard Deviation	3.48
CV	22.12
Range - maximum	26.70
Range - minimum	11.10
DENTARY "A"	
Number of Specimens	73.00
Mean	9.56
Standard Deviation	1.45
CV	15.14
Range - maximum	17.00
Range - minimum	7.00
DENTARY "B"	
Number of Specimens	37.00
Mean	28.15
Standard Deviation	3.49
CV	12.40
Range - maximum	40.20
Range - minimum	23.40
OTOLITH	
Number of Specimens	22.00
Mean	17.91
Standard Deviation	1.98
CV	11.06
Range - maximum	21.30
Range - minimum	13.40

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Table 8.21 - The summary statistics for the atlantic cod crania osteometric data from Hus 17.

Storaborg Fish Cranial Metrics H 17

Taxon	Gadus morhua Cod
Site	Storaborg
Date	1-18-86
Unit	H 17
Strat.Unit	all
Depth	all
A.U.	all

Summary Statistics

VOMER	
Number of Specimens	8.00
Mean	29.64
Standard Deviation	2.70
CV	9.10
Range - maximum	35.40
Range - minimum	26.20
PREMAXILLA	
Number of Specimens	27.00
Mean	15.39
Standard Deviation	1.91
CV	12.42
Range - maximum	18.10
Range - minimum	8.40
DENTARY "A"	
Number of Specimens	38.00
Mean	10.12
Standard Deviation	1.52
CV	15.01
Range - maximum	12.90
Range - minimum	6.90
DENTARY "B"	
Number of Specimens	14.00
Mean	28.04
Standard Deviation	4.64
CV	16.55
Range - maximum	34.10
Range - minimum	21.90
OTOLITH	
Number of Specimens	13.00
Mean	19.45
Standard Deviation	1.99
CV	10.21
Range - maximum	22.30
Range - minimum	15.60

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Table 8.22 - The summary statistics for the atlantic cod crania osteometric data from Hus 19.

Storaborg Fish Cranial Metrics H 19

Taxon	Gadus morhua Cod
Site	Storaborg
Date	1-18-86
Unit	H 19
Strat.Unit	all
Depth	all
A.U.	all

Summary Statistics

VOMER	
Number of Specimens	3.00
Mean	29.77
Standard Deviation	0.93
CV	3.12
Range - maximum	30.40
Range - minimum	28.70
PREMAXILLA	
Number of Specimens	28.00
Mean	16.05
Standard Deviation	1.58
CV	9.85
Range - maximum	18.60
Range - minimum	12.60
DENTARY "A"	
Number of Specimens	12.00
Mean	10.66
Standard Deviation	1.27
CV	11.88
Range - maximum	13.00
Range - minimum	9.20
DENTARY "B"	
Number of Specimens	4.00
Mean	28.65
Standard Deviation	5.11
CV	17.83
Range - maximum	35.40
Range - minimum	24.40
OTOLITH	
Number of Specimens	0.00
Mean	ERR
Standard Deviation	ERR
CV	ERR
Range - maximum	ERR
Range - minimum	ERR

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Table 8.23 - Tabular data for the reconstructed atlantic cod length based upon premaxillary measurements.

Cod Length Data Storaborg
Excavated Cod Premaxillaries

regression (after Bigelow 1984) $y = 60.83x + 10.35$

Length Group (in cm)	Early Phase ca. 1450–1600 no.	%	Middle Phase ca. 1600–1700 no.	%	Later Phase ca. 1700–1800 no.	%	TOTAL 15th–18th century no.	%
5 - 9	0	0.00	0	0.00	0	0.00	0	0.00
10–19	0	0.00	0	0.00	0	0.00	0	0.00
20–29	0	0.00	0	0.00	0	0.00	0	0.00
30–39	0	0.00	0	0.00	0	0.00	0	0.00
40–49	0	0.00	0	0.00	0	0.00	0	0.00
50–59	0	0.00	0	0.00	0	0.00	0	0.00
60–69	1	1.15	1	8.33	0	0.00	2	1.09
70–79	7	8.05	1	8.33	0	0.00	8	4.37
80–89	21	24.14	1	8.33	30	34.48	52	28.42
90–99	28	32.18	4	33.33	32	36.78	64	34.97
100–109	22	25.29	1	8.33	14	16.09	37	20.22
110–119	4	4.60	2	16.67	7	8.05	13	7.10
120–129	0	0.00	2	16.67	4	4.60	6	3.28
130–139	0	0.00	0	0.00	0	0.00	0	0.00
140–149	1	1.15	0	0.00	0	0.00	1	0.55
150–163	3	3.45	0	0.00	0	0.00	3	1.64
Total	87	100	12	100	87	100	183	100
mean	89.56		83.29		91.86			
SD	3.53		2.96		2.97			
Range Maximum	146.47		98.38		122.43			
Range Minimum	65.53		64.73		78.35			

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Table 8.24 - Tabular data for the reconstructed atlantic cod length based upon dentary measurements.

Cod Length Data Storaborg
Excavated Cod Dentaries
Measurement A (x)
regression (after Bigelow 1984) $y = 80.14 x + 102.3$

Length Group (in cm)	Early Phase ca. 1450–1600 no.	%	Middle Phase ca. 1600–1700 no.	%	Later Phase ca. 1700–1800 no.	%	TOTAL 15th–18th century no.	%
5 - 9	0	0.00	0	0.00	0	0.00	0	0.00
10–19	0	0.00	0	0.00	0	0.00	0	0.00
20–29	0	0.00	0	0.00	0	0.00	0	0.00
30–39	0	0.00	0	0.00	0	0.00	0	0.00
40–49	0	0.00	0	0.00	0	0.00	0	0.00
50–59	0	0.00	0	0.00	0	0.00	0	0.00
60–69	0	0.00	0	0.00	0	0.00	0	0.00
70–79	2	1.60	3	10.00	5	5.05	10	3.94
80–89	25	20.00	5	16.67	36	36.36	66	25.98
90–99	43	34.40	13	43.33	41	41.41	97	38.19
100–109	35	28.00	9	30.00	13	13.13	57	22.44
110–119	10	8.00	0	0.00	2	2.02	12	4.72
120–129	8	6.40	0	0.00	2	2.02	10	3.94
130–139	1	0.80	0	0.00	0	0.00	1	0.39
140–149	0	0.00	0	0.00	0	0.00	0	0.00
150–163	1	0.80	0	0.00	0	0.00	1	0.39
Total	125	100	30	100	99	100	254	100
mean	89.56		83.29		91.86			
SD	3.53		2.96		2.97			
Range Maximum	146.47		98.38		122.43			
Range Minimum	65.53		64.73		78.35			

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Table 8.25 - Tabular data for the length of modern atlantic cod based upon a trawled sample from 1976-1979 (Palsson 1983).

Cod length data 1976-1979
Source : Table 4,
Olafur K. Palsson (1983) Feeding habits of demersal
Fish species in Icelandic Waters Rit Fiskideildar7(1)
Marine Research Institute, Reykjavik.

Length Group (in cm)	1976 no.	%	1977 no.	%	1978 no.	%	1979 no.	%	TOTAL 1976-79 no.	%
5 - 9	12	0.70	7	0.20	0	0.00	64	5.28	83	0.79
10-19	90	5.24	302	8.63	125	3.09	115	9.49	632	6.03
20-29	210	12.23	375	10.71	494	12.21	141	11.63	1220	11.65
30-39	246	14.33	381	10.88	713	17.62	149	12.29	1489	14.21
40-49	307	17.88	502	14.34	655	16.19	158	13.04	1622	15.48
50-59	331	19.28	632	18.05	646	15.97	156	12.87	1765	16.85
60-69	268	15.61	618	17.65	651	16.09	132	10.89	1669	15.93
70-79	169	9.84	383	10.94	457	11.30	124	10.23	1133	10.82
80-89	49	2.85	211	6.03	190	4.70	88	7.26	538	5.14
90-99	25	1.46	63	1.80	80	1.98	55	4.54	223	2.13
100-109	6	0.35	16	0.46	20	0.49	20	1.65	62	0.59
110-119	2	0.12	8	0.23	10	0.25	8	0.66	28	0.27
120-129	0	0.00	0	0.00	3	0.07	1	0.08	4	0.04
130-139	2	0.12	3	0.09	2	0.05	1	0.08	8	0.08
Total	1717	100	3501	100	4046	100	1212	100	10476	100

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Table 8.26 - The relative percentage of neonatal bovids in the Storaborg collection.

DOMESTIC MAMMALS, NEONATAL % OF NISP
(major structural contexts only)

Period	Structure		Cattle	Caprine
ca. 1700-1800		H 7	20.19	2.47
		H 9	12.35	2.82
		H 14	26.49	3.92
ca. 1600-1700		H9/14	17.2	1.37
ca. 1600-late 1400's		H 17	16.13	0.65
		H 18	21.78	4.31
		H 19	28.48	1.37
Data Summary				
ca. 1700-1800		mean	19.68	3.07
		SD	7.08	0.76
		CV	36.00	24.65
ca. 1600-1700			17.2	1.37
ca. 1600-late 1400's		mean	22.13	2.11
		SD	6.18	1.94
		CV	27.94	91.89
Total All Periods				
		mean	20.37	2.42
		SD	5.74	1.37
		CV	28.17	56.87

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Table 8.27 - The taphonomic indicators observed for the Storaborg archaeofauna.

Taphonomic Indicators
(major structural contexts only)

Period	Structure	Identified Fragments	% ID	% Chewed Cattle	% Chewed Caprine	Dog % of Domesticates
ca. 1700–1800	H 7	4230	98.39	0	0.41	0
	H 9	1154	94.44	0	0	0
	H 14	5302	92.29	2.97	3.14	0
ca. 1600–1700	H 9/14	2450	95.67	0.64	0	0
ca. 1450–1600	H 17	4057	39.6	2.15	5.23	0.39
	H 18	11149	91.79	0	0.29	0.06
	H 19	3983	94.23	0	2.4	0.21
DATA SUMMARY						
ca. 1700–1800	Total NISP	10686				
	mean	3562.00	95.04	0.99	1.18	0.00
	SD	2153.17	3.09	1.71	1.71	0.00
	CV	60.45	3.26	173.21	144.24	ERR
ca. 1600–1700	Total NISP	2450				
		2450	95.67	0.64	0	0
ca. 1450–1600	Total NISP	19189				
	mean	6396.33	91.87	0.72	2.64	0.22
	SD	4116.10	2.32	1.24	2.48	0.17
	CV	64.35	2.52	173.21	93.89	75.10
Total, All Periods						
	Total NISP	32325				
	mean	4040.63	82.05	0.72	1.43	0.08
	SD	3366.83	33.26	1.18	1.96	0.14
	CV	83.32	40.53	163.54	136.42	174.66

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Table 8.28 - Summary of the caprine tooth wear analysis.

Summary of Caprine Toothwear Analysis
Mandibles and Maxillae Combined (after Crabtree 1980)
Phases Combined
Number of Specimens = 245

Age Class	Age in Months	Number	Percent
I	0 - 6	25	10.20
II	6 - 12	43	17.55
III	12 - 24	53	21.63
IV	24 - 36	38	15.51
V	36 - 48	32	13.06
VI	48 - 72	33	13.47
VII	72 - 96	19	7.76
VIII	96 - 120	2	0.82

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Table 8.29 - Summary of the cattle mandibular wear stages.

Summary of Mandibular Wear Stages (MWS)
of Cattle Mandibles from Storaborg (after Grant 1983)
Phases Combined
Number of Specimens = 45

MWS	Age in Months	Number	Percent
1		3	6.67
2		24	53.33
3		2	4.44
4		1	2.22
13		2	4.44
14		1	2.22
19		2	4.44
20		1	2.22
26		1	2.22
30		1	2.22
33		1	2.22
34		1	2.22
42		2	4.44
43		1	2.22
45		1	2.22
55		1	2.22

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Table 8.30 - The mammalian NISP summary for Hus 7.

Storaborg H 7 Archaeofauna Summary

SITE : Storaborg Taxon	UNIT : H 7 NISP	% of whole	% of group
DOMESTICATES			
Bos taurus	104	2.46	29.80
Equus caballus	2	0.05	0.57
Canis familaris	0	0.00	0.00
Sus scrofa	0	0.00	0.00
Ovis aries	47	1.11	13.47
Capra hircus	9	0.21	2.58
Ovis/Capra sp.	187	4.42	53.58
total Ovis/Capra	243	5.74	69.63
total Domesticates	349	8.25	
SEALS			
Phoca vitulina		0.00	ERR
Large seal (H. gryphus ?)		0.00	ERR
Phocid sp.		0.00	
total Phocid	0	0.00	
CETACEA			
Cetacea sp.		0.00	
OTHER MAMMALS			
Alopex lagopus		0.00	

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Table 8.31 - The avian and pisces NISP summary for Hus 7.

Storaborg H 7 Archaeofauna Summary

Taxon	NISP	% of whole	% of group
BIRDS			
Wildfowl			
Uria sp.	1	0.02	50.00
Fratercula arctica		0.00	0.00
Alca torda		0.00	0.00
Larus hyperboreus		0.00	0.00
Larus argentatus		0.00	0.00
Larus marinus		0.00	0.00
Larus sp.		0.00	0.00
Fulmaris glacialis		0.00	0.00
Catharacta skua		0.00	0.00
Stercorcarius parasiticus		0.00	0.00
Sula bassana		0.00	0.00
Branta leucopsis	1	0.02	50.00
Branta sp.		0.00	0.00
Nyctea scandia		0.00	0.00
Rallus aquaticus		0.00	0.00
Total Wildfowl	2		100.00
Domestic Fowl			
Anser anser	1	0.02	100.00
Gallus gallus		0.00	0.00
Total Domestic Fowl	1		100.00
Bird sp.	1	0.02	
Total Birds	4	0.09	
FISH			
Gadus morhua	185	4.37	91.58
Pollachius virens	5	0.12	2.48
Molva molva	8	0.19	3.96
Melanogrammus aegl.	4	0.09	1.98
Merlangius merl.		0.00	0.00
Total Ident. Pisces	202	4.78	100.00
Total Pisces Cranial	3441	4.78	
Total Pisces Vertebral	215	5.08	
Total Fish	3858	91.21	
MOLLUSCA			
Mya truncata	14	0.33	
Mytilus edulis	1		
Mollusca sp.	4	0.09	
Total Mollusca	19	0.45	
TOTAL NISP =	4230	100.00	

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Table 8.32 - The summary of ratio data for Hus 7.

Storaborg H 7 Archaeofauna Summary

Species Group Relative % (NISP)

	NISP	%
Domesticates	349	8.25
Seals	0	0.00
Cetacea	0	0.00
Other Mammals	0	0.00
Birds	4	0.09
Fish	3858	91.21
Mollusca	19	0.45
sum of major groups	4230	

Ratios

L&M Mam.+Dom.Mam. : Tot. Fish	1 to	4.86
Cattle : Caprine	1 to	2.34
Cattle : Horse	1 to	0.02
Cattle : Pigs	1 to	0.00
Cattle : Dogs	1 to	0.00
Goat : Sheep	1 to	5.22
Domestic Mammal : All Fish	1 to	11.05
Domestic Mammal : Ident.Fish	1 to	0.58
Domestic Mammal : Seals	1 to	0.00
Domestic Mammal : Birds	1 to	0.01
Domestic Fowl : Wildfowl	1 to	2.00

Unident. Scrap	69	
% Identified		98.39
large mammal	66	
medium mammal	379	
total L & M mammal	445	
ratio M : L mammal	5.742	
L&M mammal : tot.Pisces	0.115	

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Table 8.33 - The mammalian NISP summary for Hus 9.

Storaborg H 9 Archaeofauna Summary

SITE : Storaborg Taxon	UNIT : H 9 NISP	% of whole	% of group
DOMESTICATES			
Bos taurus	81	7.02	36.16
Equus caballus	1	0.09	0.45
Canis familaris	0	0.00	0.00
Sus scrofa	0	0.00	0.00
Ovis aries	24	2.08	10.71
Capra hircus	4	0.35	1.79
Ovis/Capra sp.	114	9.88	50.89
total Ovis/Capra	142	12.31	63.39
total Domesticates	224	19.41	
SEALS			
Phoca vitulina		0.00	ERR
Large seal (H. gryphus ?)		0.00	ERR
Phocid sp.		0.00	
total Phocid	0	0.00	
CETACEA			
Cetacea sp.		0.00	
OTHER MAMMALS			
Alopex lagopus		0.00	

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Table 8.34 - The avian and pisces NISP summary for Hus 9.
Storaborg H 9 Archaeofauna Summary

Taxon	NISP	% of whole	% of group
BIRDS			
Wildfowl			
Uria sp.		0.00	0.00
Fratercula arctica	3	0.26	100.00
Alca torda		0.00	0.00
Larus hyperboreus		0.00	0.00
Larus argentatus		0.00	0.00
Larus marinus		0.00	0.00
Larus sp.		0.00	0.00
Fulmaris glacialis		0.00	0.00
Catharacta skua		0.00	0.00
Stercorcarius parasiticus		0.00	0.00
Sula bassana		0.00	0.00
Branta leucopsis		0.00	0.00
Branta sp.		0.00	0.00
Nyctea scandia		0.00	0.00
Rallus aquaticus		0.00	0.00
Total Wildfowl	3		100.00
Domestic Fowl			
Anser anser		0.00	ERR
Gallus gallus		0.00	ERR
Total Domestic Fowl	0		ERR
Bird sp.		0.00	
Total Birds	3	0.26	
FISH			
Gadus morhua	41	3.55	100.00
Pollachius virens		0.00	0.00
Molva molva		0.00	0.00
Melanogrammus aegl.		0.00	0.00
Merlangius merl.		0.00	0.00
Total Ident. Pisces	41	3.55	100.00
Total Pisces Cranial	752	3.55	
Total Pisces Vertebral	130	11.27	
Total Fish	923	79.98	
MOLLUSCA			
Mya truncata	1	0.09	
Mollusca sp.	3	0.26	
Total Mollusca	4	0.35	
TOTAL NISP =	1154	100.00	

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Table 8.35 - The summary of the ratio data for Hus 9.

Storaborg H 9 Archaeofauna Summary

Species Group Relative % (NISP)

	NISP	%
Domesticates	224	19.41
Seals	0	0.00
Cetacea	0	0.00
Other Mammals	0	0.00
Birds	3	0.26
Fish	923	79.98
Mollusca	4	0.35
sum of major groups	1154	

Ratios

L&M Mam.+Dom.Mam. : Tot. Fish	1 to	1.98
Cattle : Caprine	1 to	1.75
Cattle : Horse	1 to	0.01
Cattle : Pigs	1 to	0.00
Cattle : Dogs	1 to	0.00
Goat : Sheep	1 to	6.00
Domestic Mammal : All Fish	1 to	4.12
Domestic Mammal : Ident.Fish	1 to	0.18
Domestic Mammal : Seals	1 to	0.00
Domestic Mammal : Birds	1 to	0.01
Domestic Fowl : Wildfowl	1 to	ERR

Unident. Scrap	68	
% Identified		94.44
large mammal	17	
medium mammal	225	
total L & M mammal	242	
ratio M : L mammal	13.23	
L&M mammal : tot.Pisces	0.262	

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Table 8.36 - The mammalian NISP summary for Hus 14.

Storaborg H 14 Archaeofauna Summary

SITE : Storaborg Taxon	UNIT : H 14 NISP	% of whole	% of group
DOMESTICATES			
Bos taurus	370	6.98	32.26
Equus caballus	5	0.09	0.44
Canis familaris	0	0.00	0.00
Sus scrofa	7	0.13	0.61
Ovis aries	135	2.55	11.77
Capra hircus	9	0.17	0.78
Ovis/Capra sp.	621	11.71	54.14
total Ovis/Capra	765	14.43	66.70
total Domesticates	1147	21.63	
SEALS			
Phoca vitulina	2	0.04	100.00
Large seal (H. gryphus ?)		0.00	0.00
Phocid sp.	1	0.02	
total Phocid	3	0.06	
CETACEA			
Cetacea sp.	2	0.04	
OTHER MAMMALS			
Alopex lagopus	1	0.02	

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Table 8.37 - The avian and pisces NISP summary for Hus 14.

Storaborg H 14 Archaeofauna Summary

Taxon	NISP	% of whole	% of group
BIRDS			
Wildfowl			
Uria sp.		0.00	0.00
Fratercula arctica	3	0.06	37.50
Alca torda	1	0.02	12.50
Larus hyperboreus		0.00	0.00
Larus argentatus		0.00	0.00
Larus marinus		0.00	0.00
Larus sp.		0.00	0.00
Fulmaris glacialis	1	0.02	12.50
Catharacta skua		0.00	0.00
Stercorcarius parasiticus		0.00	0.00
Sula bassana	3	0.06	37.50
Branta leucopsis		0.00	0.00
Branta sp.		0.00	0.00
Nyctea scandia		0.00	0.00
Rallus aquaticus		0.00	0.00
Total Wildfowl	8		100.00
Domestic Fowl			
Anser anser		0.00	ERR
Gallus gallus		0.00	ERR
Total Domestic Fowl	0		ERR
Bird sp.	17	0.32	
Total Birds	25	0.47	
FISH			
Gadus morhua	359	6.77	91.82
Pollachius virens	7	0.13	1.79
Molva molva	13	0.25	3.32
Melanogrammus aegl.	12	0.23	3.07
Merlangius merl.		0.00	0.00
Total Ident. Pisces	391	7.37	100.00
Total Pisces Cranial	3246	7.37	
Total Pisces Vertebral	323	6.09	
Total Fish	3960	74.69	
MOLLUSCA			
Mya truncata	70	1.32	
Mytilus edulis	9		
Mollusca sp.	85	1.60	
Total Mollusca	164	3.09	
TOTAL NISP =	5302	100.00	

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Table 8.38 - The summary of the ratio data for Hus 14.

Storaborg H 14 Archaeofauna Summary

Species Group Relative % (NISP)

	NISP	%
Domesticates	1147	21.63
Seals	3	0.06
Cetacea	2	0.04
Other Mammals	1	0.02
Birds	25	0.47
Fish	3960	74.69
Mollusca	164	3.09
sum of major groups	5302	

Ratios

L&M Mam.+Dom.Mam. : Tot. Fish	1 to	3.06
Cattle : Caprine	1 to	2.07
Cattle : Horse	1 to	0.01
Cattle : Pigs	1 to	0.02
Cattle : Dogs	1 to	0.00
Goat : Sheep	1 to	15.00
Domestic Mammal : All Fish	1 to	3.45
Domestic Mammal : Ident.Fish	1 to	0.34
Domestic Mammal : Seals	1 to	.00
Domestic Mammal : Birds	1 to	0.02
Domestic Fowl : Wildfowl	1 to	ERR

Unident. Scrap	443	
% Identified		92.29
large mammal	18	
medium mammal	128	
total L & M mammal	146	
ratio M : L mammal	7.111	
L&M mammal : tot.Pisces	0.036	

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Table 8.39 - The mammalian NISP summary for Hus 9/14.

Storaborg H 9/14 Archaeofauna Summary

SITE : Storaborg Taxon	UNIT : NISP	H 9/14 % of whole	% of group
DOMESTICATES			
Bos taurus	157	6.41	34.43
Equus caballus	4	0.16	0.88
Canis familaris	0	0.00	0.00
Sus scrofa	4	0.16	0.88
Ovis aries	67	2.73	14.69
Capra hircus	7	0.29	1.54
Ovis/Capra sp.	217	8.86	47.59
total Ovis/Capra	291	11.88	63.82
total Domesticates	456	18.61	
SEALS			
Phoca vitulina		0.00	ERR
Large seal (H. gryphus ?)		0.00	ERR
Phocid sp.	1	0.04	
total Phocid	1	0.04	
CETACEA			
Cetacea sp.	1	0.04	
OTHER MAMMALS			
Alopex lagopus		0.00	

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Table 8.40 - The avian and pisces summary for Hus 9/14.

Storaborg H 9/14 Archaeofauna Summary

Taxon	NISP	% of whole	% of group
BIRDS			
Wildfowl			
Uria sp.	2	0.08	50.00
Fratercula arctica		0.00	0.00
Alca torda		0.00	0.00
Larus hyperboreus		0.00	0.00
Larus argentatus		0.00	0.00
Larus marinus	2	0.08	50.00
Larus sp.		0.00	0.00
Fulmaris glacialis		0.00	0.00
Catharacta skua		0.00	0.00
Stercorcarius parasiticus		0.00	0.00
Sula bassana		0.00	0.00
Branta leucopsis		0.00	0.00
Branta sp.		0.00	0.00
Nyctea scandia		0.00	0.00
Rallus aquaticus		0.00	0.00
Total Wildfowl	4		100.00
Domestic Fowl			
Anser anser	1	0.04	100.00
Gallus gallus		0.00	0.00
Total Domestic Fowl	1		100.00
Bird sp.	7	0.29	
Total Birds	12	0.49	
FISH			
Gadus morhua	87	3.55	90.63
Pollachius virens	2	0.08	2.08
Molva molva	5	0.20	5.21
Melanogrammus aegl.		0.00	0.00
Merlangius merl.	2	0.08	2.08
Total Ident. Pisces	96	3.92	100.00
Total Pisces Cranial	1643	3.92	
Total Pisces Vertebral	220	8.98	
Total Fish	1959	79.96	
MOLLUSCA			
Mya truncata	10	0.41	
Mollusca sp.	11	0.45	
Total Mollusca	21	0.86	
TOTAL NISP =	2450	100.00	

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Table 8.41 - The summary of the ratio data for Hus 9/14.

Storaborg H 9/14 Archaeofauna Summary

Species Group Relative % (NISP)

	NISP	%
Domesticates	456	18.61
Seals	1	0.04
Cetacea	1	0.04
Other Mammals	0	0.00
Birds	12	0.49
Fish	1959	79.96
Mollusca	21	0.86
sum of major groups	2450	

Ratios

L&M Mam.+Dom.Mam. : Tot. Fish	1 to	2.17
Cattle : Caprine	1 to	1.85
Cattle : Horse	1 to	0.03
Cattle : Pigs	1 to	0.03
Cattle : Dogs	1 to	0.00
Goat : Sheep	1 to	9.57
Domestic Mammal : All Fish	1 to	4.30
Domestic Mammal : Ident.Fish	1 to	0.21
Domestic Mammal : Seals	1 to	.00
Domestic Mammal : Birds	1 to	0.03
Domestic Fowl : Wildfowl	1 to	4.00
Unident. Scrap	111	
% Identified		95.67
large mammal	133	
medium mammal	312	
total L & M mammal	445	
ratio M : L mammal	2.345	
L&M mammal : tot.Pisces	0.227	

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Table 8.42 - The mammalian NISP summary for Hus 17.

Storaborg H 17 Archaeofauna Summary

SITE : Storaborg UNIT : H17

Taxon	NISP	% of whole	% of group
DOMESTICATES			
Bos taurus	186	4.58	36.33
Equus caballus	16	0.39	3.13
Canis familaris	2	0.05	0.39
Sus scrofa	2	0.05	0.39
Ovis aries	41	1.01	8.01
Capra hircus	0	0.00	0.00
Ovis/Capra sp.	265	6.53	51.76
total Ovis/Capra	306	7.54	59.77
total Domesticates	512	12.62	
SEALS			
Phoca vitulina		0.00	
Large seal (H. gryphus ?)		0.00	
Phocid sp.	2	0.05	
total Phocid	2	0.05	
CETACEA			
Cetacea sp.	2	0.05	
OTHER MAMMALS			
Alopex lagopus		0.00	

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Table 8.43 - The avian and pisces NISP summary for Hus 17.

Storaborg H 17 Archaeofauna Summary

Taxon	NISP	% of whole	% of group
BIRDS			
Wildfowl			
Uria sp.	2	0.05	40.00
Fratercula arctica	2	0.05	40.00
Alca torda	1	0.02	20.00
Larus hyperboreus		0.00	0.00
Larus argentatus		0.00	0.00
Larus marinus		0.00	0.00
Larus sp.		0.00	0.00
Fulmaris glacialis		0.00	0.00
Catharacta skua		0.00	0.00
Stercorcarius parasiticus		0.00	0.00
Sula bassana		0.00	0.00
Branta leucopsis		0.00	0.00
Branta sp.		0.00	0.00
Nyctea scandia		0.00	0.00
Rallus aquaticus		0.00	0.00
Total Wildfowl	5		100.00
Domestic Fowl			
Anser anser	5	0.12	100.00
Gallus gallus		0.00	0.00
Total Domestic Fowl	5		100.00
Bird sp.	20	0.49	
Total Birds	30	0.74	
FISH			
Gadus morhua	113	2.79	94.17
Pollachius virens	4	0.10	3.33
Molva molva		0.00	0.00
Melanogrammus aegl.	3	0.07	2.50
Merlangius merl.		0.00	0.00
Total Ident. Pisces	120	2.96	100.00
Total Pisces Cranial	3147	2.96	
Total Pisces Vertebral	226	5.57	
Total Fish	3493	86.10	
MOLLUSCA			
Mya truncata	54	1.33	
Mytilus edulis	2	0.05	
Mollusca sp.	16	0.39	
Total Mollusca	18	0.44	
TOTAL NISP =	4057	100.00	

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Table 8.44 - The summary of the ratio data for Hus 17.

Storaborg H 17 Archaeofauna Summary

Species Group Relative % (NISP)

	NISP	%
Domesticates	512	12.62
Seals	2	0.05
Cetacea	2	0.05
Other Mammals	0	0.00
Birds	30	0.74
Fish	3493	86.10
Mollusca	18	0.44
sum of major groups	4057	

Ratios

L&M Mam.+Dom.Mam. : Tot. Fish	1 to	5.22
Cattle : Caprine	1 to	1.65
Cattle : Horse	1 to	0.09
Cattle : Pigs	1 to	0.01
Cattle : Dogs	1 to	0.00
Goat : Sheep	1 to	ERR
Domestic Mammal : All Fish	1 to	6.82
Domestic Mammal : Ident.Fish	1 to	0.23
Domestic Mammal : Seals	1 to	.00
Domestic Mammal : Birds	1 to	0.06
Domestic Fowl : Wildfowl	1 to	1.00

Unident. Scrap	471	
% Identified		89.60
large mammal	53	
medium mammal	104	
total L & M mammal	157	
ratio M : L mammal	1.962	
L&M mammal : tot.Pisces	0.044	

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Table 8.45 - The mammalian NISP summary for Hus 18.

Storaborg H 18 Archaeofauna Summary

SITE : Storaborg Taxon	UNIT : NISP	H 18 % of whole	% of group
DOMESTICATES			
Bos taurus	450	4.04	29.15
Equus caballus	11	0.10	0.71
Canis familaris	1	0.01	0.06
Sus scrofa	38	0.34	2.46
Ovis aries	245	2.20	15.87
Capra hircus	15	0.13	0.97
Ovis/Capra sp.	784	7.03	50.78
total Ovis/Capra	1044	9.36	67.62
total Domesticates	1544	13.85	
SEALS			
Phoca vitulina	2	0.02	100.00
Large seal (H. gryphus ?)		0.00	0.00
Phocid sp.	19	0.17	
total Phocid	21	0.19	
CETACEA	5		
Cetacea sp.		0.00	
OTHER MAMMALS			
Alopex lagopus	0	0.00	

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Table 8.46 - The avian and pisces NISP summary for Hus 18.

Storaborg 4 15 Archaeofauna Summary

Taxon	NISP	% of whole	% of group
BIRDS			
Wildfowl			
Uria sp.	6	0.05	10.53
Fratercula arctica	34	0.30	59.65
Alca torda	3	0.03	5.26
Larus hyperboreus	1	0.01	1.75
Larus argentatus	4	0.04	7.02
Larus marinus	1	0.01	1.75
Larus sp.	1	0.01	1.75
Fulmaris glacialis		0.00	0.00
Catharacta skua	2	0.02	3.51
Stercorcarius parasiticus		0.00	0.00
Sula bassana	3	0.03	5.26
Branta leucopsis	2	0.02	3.51
Branta sp.		0.00	0.00
Nyctea scandia		0.00	0.00
Rallus aquaticus		0.00	0.00
Total Wildfowl	57		100.00
Domestic Fowl			
Anser anser	71	0.64	97.26
Gallus gallus	2	0.02	2.74
Total Domestic Fowl	73		100.00
Bird sp.	116	1.04	
Total Birds	246	2.21	
FISH			
Gadus morhua	329	2.95	92.94
Pollachius virens	18	0.16	5.08
Molva molva	3	0.03	0.85
Melanogrammus aegl.	4	0.04	1.13
Merlangius meri.		0.00	0.00
Total Ident. Pisces	354	3.18	100.00
Total Pisces Cranial	6394	3.18	
Total Pisces Vertebral	2536	22.75	
Total Fish	9284	83.27	
MOLLUSCA			
Mya truncata	38	0.34	
Mytilus edulis	2		
Mollusca sp.	14	0.13	
Total Mollusca	54	0.48	
TOTAL NISP =	11149	100.00	

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Table 8.47 - The summary of the ratio data for Hus 18.

Storaborg H 18 Archaeofauna Summary

Species Group Relative % (NISP)

	NISP	%
Domesticates	1544	13.85
Seals	21	0.19
Cetacea	0	0.00
Other Mammals	0	0.00
Birds	246	2.21
Fish	9284	83.27
Mollusca	54	0.48
sum of major groups	11149	

Ratios

L&M Mam.+Dom.Mam. : Tot. Fish	1 to	2.92
Cattle : Caprine	1 to	2.32
Cattle : Horse	1 to	0.02
Cattle : Pigs	1 to	0.08
Cattle : Dogs	1 to	0.00
Goat : Sheep	1 to	16.33
Domestic Mammal : All Fish	1 to	6.01
Domestic Mammal : Ident.Fish	1 to	0.23
Domestic Mammal : Seals	1 to	0.01
Domestic Mammal : Birds	1 to	0.16
Domestic Fowl : Wildfowl	1 to	0.78

Unident. Scrap	997	
% Identified		91.79
large mammal	433	
medium mammal	1199	
total L & M mammal	1632	
ratio M : L mammal	2.769	
L&M mammal : tot.Pisces	0.175	

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Table 8.48 - The mammalian NISP summary for Hus 19.

Storaborg H 19 Archaeofauna Summary

SITE : Storaborg Taxon	UNIT : H 19 NISP	% of whole	% of group
DOMESTICATES			
Bos taurus	151	3.79	32.40
Equus caballus	10	0.25	2.15
Canis familaris	1	0.03	0.21
Sus scrofa	12	0.30	2.58
Ovis aries	45	1.13	9.66
Capra hircus	6	0.15	1.29
Ovis/Capra sp.	241	6.05	51.72
total Ovis/Capra	292	7.33	62.66
total Domesticates	466	11.70	
SEALS			
Phoca vitulina		0.00	0.00
Large seal (H. gryphus ?)	3	0.08	100.00
Phocid sp.	3	0.08	
total Phocid	6	0.15	
CETACEA			
Cetacea sp.	1	0.03	
OTHER MAMMALS			
Alopex lagopus		0.00	

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Table 8.49 - The avian and pisces NISP summary for Hus 19.

Storaborg H 19 Archaeofauna Summary

Taxon	NISP	% of whole	% of group
BIRDS			
Wildfowl			
Uria sp.	15	0.38	83.33
Fratercula arctica	2	0.05	11.11
Alca torda		0.00	0.00
Larus hyperboreus		0.00	0.00
Larus argentatus		0.00	0.00
Larus marinus		0.00	0.00
Larus sp.	1	0.03	5.56
Fulmaris glacialis		0.00	0.00
Catharacta skua		0.00	0.00
Stercorcarius parasiticus		0.00	0.00
Sula bassana		0.00	0.00
Branta leucopsis		0.00	0.00
Branta sp.		0.00	0.00
Nyctea scandia		0.00	0.00
Rallus aquaticus		0.00	0.00
Total Wildfowl	18		100.00
Domestic Fowl			
Anser anser	10	0.25	40.00
Gallus gallus	15	0.38	60.00
Total Domestic Fowl	25		100.00
Bird sp.	49	1.23	
Total Birds	92	2.31	
FISH			
Gadus morhua	116	2.91	91.34
Pollachius virens	6	0.15	4.72
Molva molva	1	0.03	0.79
Melanogrammus aegl.	4	0.10	3.15
Merlangius merl.		0.00	0.00
Total Ident. Pisces	127	3.19	100.00
Total Pisces Cranial	2894	72.66	
Total Pisces Vertebral	519	13.03	
Total Fish	3413	85.69	
MOLLUSCA			
Mya truncata	1	0.03	
Mollusca sp.	4	0.10	
Total Mollusca	5	0.13	
TOTAL NISP =	3983	100.00	

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Table 8.50 - The summary of the ratio data for Hus 19.

Storaborg H 19 Archaeofauna Summary

Species Group Relative % (NISP)

	NISP	%
Domesticates	466	11.70
Seals	6	0.15
Cetacea	1	0.03
Other Mammals	0	0.00
Birds	92	2.31
Fish	3413	85.69
Mollusca	5	0.13
sum of major groups	3983	

Ratios

L&M Mam.+Dom.Mam. : Tot. Fish	1 to	5.34
Cattle : Caprine	1 to	1.93
Cattle : Horse	1 to	0.07
Cattle : Pigs	1 to	0.08
Cattle : Dogs	1 to	0.00
Goat : Sheep	1 to	7.50
Domestic Mammal : All Fish	1 to	7.32
Domestic Mammal : Ident.Fish	1 to	0.27
Domestic Mammal : Seals	1 to	0.01
Domestic Mammal : Birds	1 to	0.20
Domestic Fowl : Wildfowl	1 to	0.72

Unident. Scrap	244	
% Identified		94.23
large mammal	41	
medium mammal	132	
total L & M mammal	173	
ratio M : L mammal	3.219	
L&M mammal : tot.Pisces	0.050	

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Table 9.1 The 1986 Central Erosion Face surface collected archaeofauna.

Taxon	NISP	TNF
DOMESTICATES		
Bos taurus - cattle	19	-
Equus caballus - horse	5	-
Canis familiaris - domestic dog	2	-
Sus scrofa - domestic pig	1	-
Ovis aries - sheep	28	-
Ovis/Capra - caprine	97	-
Total Domesticates	152	-
SEALS		
Phocidae	51	-
Phoca vitulina - common seal	1	-
Pagophilus groenlandicus - harp seal	12	-
Total Seals	64	-
CETACEA		
Great Whale	70	-
Delphinidae	3	-
Total Whales	73	-
OTHER MAMMALS		
Ursus maritimus - polar bear	1	-
AVES - birds	6	-
Anseriformes - geese & ducks	1	-
Anser anser - greylag goose	2	-
Anser sp. - goose species	1	-
Alcidae		
Alca torda - razor-bill	1	-
Total Birds	12	-

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Table 9.1 (cont.) - The 1986 Central Erosion Face surface collected archaeofauna.

Taxon	NISP	TNF
PISCES - fish	71	-
Gadidae - cod family	8	-
Gadus morhua	22	-
Total Fish	101	-
MOLLUSCA		
Mytilus edulis - blue mussel	121	-
UNIDENTIFIED FRAGMENTS	-	7
Large Terrestrial Mammals	-	10
Medium Terrestrial Mammals	-	134
Medium Marine Mammals	-	2
Total	-	153

Total NISP = 523
Total TNF = 153
Assemblage Total = 676

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Table 10.1 - Comparison of the major taxa recovered from the Medieval and Early Modern phases from the 1987-1988 Videy faunal samples.

VIDEY
Medieval - Early Modern Comparison
1987-88 ONLY

Summary By Phase
NISP counts

		MAJOR TAXA	
		MEDIEVAL	EARLY MODERN
DOMESTICATES			
Bos taurus	cattle	478	213
Equus caballus	horse	19	1
Sus scrota	pig	6	3
Ovis aries	sheep	127	55
Capra hircus	goat	1	0
Ovis/Capra sp.	caprine	526	322
total Ovis/Capra		654	377
total Domesticates		1157	594
SEALS			
Phoca vitulina	common	4	0
Phocid sp.	seal sp.	36	3
total Phocid		40	3
CETACEA			
Great whale		2	0
Small whale/porpoise		2	0
Cetacea sp.		1	11
total Cetacea		5	11
OTHER MAMMALS			
Alopex lagopus	fox	3	0
total Other Mammals		3	0
BIRDS			
Bird sp.		593	667
FISH			
Fish sp.		950	1804
MOLLUSCA			
Mollusca sp.		36	139
TOTAL NISP =		2784	3218

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Table 10.2 - Summary of the relative percentage of the Number of Identified Specimens (NISP) for the phased 1987-1988 archaeofauna recovered from Videy.

VIDEY			
Summary By Phase Percent of Archaeofauna		NISP %	
DOMESTICATES		MEDIEVAL	EARLY MODERN
Bos taurus	cattle	17.17	6.62
Equus caballus	horse	0.68	0.03
Sus scrofa	pig	0.22	0.09
Ovis aries	sheep	4.56	1.71
Capra hircus	goat	0.04	0.00
Ovis/Capra sp.	caprine	18.89	10.01
total Ovis/Capra		23.49	11.72
total Domesticates		41.56	18.46
SEALS			
Phoca vitulina	common	0.14	0.00
Phocid sp.	seal sp.	1.29	0.09
total Phocid		1.44	0.09
CETACEA			
Great whale		0.07	0.00
Small whale/porpoise		0.07	0.00
Cetacea sp.		0.04	0.34
total Cetacea		0.18	0.34
OTHER MAMMALS			
Alopex lagopus	fox	0.11	0.00
total Other Mammals		0.11	0.00
BIRDS			
Bird sp.		21.30	20.73
FISH			
Fish sp.		34.12	56.06
MOLLUSCA			
Mollusca sp.		1.29	4.32
TOTAL NISP =		100.00	100.00

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Table 10.3 - Comparison of the domestic mammals recovered from the Medieval and Early Modern phases from the 1987-1988 Videy faunal samples.

VIDEY DOMESTIC MAMMALS 1987-88

NISP

DOMESTICATES		MEDIEVAL	Early Modern
Bos taurus	cattle	478	213
Equus caballus	horse	19	1
Sus scrofa	pig	6	3
Ovis aries	sheep	127	55
Capra hircus	goat	1	0
Ovis/Capra sp.	caprine	526	322
total Ovis/Capra		654	377
total Domesticates		1157	594

PERCENT OF DOMESTICATES

DOMESTICATES		MEDIEVAL	Early Modern
Bos taurus	cattle	41.31	35.86
Equus caballus	horse	1.64	0.17
Sus scrofa	pig	0.52	0.51
Ovis aries	sheep	10.98	9.26
Capra hircus	goat	0.09	0.00
Ovis/Capra sp.	caprine	45.46	54.21
total Ovis/Capra		56.53	63.47

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Table 10.4 - A listing by site context and phases of the neonatal bovid (both cattle and caprines) remains recovered from the 1987-1988 Videy faunal samples.

Videy 1987-88

AGEING

Neonatal Remains

		NISP COUNTS				PERCENT OF TAXON	
Context	Phase	Cattle	Caprine	Context	Phase	Cattle	Caprine
M2	EARLY MODERN	38	2	M2	EARLY MODERN	48.10	1.04
32 I		0	0	32 I		0.00	0.00
33 I		4	1	33 I		33.33	6.25
33 II		1	0	33 II		10.00	0.00
34 I		2	0	34 I		5.41	0.00
34 II		3	0	34 II		13.04	0.00
35 I		4	0	35 I		30.77	0.00
36 I		0	0	36 I		0.00	0.00
	TOTAL	52	3		TOTAL	24.53	0.71
M12	MEDIEVAL	72	67	M12	MEDIEVAL	30.25	20.30
33 III		0	0	33 III		0.00	0.00
34 III		27	5	34 III		15.61	2.07
35 II		0	0	35 II		0.00	0.00
35 III		2	0	35 III		25.00	0.00
36 III		2	0	36 III		5.13	0.00
	TOTAL	103	72		TOTAL	21.55	11.01

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Table 10.5 - A partial listing of the bird species present in the 1987-1988 Videy faunal samples.

TABLE 6 A Partial Listing of Bird Species in the Videy Archaeofauna.

Key: +++ Very Numerous
++ Numerous
+ Infrequent

Order Pelecaniformes – Pelicans, Gannets & Boobies	+
Sulidae – Gannet Family	+
Sula bassana – Northern Gannet	+
Order Charadriiformes – Seabirds & Gulls	+++
Laridae – Gull Family	++
Alcidae – Auk Family	+++
Fratercula arctica – Atlantic Puffin	+++
Uria sp. – Murre or Guillemot Species	++
Order Anseriformes – Waterfowl	++
Anserinae – Geese Family	+
Anser anser – Greylag Goose	+
Aythinae – Diving Ducks	++
Somateria mollissima – Eider Duck	++
Anatinae – Salt-Marsh Ducks	++
Anas platyrynchos – Mallard	++

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Table 10.6 - The listing of identified fish species (NISP and the relative percentage of NISP) found within the 1987-1988 Videy faunal samples.

VIDEY 1987-88 IDENTIFIED FISH By Major Phase	NISP COUNT		
		Medieval	Early Modern
TAXA			
Gadus morhua	Atlantic cod	310	794
Molva molva	Ling	0	1
Anarrhicas lupus	Wolf fish	1	1
Hippoglossus sp.	Halibut sp.	9	3
Salmo sp.	Salmon	5	1
total identified to genus		325	800
Gadid	cod family	512	644
Selachimorpha	shark family	1	0

VIDEY 1987-88 IDENTIFIED FISH By Major Phase	PERCENT OF IDENTIFIED SPECIMENS		
		Medieval	Early Modern
TAXA		%	%
Gadus morhua	Atlantic cod	95.38	99.25
Molva molva	Ling	0.00	0.13
Anarrhicas lupus	Wolf fish	0.31	0.13
Hippoglossus sp.	Halibut sp.	2.77	0.38
Salmo sp.	Salmon	1.54	0.13
total identified to genus		100	100

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Table 10.7 - A listing of the molluscan species by site context and phase recovered from the 1987-1988 Videy faunal samples.

VIDEY 1987-88 TABLE

MOLLUSCA

Please note: Mollusca (Shellfish) are very fragile and their shells are suoject to rapid destruction by only slightly acid soils (as at Videy). These data are thus probably a partial species list rather than a fully quantified count.

		TAXON				
Context	Phase	Blue Mussel	Clam	Snail	Unident.	TOTAL
	EARLY MODERN	Mytilus edulis	Mya sp.	Gastropod	Shellfish	MOLLUSCA
M2		25	5	2	57	89
32 I		1			1	2
33 I		3	1		2	6
33 II		5			6	11
34 I		9	1	1	8	19
34 II		3			6	9
35 I		0			3	3
36 I		0	0	0	0	0
	TOTAL	46	7	3	83	139
M12	MEDIEVAL	2	1		2	5
33 III		1			5	6
34 III		3	1	1	7	12
35 II		1			2	3
35 III		2			3	5
36 III		2			3	5
	TOTAL	11	2	1	22	36

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Table 10.8 - The skeletal element distributions and taphonomic measures for the *Bos* M2 sub-sample dated to the Early Modern phases at Videy.

Table 10.9 - The skeletal element distributions and taphonomic measures for the caprine M2 sub-sample dated to the Early Modern phases at Videy.

[illegible]

[illegible]

[illegible]

Table 10.10 - The skeletal element distributions and taphonomic measures for the ***Bos*** M12 sub-sample dated to the Medieval phases at Videy.

Table 10.11 - The skeletal element distributions and taphonomic measures for the caprines M12 sub-sample dated to the Medieval phases at Videy.

Table 10.12 - The attritional factors and meat values for the bovid (both cattle and caprines) materials from the M2 and M12 sub-samples at Videy.

[illegible]

[illegible]

[illegible]

[illegible]

Table 10.13 - A summary of the Number of Identified Specimens (NISP) recovered in the 1987-1988 faunal samples at Videy. The table is organized by site context and phases.

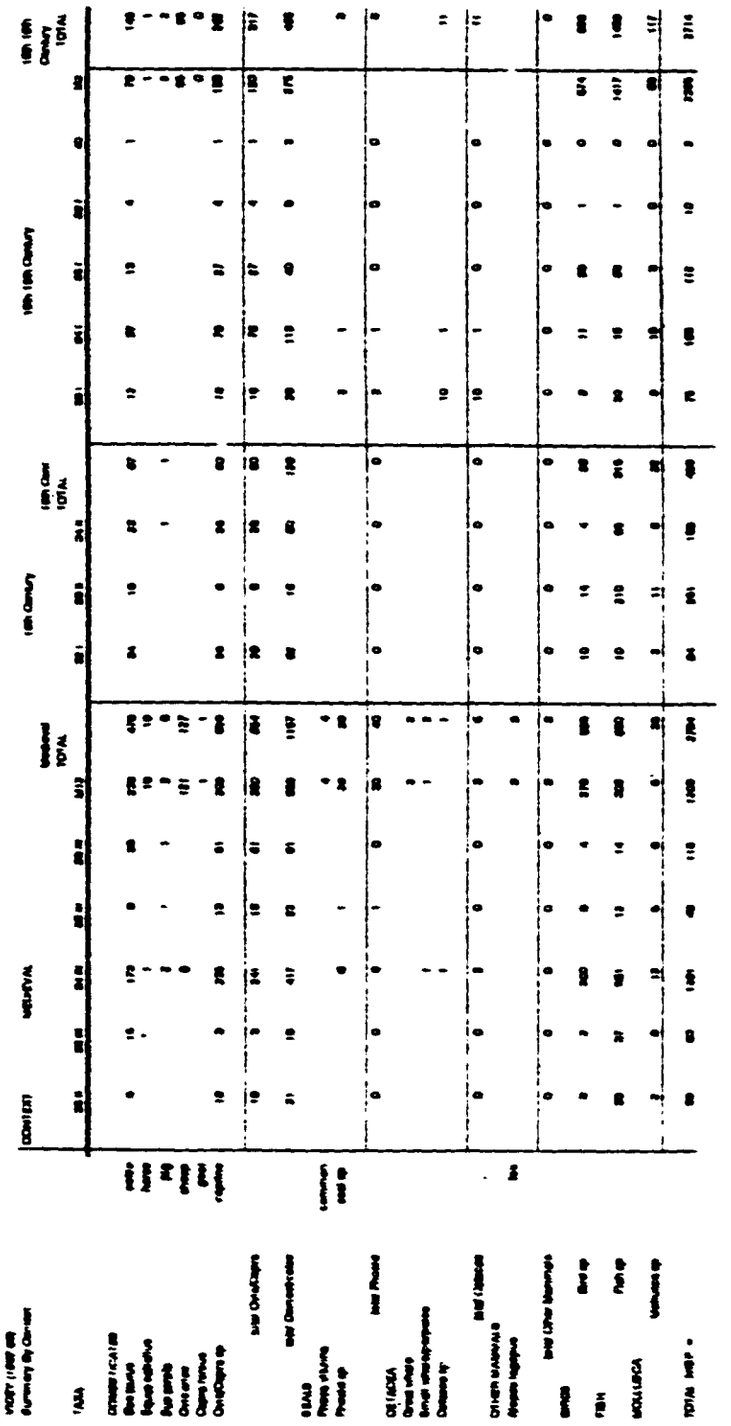

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Table 10.14 - A summary of the fish species NISP recovered from the 1987-1988 faunal samples at Videy. The table is organized by site context and phases.

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Table 10.15 - A breakdown of the 1987-1988 Videy faunal samples by the Medieval, 18th century, 18th & 19th centuries. Site context 57049 was not loaned to the author for study and these data were only roughly sorted by Tom McGovern in 1990.

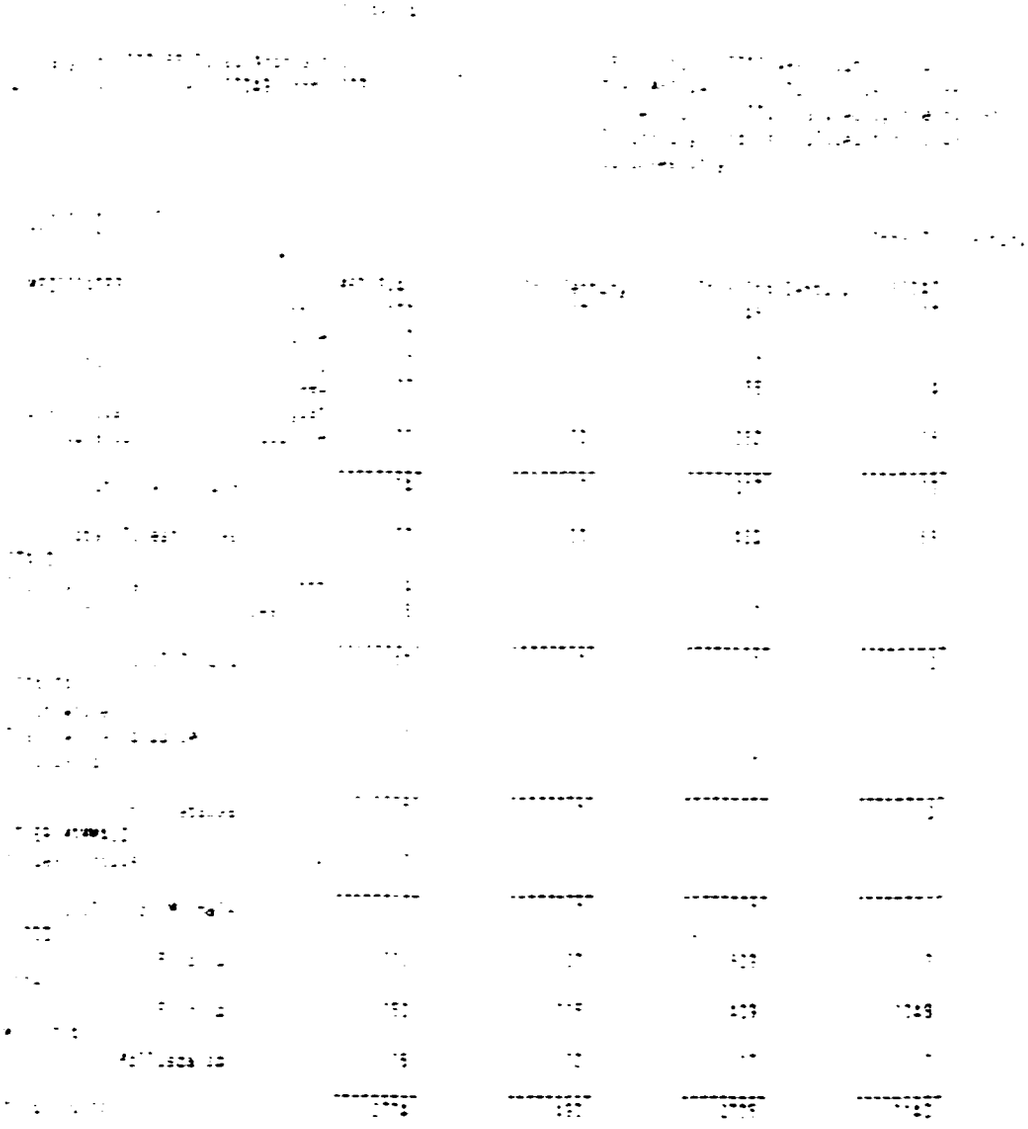

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Table 10.16 - Icelandic and Norse Greenlandic caprine metacarpi and metatarsi distal breadth (Bd) measurements. The Greenlandic data was kindly provided by T.H. McGovern.

Caprine Metatarsal Distal Breadth (Bd)	GREENLAND					Dagerbol (1936) W Settlement				ICELAND Adalbol	Storaborg	Videy
site	Ø 71 S	Ø 71 S	Ø 167	Ø 167	Ø 149		V 48	V 48	V 54			
taxon	Ovis	Capra	Ovis	Capra	Ovis	Capra	Ovis	Capra	Ovis	Ovis	Ovis	Ovis
Number of Specimens	8	4	2	1	1	8	4	3	2	3	28	31
Range Maximum	2.4	2.6	2.41			2.45	2.46	2.43	2.34	2.4	2.2	2.75
Range Minimum	2.2	2.2	2.21			2.16	2.23	2.14	2.1	2.15	2.62	2
mean	2.33	2.35	2.31	2.64	2.40	2.31	2.36	2.25	2.22	2.29	2.41	2.45
sd	0.09	0.17	0.14			0.10	0.10	0.16	0.17	0.13	0.94	0.18
CV	3.79	7.37	6.12			4.44	4.04	6.88	7.64	5.58	39.00	7.36

Caprine Metacarpal Distal Breadth (Bd)	GREENLAND					Dagerbol (1936) W Settlement				ICELAND Adalbol	Storaborg	Videy
site	Ø 71 S	Ø 71 S	Ø 167	Ø 29	W 149		V 48	V 48	V 54			
taxon	Ovis	Capra	Ovis	Ovis	Ovis	Capra	Ovis	Capra	Ovis	Ovis	Ovis	Ovis
Number of Specimens	5	1	3	3	14	5	2	3	1	8	38	33
Range Maximum	2.6	2.4	2.5	3.1	2.7	2.7	2.48	2.41	2.73	2.7	2.97	3.62
Range Minimum	2.3	2.4	2.05	2.3	2.23	2.36	2.46	2.33	2.73	2.37	2.3	1.73
mean	2.46	2.40	2.26	2.64	2.54	2.50	2.47	2.38	2.73	2.49	2.56	2.56
sd	0.11		0.23	0.41	0.15	0.15	0.01	0.04		0.10	0.149	0.289
CV	4.67		10.02	15.58	5.94	6.00	0.57	1.83		4.12	5.82	11.29

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Table 10.17 - A comparison of NISP data from large sized Icelandic archaeofauna.

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Table 10.18 - A list of "direct ratios" recovered from the 1987-198 faunal samples from Videy.

VIDEY 1987-1988	DIRECT RATIOS	
RATIOS	Medieval	Early Modern
cattle:caprine	1.37	1.77
Domestic:fish	0.82	3.04
Domestic:Mollusca	0.03	0.23
Domestic: Bird	0.51	1.12
Mollusca:Fish	26.39	12.98

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Table 11.1 - A summary of the sample sizes for the various Icelandic archaeofauna described in the previous chapters.

	NISP	TNF	TNB
Small Collections - <200 fragments	531	237	768
Small Collections - >200 fragments	1,403	91,685	93,088
Old Coll., Tests & Col. Samples	23,489	4,626	28,205
Large Collections	60,611	32,050	92,661
	84,631	123,972	214,722

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Table 11.2 - A summary of the sample sizes for the various Icelandic archaeofauna with <200 fragments (described in chapter 4).

Collection	NISP	TNF	TNB
Baegisstadir	5	3	8
Drangar	1	-	1
Eldvorp	64	44	108
Esjuberg	62	51	113
Grunnasundnes	1	-	1
Haukadalur	5	1	6
Hellisandur	2	-	2
Hergranes	-	-	+
Holar	62	25	87
Kolholtshellir	1	-	1
Lambastadir	184	13	197
Melholar	26	-	26
Melstadir	1	-	1
Rofunum	81	80	161
Reykholt	5	-	5
Skalholt	8	5	13
Sudurgata 3-5	-	-	+
Thingnes	-	1	1
Thorsteinsstadir	23	14	37
	531	237	768

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Table 11.3 - A summary of sample sizes for the various Icelandic archaeofauna with >200 fragments (described in chapter 4).

Collection	NISP	TNF	TNB
Adalstraeti 8	98	159	257
Fornusandar 2	95	1,732	1,827
Gammel-Grimstadir	515	230	745
Hakonstadir	124	62	186
Hofstadir	345	89,306	89,651
Nyibaer	68	111	179
Stong	158	85	243
	1,403	91,685	93,088

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Table 11.4 - A summary of sample sizes for the Old Collections, Modern Tests and Column Samples (described in chapter 5).

Collection	NISP	TNF	TNB
Adalbol	987	750	1,737
Herjolfsda	1,135	707	1,842
Hjallholl	2,519	880	3,399
Midbaer	8,961	1,842	10,803
Nesstofa	9,290	306	9,596
Tjarnargat	643	185	828
	23,489	4,626	28,205

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Table 11.5 - A summary of the sample sizes for the Large collections (described in chapters 6-10).

Collection	NISP	TNF	TNB
Bessastadir	12,323	4,234	16,557
Granastadir	1,656	3,839	5,495
Storaborg	32,325	5,641	37,966
Svalbard	8,340	12,119	20,459
Videy	5,967	6,217	12,184
	60,611	32,050	92,661

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Table 11.6 - The various taphonomic indicators used for comparing Iceland archaeofauna.

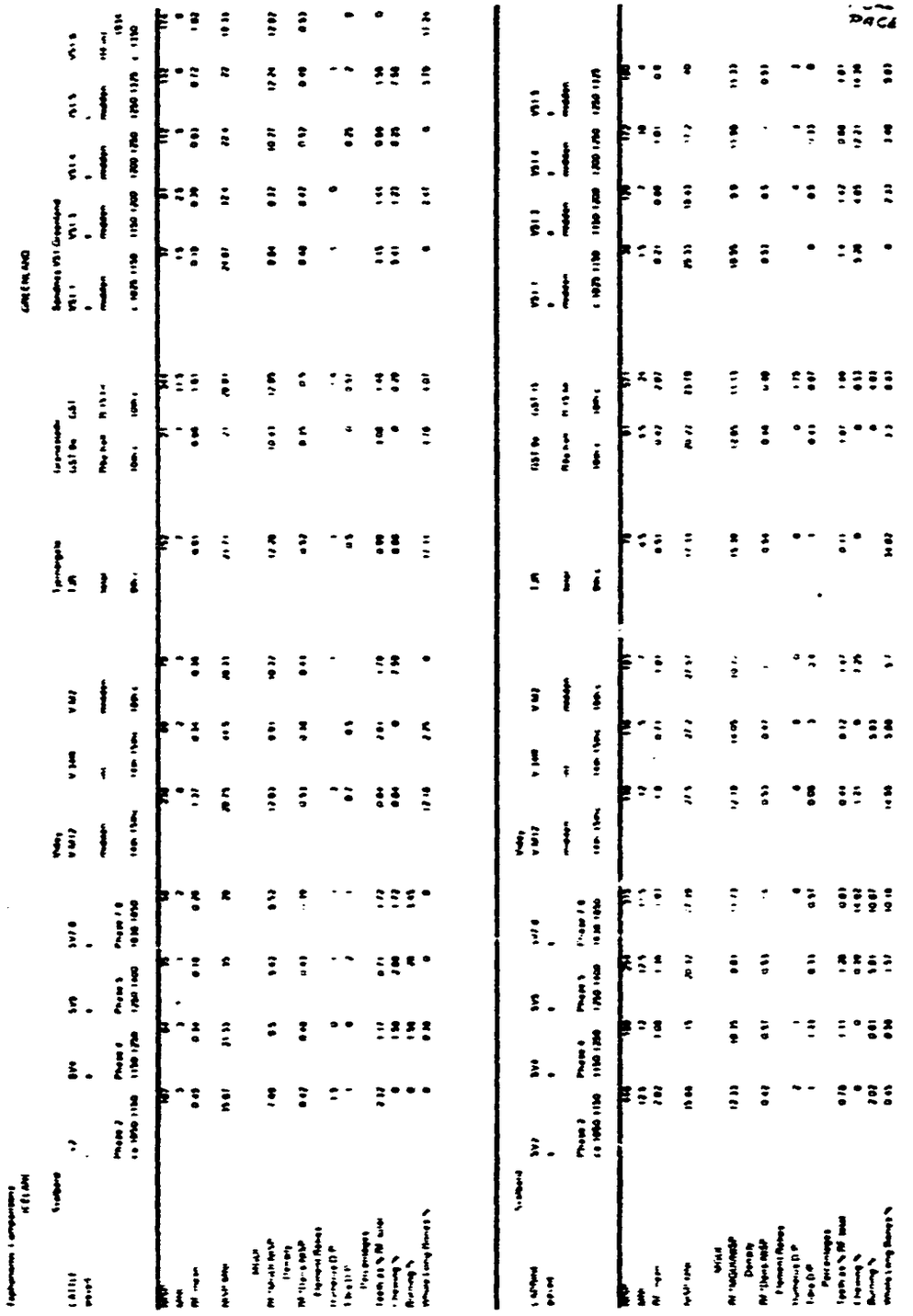

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Table 11.7 - The "dummy" data trial for the skeletal element distribution of a whole skeleton.

DUMMY DATA TRIALS

TABLE 11.7
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WHOLE SKELETONS

Dummy 10 skelets
deposited with no fragmentation

SUMMARY STATISTICS			Obons 8.0
NISP total	1390		
RF mean	3.78	non zero entries	28.00
RF Stand Dev	4.88	Sum of RF	280.00
RF Coeff of Var	129.05	Quartile Break	7.00
		ARF mean	
Maximum RF ("MNI")	10.00	NEONATALS	
Minimum RF	0.00	Total NN	0
		NonNN	1390.00
NISP/MNI Ratio	139.00	Decid. teeth	0
		%NN & Decid	0.00

ELEMENT DISTRIBUTION
(NB Will be affected by Data Sort!)

	Relative % (RF)	RF
horncore	0.00	0.00
cranial	10.71	30.00
forequarter	17.86	50.00
vert.& ribs	21.43	60.00
hindquarter	25.00	70.00
lwr hindlimb	3.57	10.00
lwr.forelimb	3.57	10.00
feet	10.71	30.00

TAPHONOMIC MEASURES

Modified Gen Util Index		Bone Density	
Mean RF*MGUI	129.11	Mean RF*Dens.	4.26
Max. RF*MGUI	1000.00	Max. RF*Dens.	15.20
total RF*MGUI	9554.10	total RF*Dens	315.10
RF*MGUI/NISP	6.87	RF*DENS/NISP	0.23
CHEWING		DIFF DENSITY RATIOS	
Total chewed	0	Humerus D/P	ERR
% chewed	0.00	Tibia D/P	ERR

Teeth as % of RF total	0.00	%
Number of whole Long Bones	140	
Percent of whole Long bones	10.07	%
Number of Burned Bones	0.00	
Percent of Burned Bones	0.00	%

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Table 11.8 - The "dummy" data trial for the skeletal element distribution of a whole skeleton with minimal fragmentation.

DUMMY DATA TRIALS

WHOLE SKELETONS

TABLE 11.8
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Dummy 10 skelets
deposited with minimal fragmentation
long bones (except Ph) broken into P/D/SH
Calvarium Discarded nearly whole. face breaks off
in bilateral bits

SUMMARY STATISTICS			10bone 3 0
NISP total	2070		
RF mean	6.76	non zero entries	50.00
RF Stand. Dev	4 71	Sum of RF	500.00
RF Coeff. of Var.	69.75	Quartile Break	12.50
		ARF mean	
Maximum RF ("MNI")	10 00	NEONATALS	
Minimum RF	0.00	Total NN	0
		NonNN	2070.00
NISP/MNI Ratio	207 00	Decid. teeth	0
		%NN & Decid	0.00

ELEMENT DISTRIBUTION
(NB Will be affected by Data Sort')

	Relative % (RF)	RF
horncore	2 00	10 00
cranial	22 00	110 00
forequarter	20 00	100 00
vert.& ribs	12 00	60 00
handquarter	22 00	110 00
hwr.hindlimb	6 00	30 00
hwr forelimb	6.00	30 00
feet	6.00	30.00

TAPHONOMIC MEASURES

Modified Gen. Util. Index		Bone Density	
Mean RF*MGUI	206.41	Mean RF*Dens	8.61
Max. RF*MGUI	1000 00	Max. RF*Dens	20 00
total RF*MGUI	15274 70	total RF*Dens	637 40
RF*MGUI/NISP	7 38	RF*DENS/NISP	0.31
CHEWING		DIFF DENSITY RATIOS	
Total chewed	0	Humerus D/P	1 00
% chewed	0 00	Tibia D/P	1 00

Teeth as % of RF total 1 93 %

Number of whole Long Bones 0
Percent of whole Long bones 0 00 %

Number of Burned Bones 0 00
Percent of Burned Bones 0.00 %

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Table 11.9 - The "dummy" data trial for the skeletal element distribution for the ravaged scenario.

DUMMY DATA TRIALS

TABLE 11.9
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RAVAGED SCENARIO

Dummy 10 skelets
only most dense elements
Upper quartile only

SUMMARY STATISTICS			Qbone 3 0
NISP total	530		
RF mean	2 16	non zero entries	16 00
RF Stand Dev	4 14	Sum of RF	160 00
RF Coeff of Var	191 89	Quartile Break	4 00
		ARF mean	
Maximum RF ("MNI")	10 00	NEONATALS	
Minimum RF	0 00	Total NN	0
		NonNN	530 00
NISP/MNI Ratio	53 00	Decid. teeth	0
		%NN & Decid	0 00

ELEMENT DISTRIBUTION
(NB Will be affected by Data Sort')

	Relative % (RF)	RF
horncore	0 00	0 00
cranial	56 25	90 00
forequarter	18 75	30 00
vert & ribs	6 25	10 00
hindquarter	12 50	20 00
fwr hindlimb	0 00	0 00
fwr forelimb	0 00	0 00
feet	0 00	0 00

TAPHONOMIC MEASURES

Modified Gen. Util. Index		Bone Density	
Mean RF*MGUI	48 91	Mean RF*Dens	3 48
Max. RF*MGUI	647 30	Max. RF*Dens.	20.00
total RF*MGUI	3619 00	total RF*Dens	257 60
RF*MGUI/NISP	6 83	RF*DENS/NISP	0 49
CHEWING		DIFF DENSITY RATIOS	
Total chewed	0	Humerus D/P	ERR
% chewed	0 00	Tibia D/P	ERR

Teeth as % of RF total 7 55 %

Number of whole Long Bones 0
Percent of whole Long bones 0.00 %

Number of Burned Bones 0 00
Percent of Burned Bones 0 00 %

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Table 11.10 - The "dummy" data trial for the skeletal element distribution for the gourmet scenario.

DUMMY DATA TRIALS
Taxon: Bos taurus dom
GOURMET SCENARIO
Dummy 10 Skeleta
with all high
meat value (mgui) elements
no whole long bones, assume
broken into P/D/Sh
Top quartile MGUI only

SUMMARY STATISTICS			Obone 3.0
NISP total	650		
RF mean	2 05	non zero entries	16 00
RF Stand Dev	4 04	Sum of RF	151 43
RF Coeff of Var	197 48	Quartile Break	4 00
		ARF mean	
Maximum RF ("MNI")	10 00	NEONATALS	
Minimum RF	0 00	Total NN	0
		NonNN	650 00
NISP/MNI Ratio	65 00	Decid. teeth	0
		%NN & Decid.	0 00

ELEMENT DISTRIBUTION
(NB: Will be affected by Data Sort!)

	Relative % (RF)	RF
horncore	0 00	0 00
cranial	0 00	0.00
forequarter	26 42	40.00
vert.& ribs	19 81	30.00
hindquarter	46 23	70 00
fwr hindlimb	0 00	0 00
fwr forelimb	0 00	0 00
feet	0 00	0 00

TAPHONOMIC MEASURES

Modified Gen Util Index		Bone Density	
Mean RF*MGUI	121 10	Mean RF*Dens	2 53
Max RF*MGUI	1000 00	Max RF*Dens	15 20
total RF*MGUI	8961 56	total RF*Dens	187 39
RF*MGUI/NISP	13 79	RF*DENS/NISP	0 29
CHEWING		DIFF DENSITY RATIOS	
Total chewed	0	Humerus D/P	1 00
% chewed	0 00	Tibia D/P	1 00

Teeth as % of RF total: 0 00 %

Number of whole Long Bones: 0
Percent of whole Long bones: 0 00 %

Number of Burned Bones: 0 00
Percent of Burned Bones: 0 00 %

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Table 11.11 - The "dummy" data trial for the skeletal element distribution for the rejects scenario.

DUMMY DATA TRIALS

Bos taurus dom

REJECTS SCENARIO
Dummy 10 Skelets
with all LOW meat value (MGUI)
elements. No whole long bones, assume
broken into P/D/Sh, except phalanges, all whole
Calvarium discarded nearly whole, face breaks off
Bottom half MGUI only

SUMMARY STATISTICS			Qbone 3.0
NISP total	1040		
RF mean	2 97	non zero entries	22 00
RF Stand Dev	4 60	Sum of RF	220 00
RF Coeff of Var	154 79	Quartile Break	5 50
		ARF mean	
Maximum RF ("MNI")	10 00	NEONATALS	
Minimum RF	0 00	Total NN	0
		NonNN	1040 00
NISP/MNI Ratio	104 00	Decid teeth	0
		%NN & Decid	0 00

ELEMENT DISTRIBUTION
(NB. Will be affected by Data Sort!)

	Relative % (RF)	RF
horncore	4 55	10 00
cranial	50.00	110.00
forequarter	9.09	20.00
vert.& ribs	4 55	10.00
hindquarter	0.00	0 00
hwr hindlimb	4 55	10 00
hwr forelimb	13 64	30.00
feet	13 64	30 00

TAPHONOMIC MEASURES

Modified Gen Util Index		Bone Density	
Mean RF*MGUI	30 13	Mean RF*Dens	3 93
Max RF*MGUI	239 30	Max RF*Dens	20 00
total RF*MGUI	2229 30	total RF*Dens	291 00
RF*MGUI/NISP	2 14	RF*DENS/NISP	0 28
CHEWING		DIFF DENSITY RATIOS	
Total chewed	0	Humerus D/P	ERR
% chewed	0 00	Tibia D/P	ERR

Teeth as % of RF total 3.85 %

Number of whole Long Bones 0
Percent of whole Long bones 0 00 %

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Table 12.1 - Modern and Medieval/Early Modern cod length distributions in Iceland. Cod measured during systematic fisheries trawls during 1976-1979 (trawls were done in the north, northeast, east and south coasts of Iceland) are compared to reconstructed cod length distributions from the archaeological sites of Midbaer, Storaborg, Svalbard and Videy. Note the absence of cod reconstructed as less than 40 cm. in length, except in the Midbaer sample. It would seem that post-modern fishing gear, unlike modern fisheries trawls of fishing gear, seem to have selected smaller fish. However, the substantial number of fragments (both dentaries and premaxillaries) from the archaeological sites which derive from fish 100 cm. and longer (see the bottom rows in the table - Amorosi, McGovern and Perdikaris 1994:42). This table should be viewed with Figure 12.5 and 12.6.

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Table 12.1 (cont.) - Modern and Medieval/Early Modern cod length distributions in Iceland.

	Measured fish	Archaeological reconstructions						
Length groups (in cm)	Icelandic trawl fisheries 1976–1979 total	Storaborg 13th–15th c total Premax	Storaborg 13th–15th c total Dentaries	Vatey 13th–15th c total Premax	Vatey 13th–18th c total Dentaries	MidMeer 13th–18th c total Premax	MidMeer 13th–15th c total Dentaries	Storaborg 13th–15th c total Premax
50–59	83	0	0	0	0	0	0	0
60–69	632	0	0	0	0	0	0	0
70–79	1220	0	0	0	0	0	0	0
80–89	1489	0	0	0	0	0	0	0
90–99	1622	0	0	0	0	2	4	0
100–109	1765	0	0	0	0	10	11	0
110–119	1669	2	0	0	2	4	5	0
120–129	1133	24	20	0	4	15	4	0
130–139	536	52	66	0	12	6	2	0
140–149	223	74	97	13	12	3	1	21
150–159	92	37	57	13	8	0	0	13
160–169	28	13	12	2	1	0	0	0
170–179	4	0	10	2	0	0	0	0
180–189	0	0	1	0	0	1	0	0
190–199	0	1	0	0	0	0	0	0
200–209	0	0	1	0	0	0	0	0
210–219	0	0	0	0	0	1	0	0
Total	10876	186	284	30	39	48	30	37
Number > 100 cm	102	40	51	19	9	8	0	26
Number > 120 cm	12	10	12	2	0	2	0	3
Number > 140 cm	0	2	1	0	0	1	0	0

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Table 12.2 - A comparison of the fish components from Icelandic and Kodiak Island Archaeofauna.

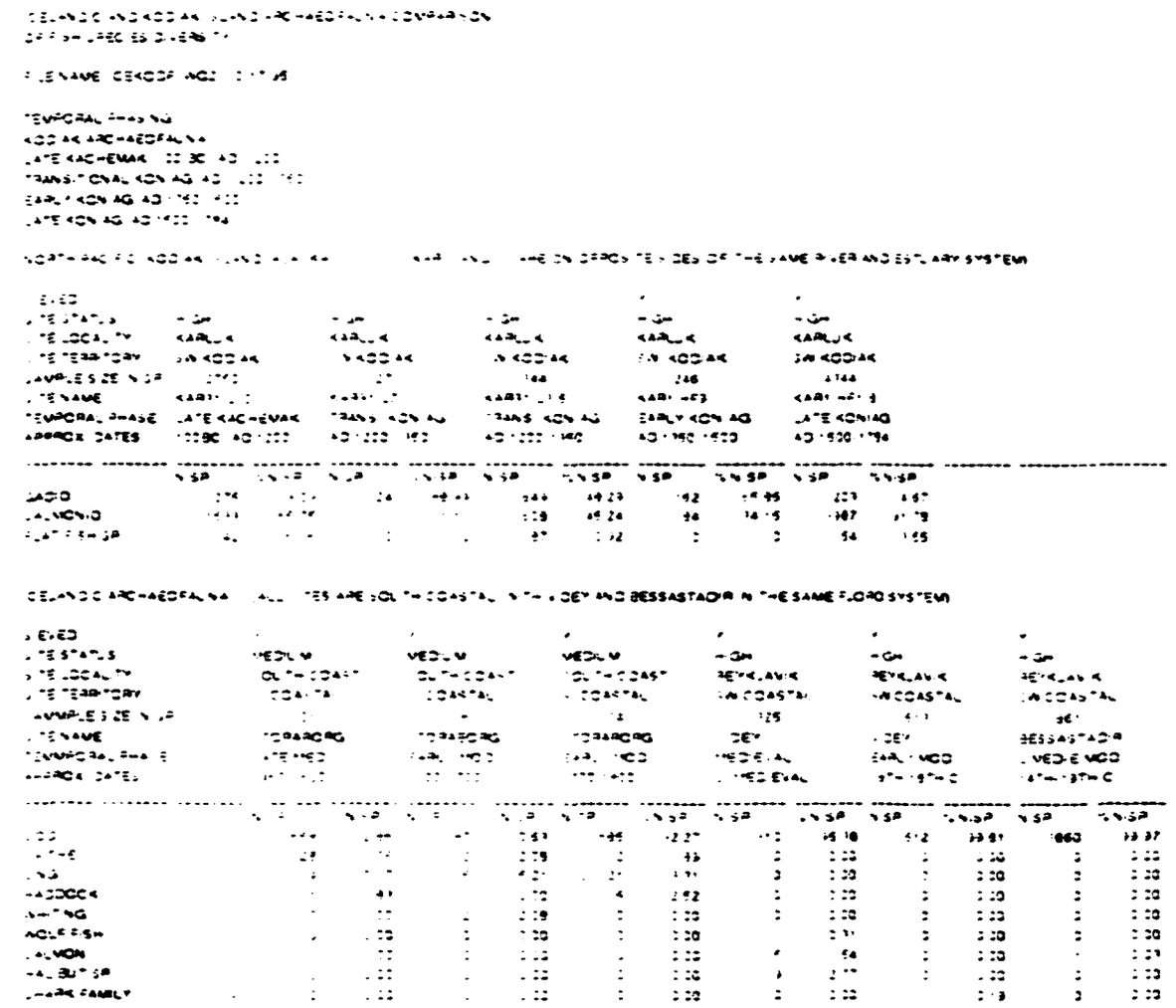

Figure 2.1 - The various bony sections of a phocid palate.

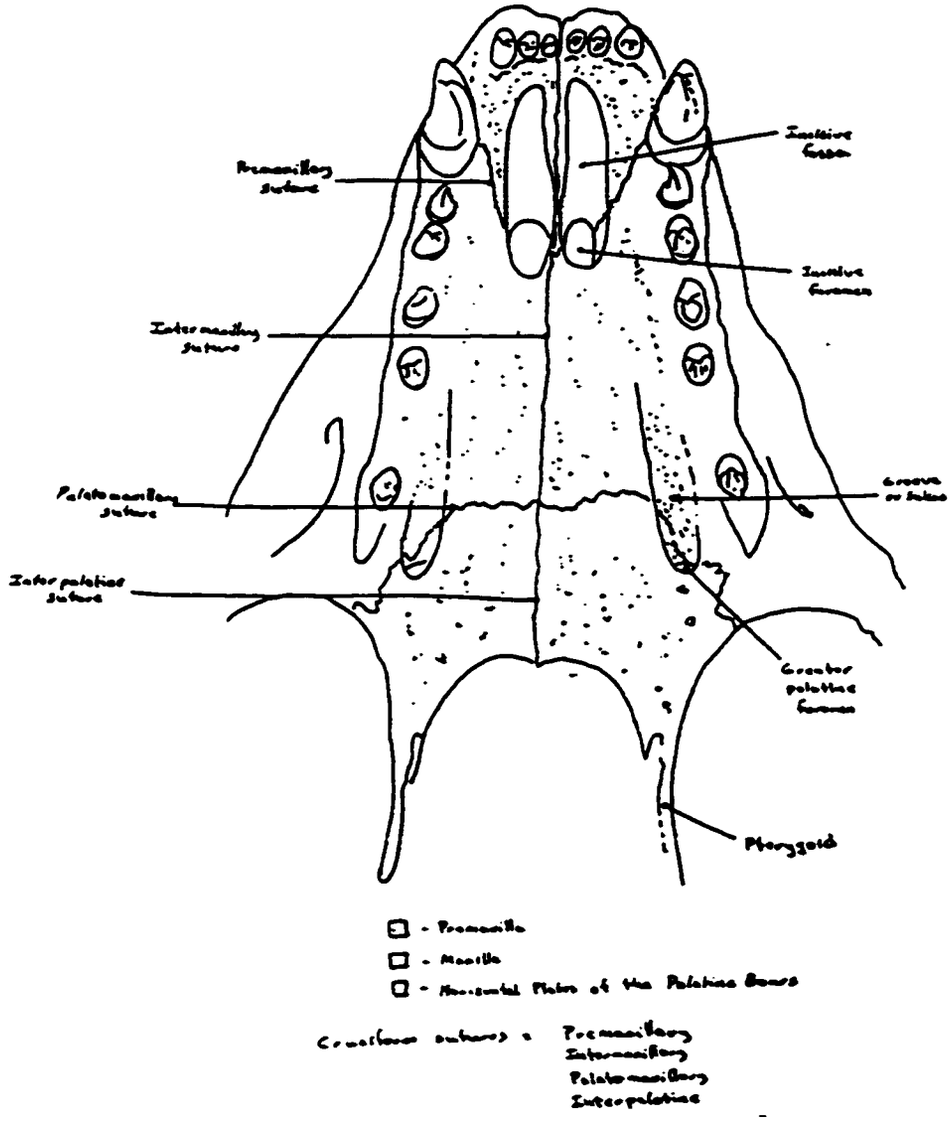

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Figure 2.2 - The bony palate of *Phoca vitulina*.

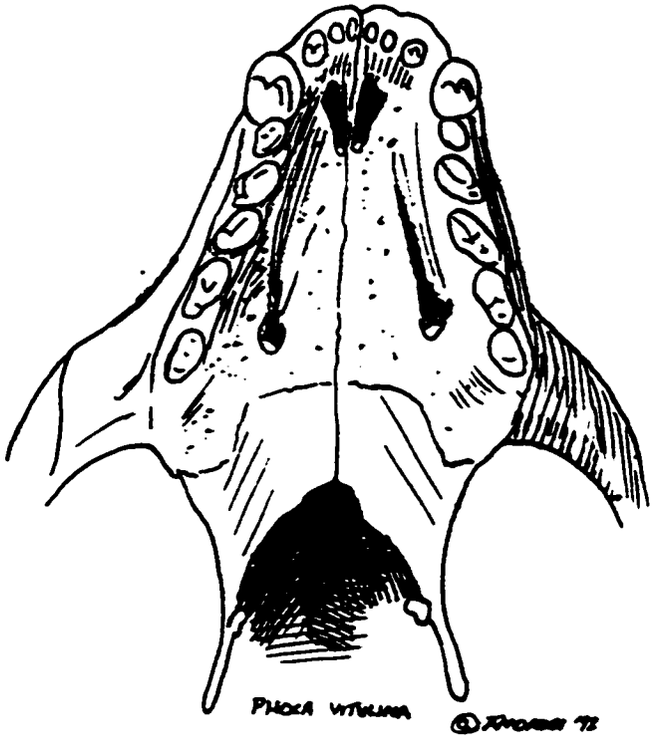

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Figure 2.3 - The bony palate of *Phoca hispida*.

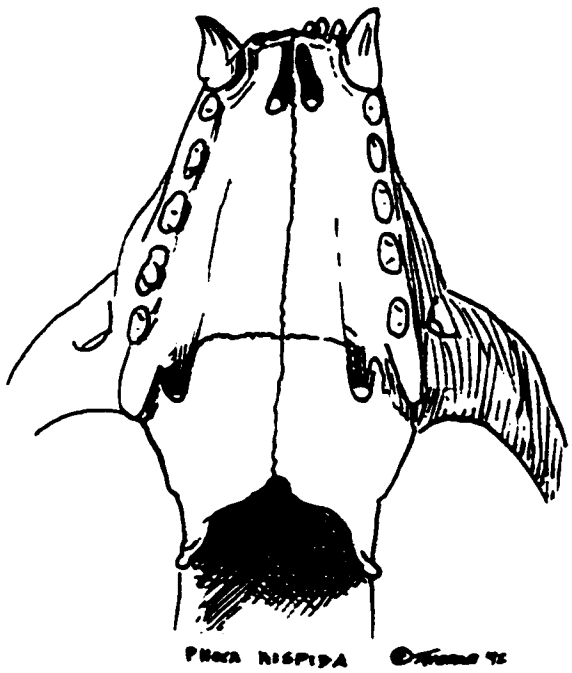

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Figure 2.4 - The bony palate of *Pagophilus groenlandicus*.

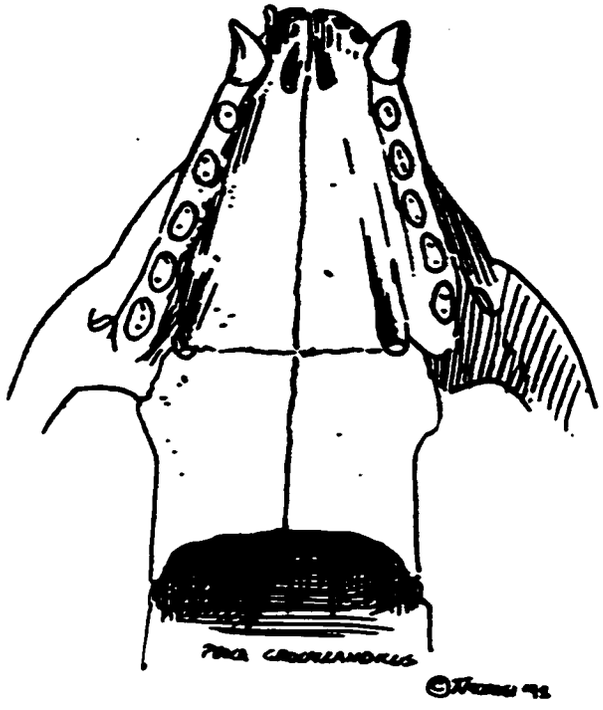

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Figure 2.5 - The bony palate of *Halichoerus grypus*.

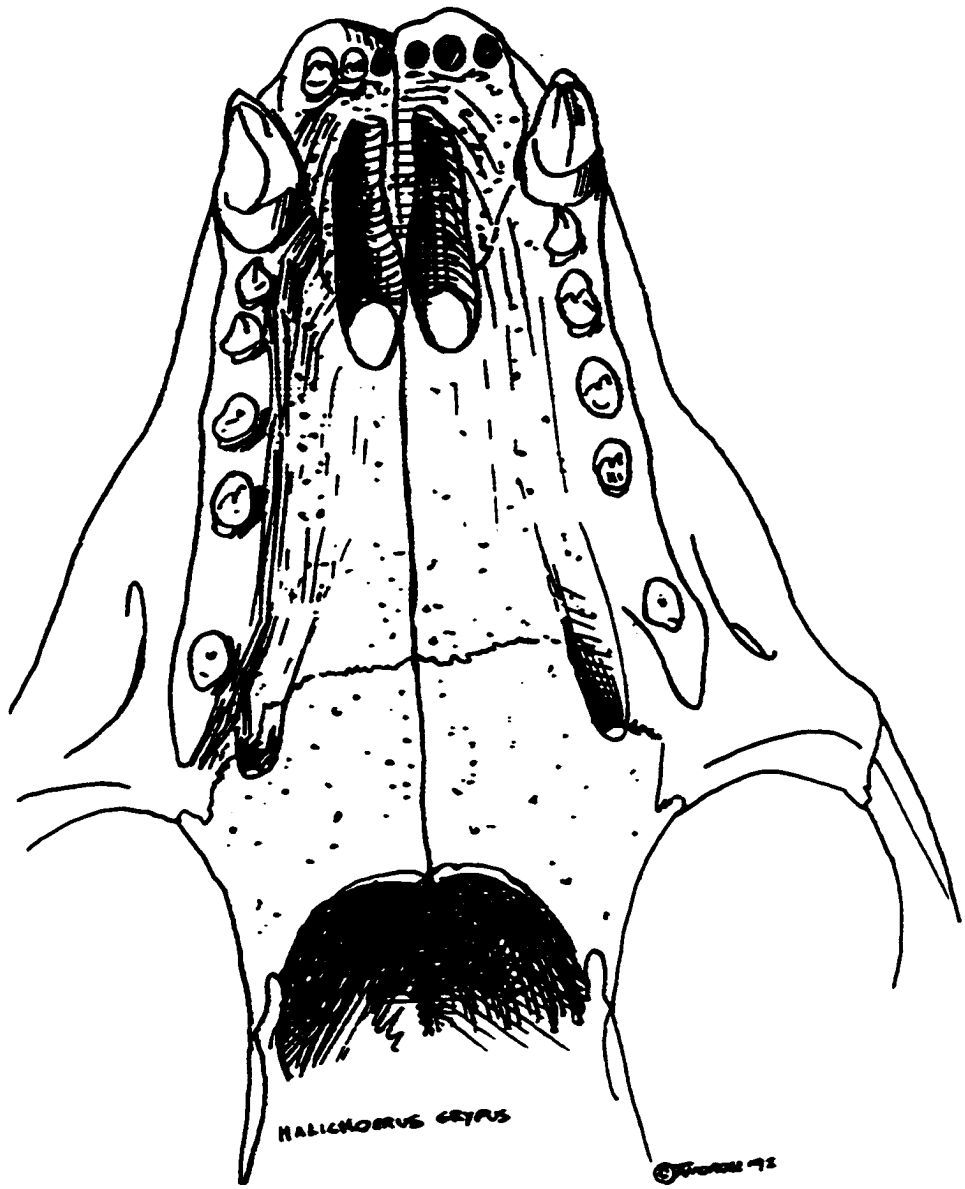

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Figure 2.6 - The bony palate of ***Ergnathus barbatus***.

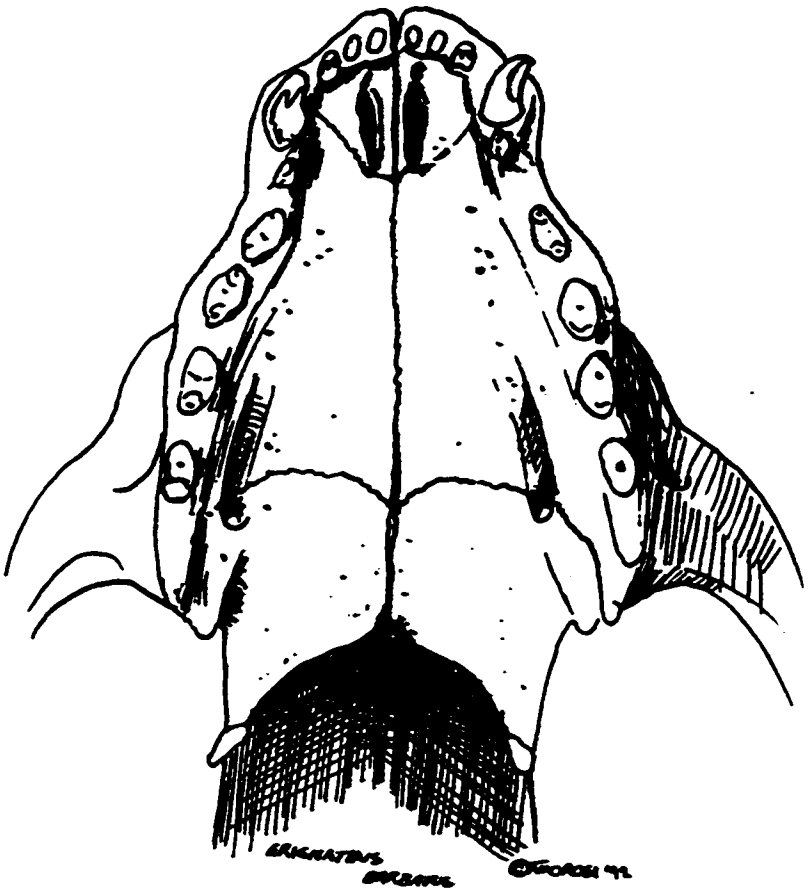

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Figure 2.7 - The bony palate of *Cystophoca cristata*.

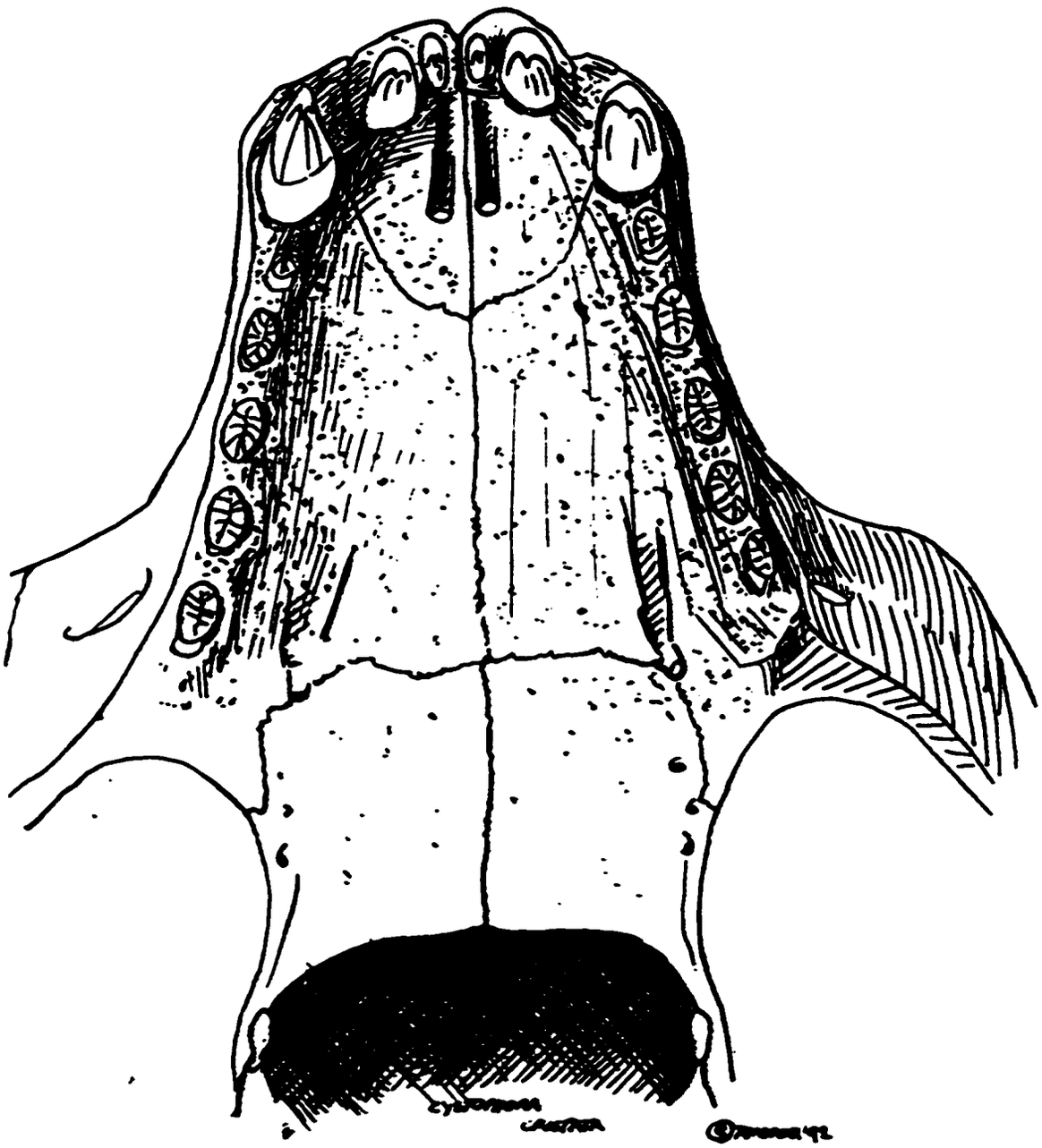

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Figure 2.8 - The species specific landmarks on the bulla of *P. vitulina*.

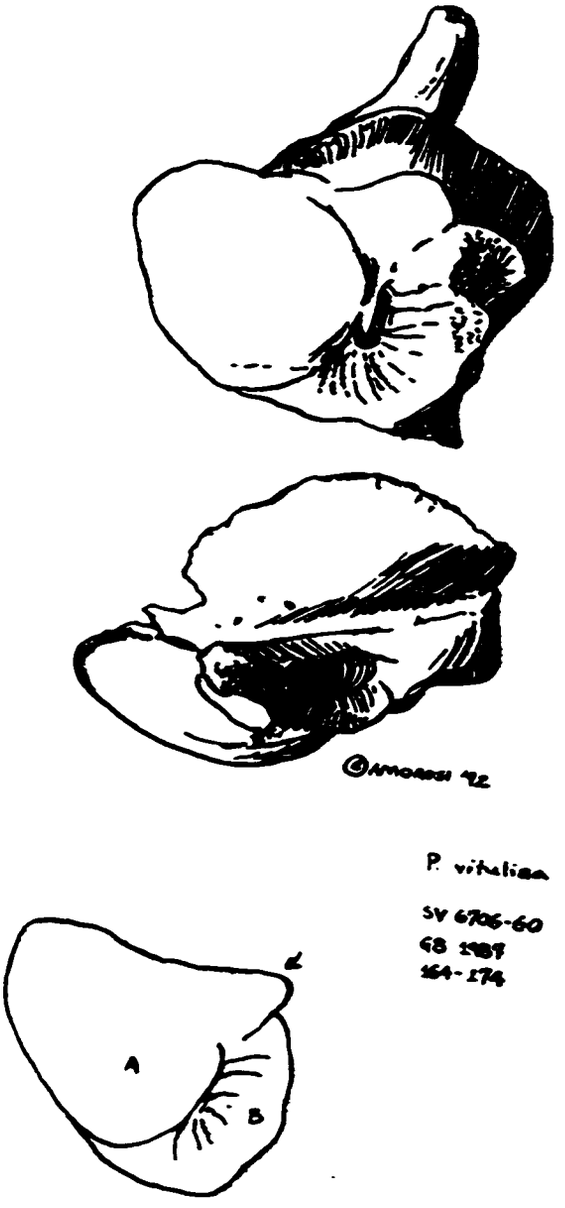

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Figure 2.9 - The species specific landmarks on the bulla of *P. hispida*.

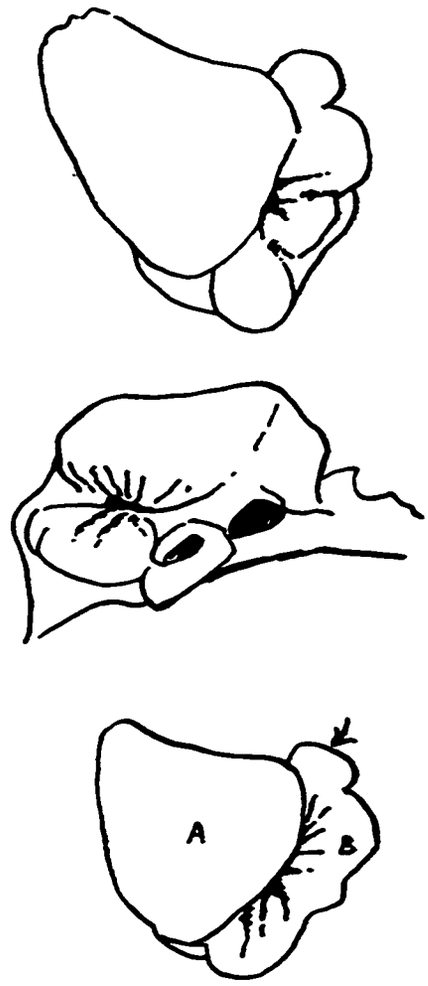

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Figure 2.10 - The species specific landmarks on the bulla of *H. grypus*.

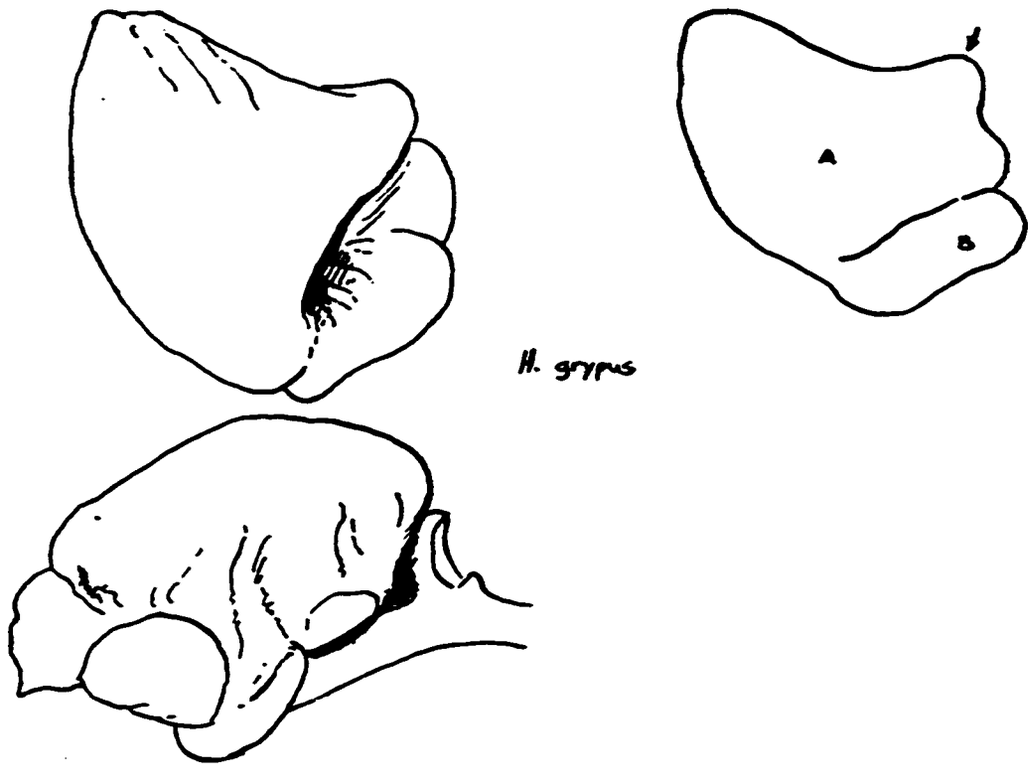

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Figure 2.11 - The species specific landmarks on the bulla of *C. cristata*.

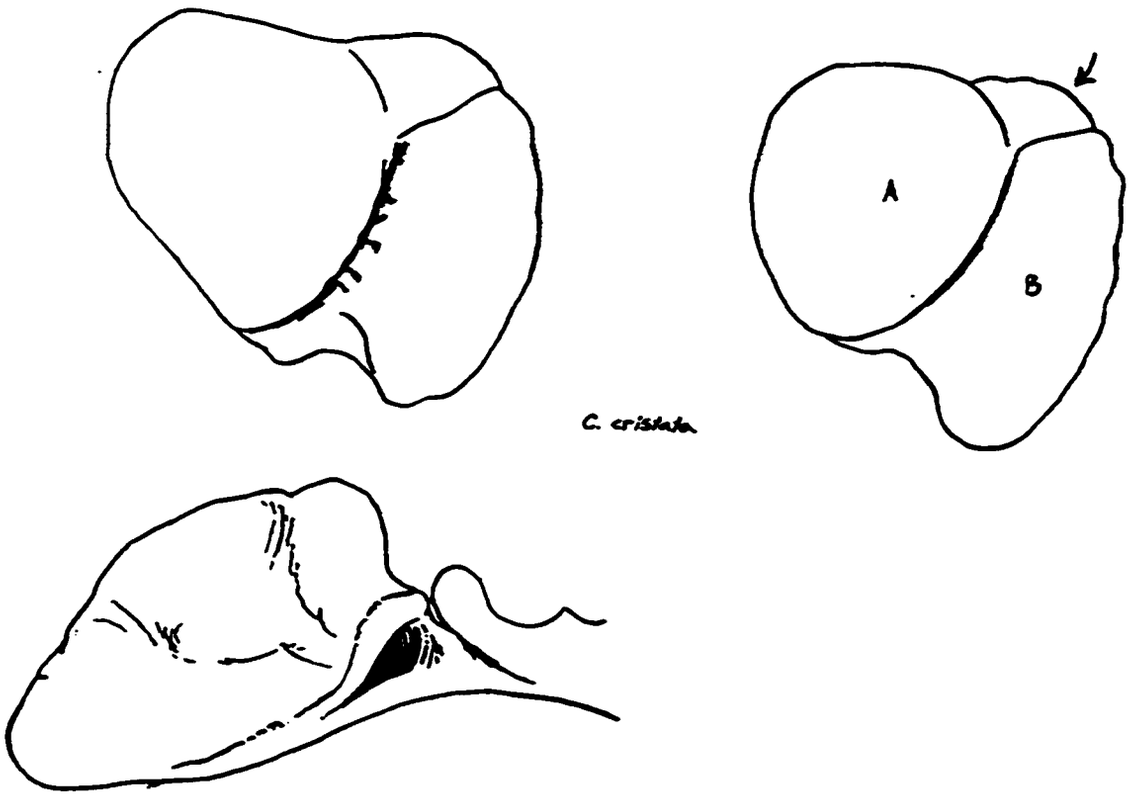

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Figure 2.12 - The species specific landmarks on the bulla of *P. groenlandicus*.

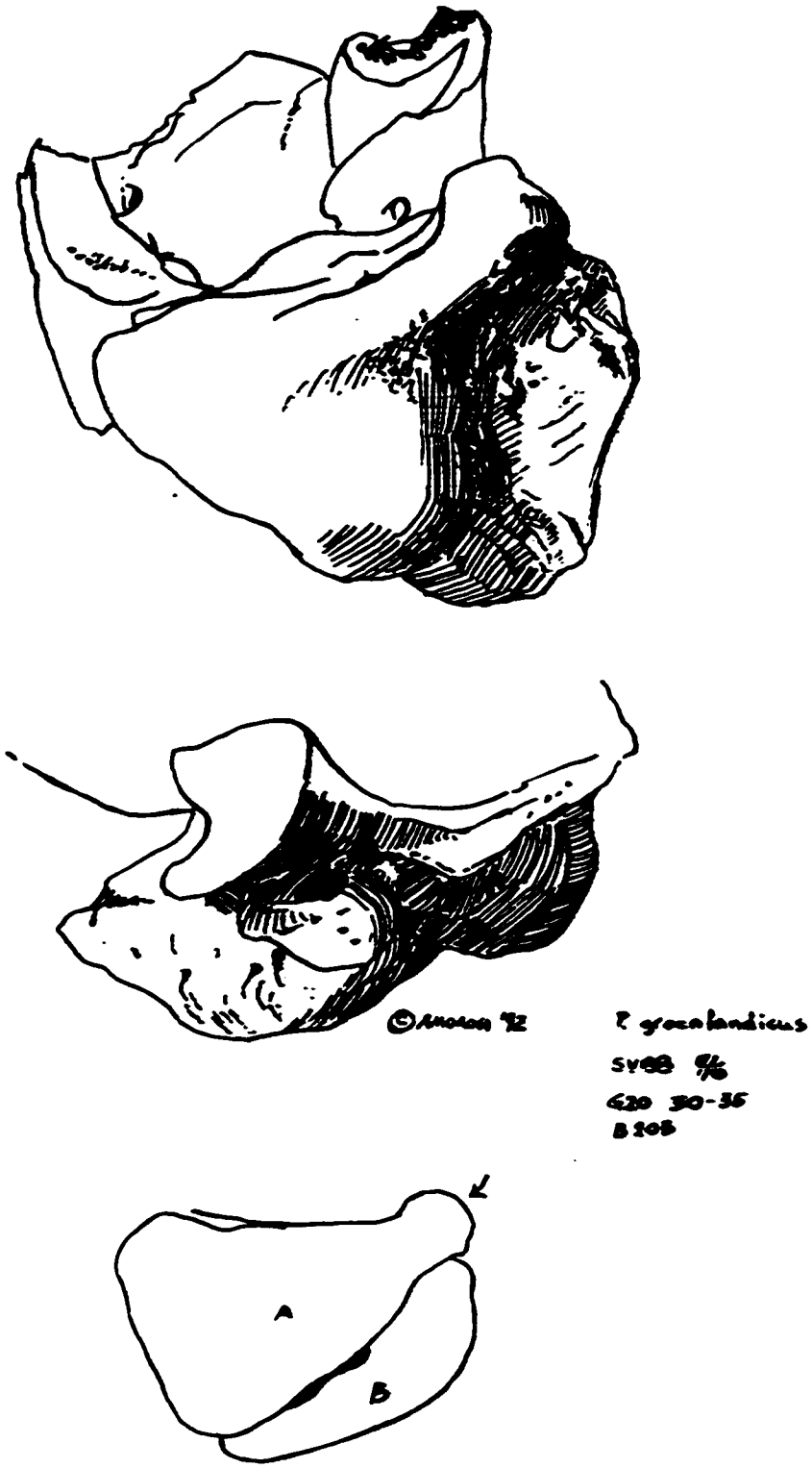

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Figure 2.13 - The species specific landmarks on the bulla of *E. barbatus*.

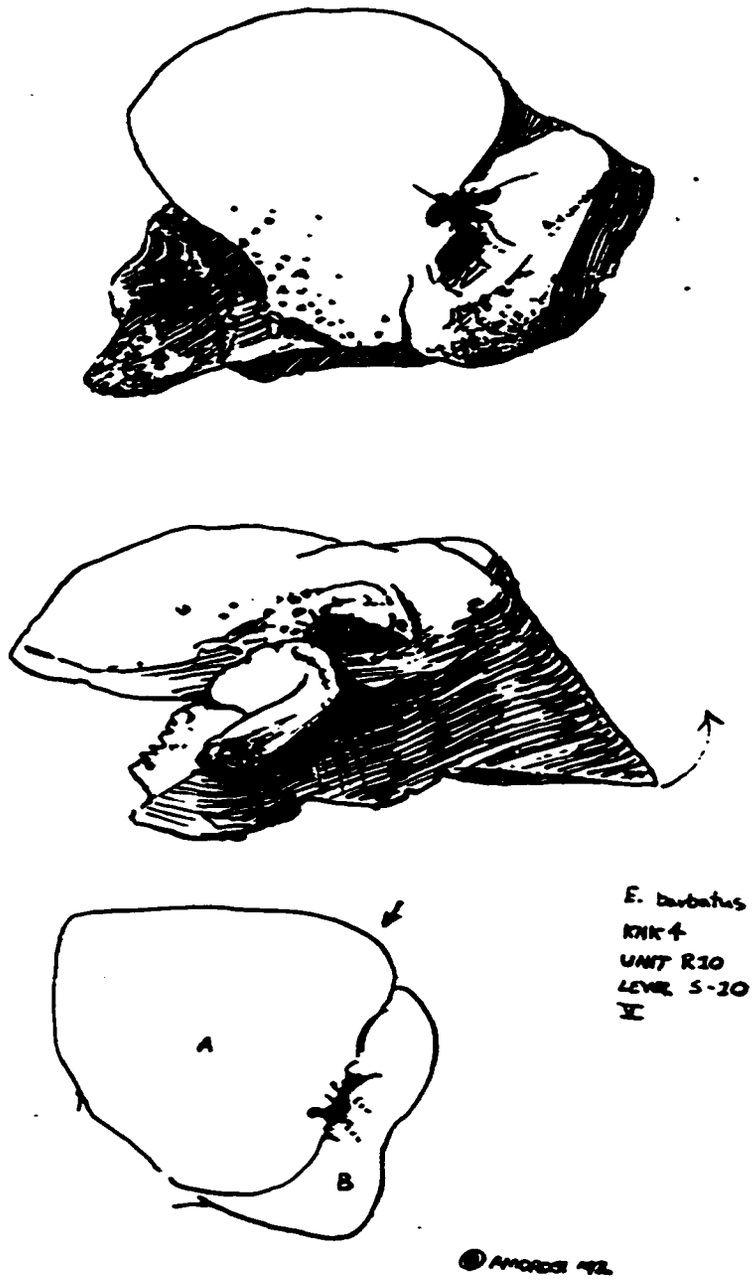

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Figure 2.14 - The mandibular specific landmarks for *P. hispida*, *P. vitulina* and *P. groenlandicus*.

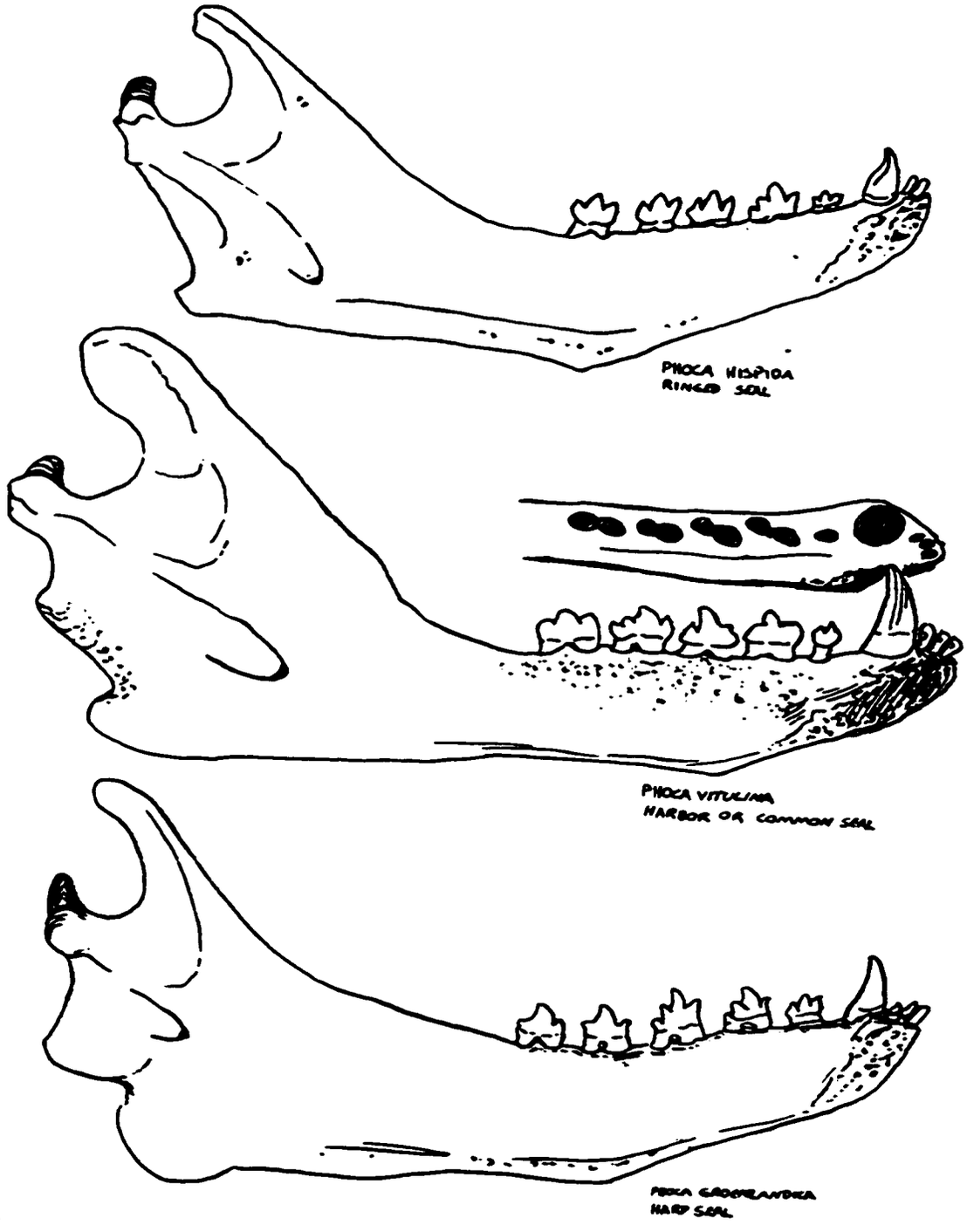

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Figure 2.15 - The mandibular specific landmarks for *E. barbatus* and *C. cristata*.

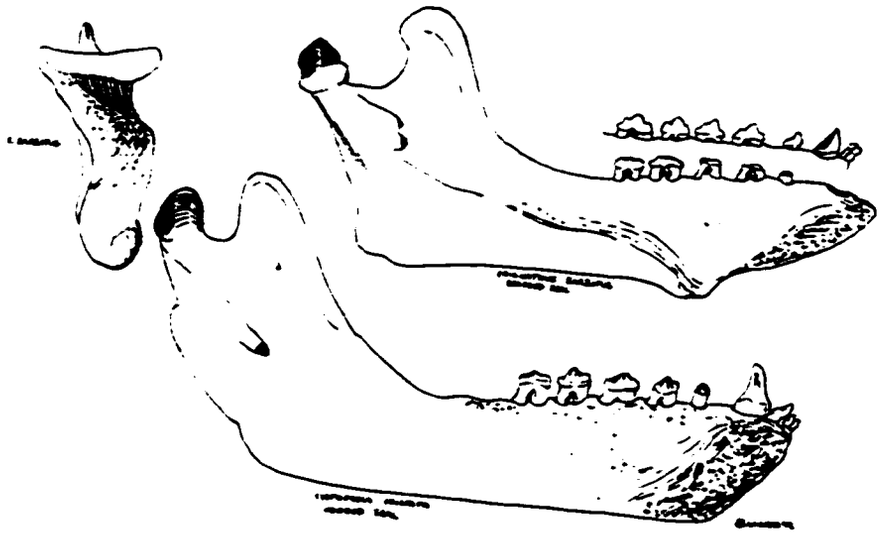

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Figure 2.16 - The mandibular specific landmarks for *H. grypus*.

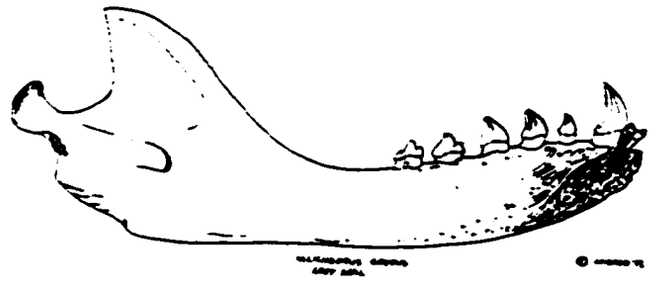

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Figure 2.17 - Dental distinctions between *Phoca* and *Halichoerus*.

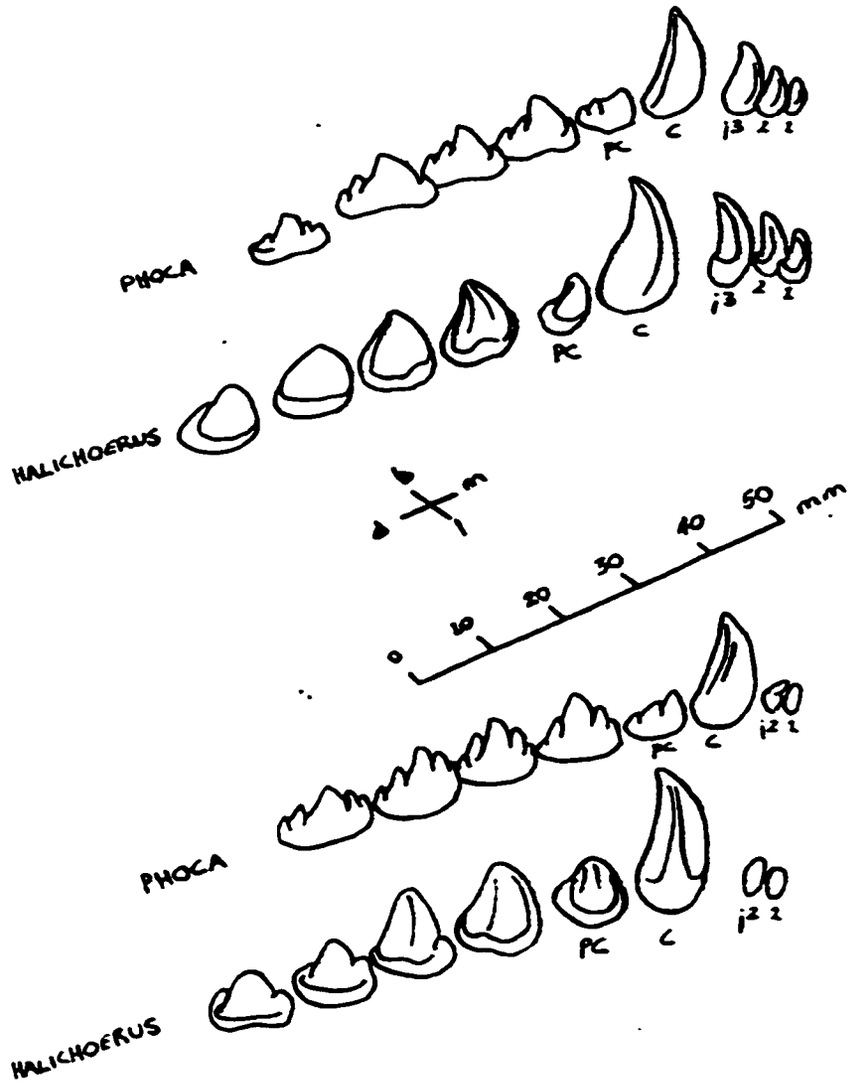

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Figure 2.18 - Maxillary distinctions for the North Atlantic phocids.

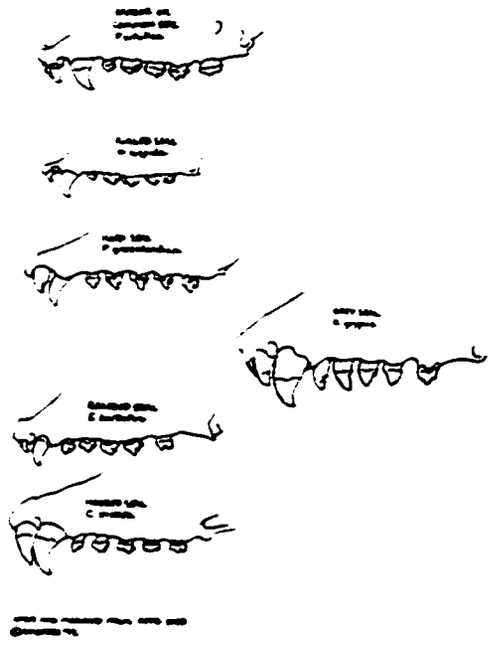

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Figure 2.19 - Humerus specific landmarks for *P. groenlandicus*.

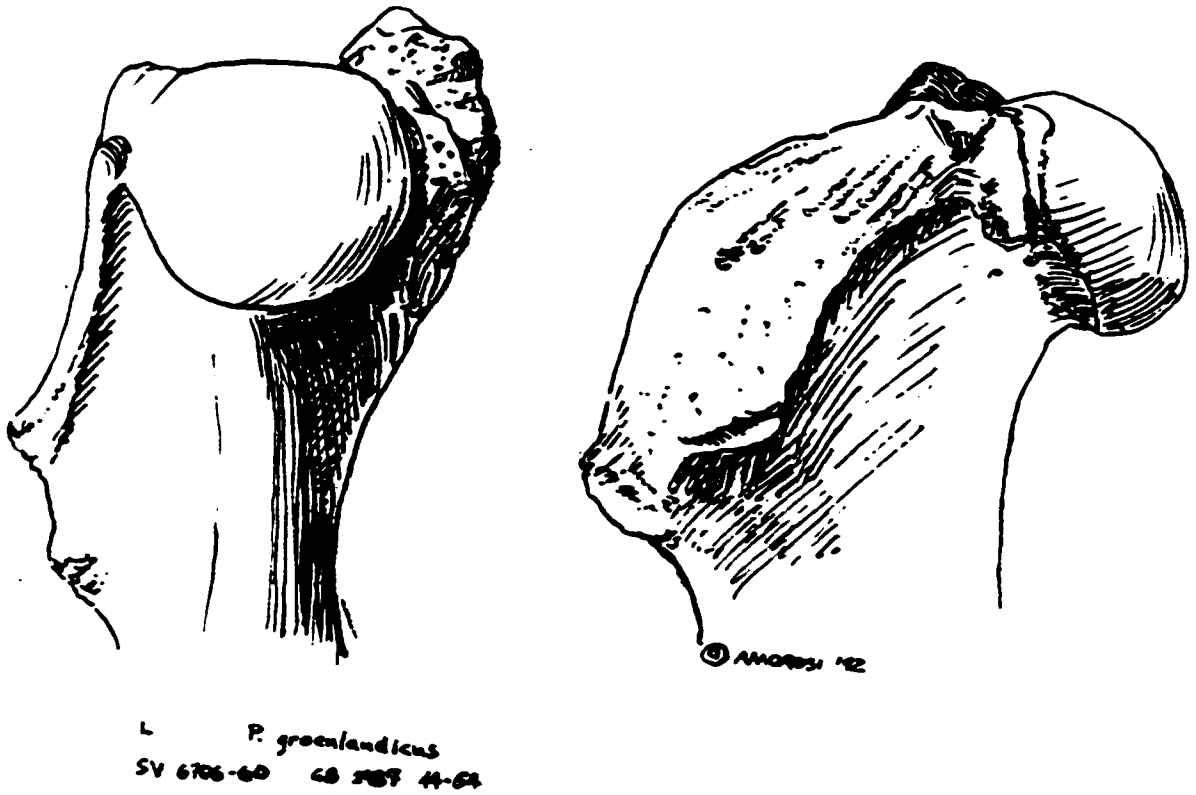

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Figure 2.20 - Humerus specific landmarks for *P. hispida*.

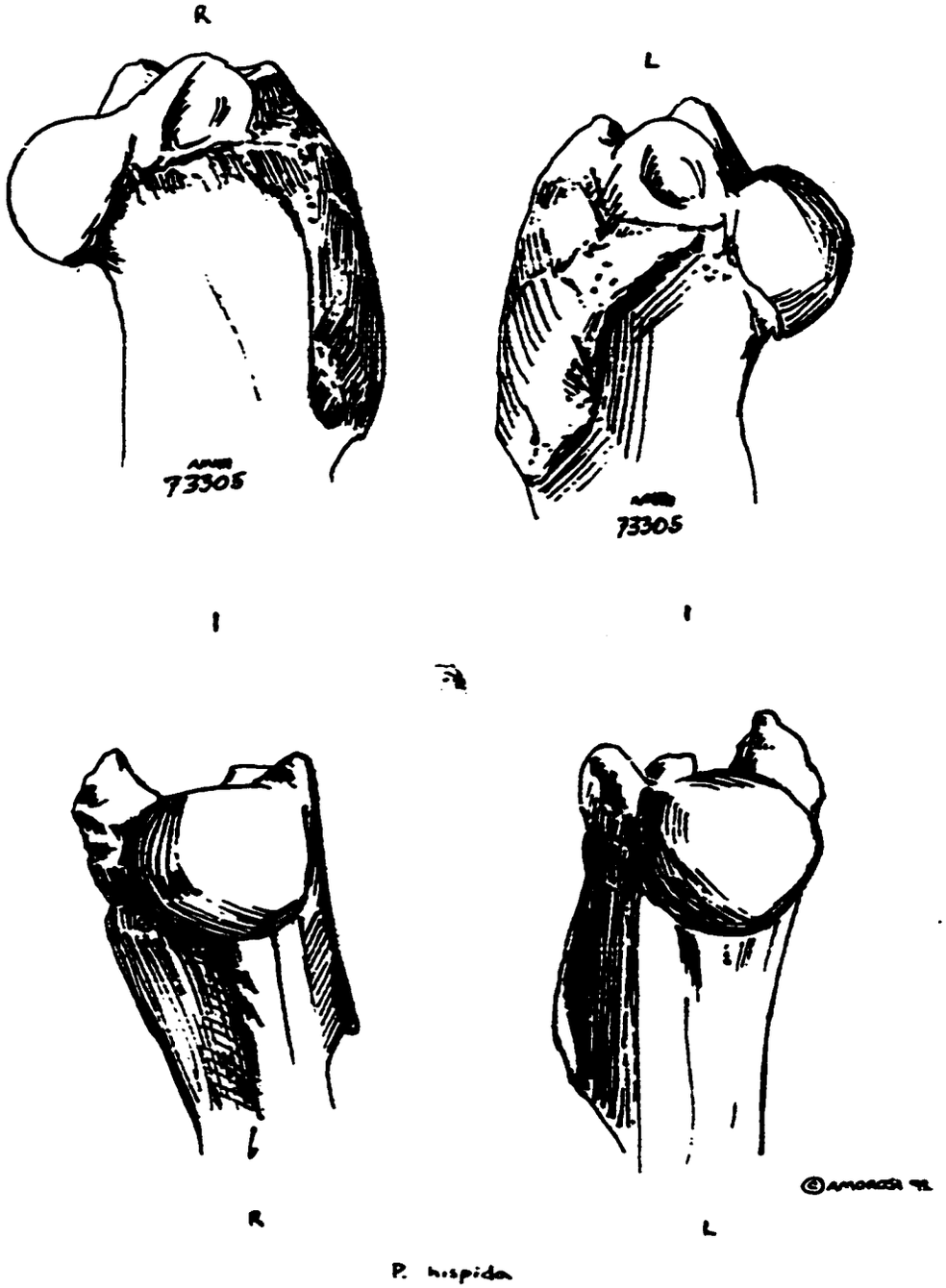

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Figure 2.21 - Humerus specific landmarks for *P. vitulina*.

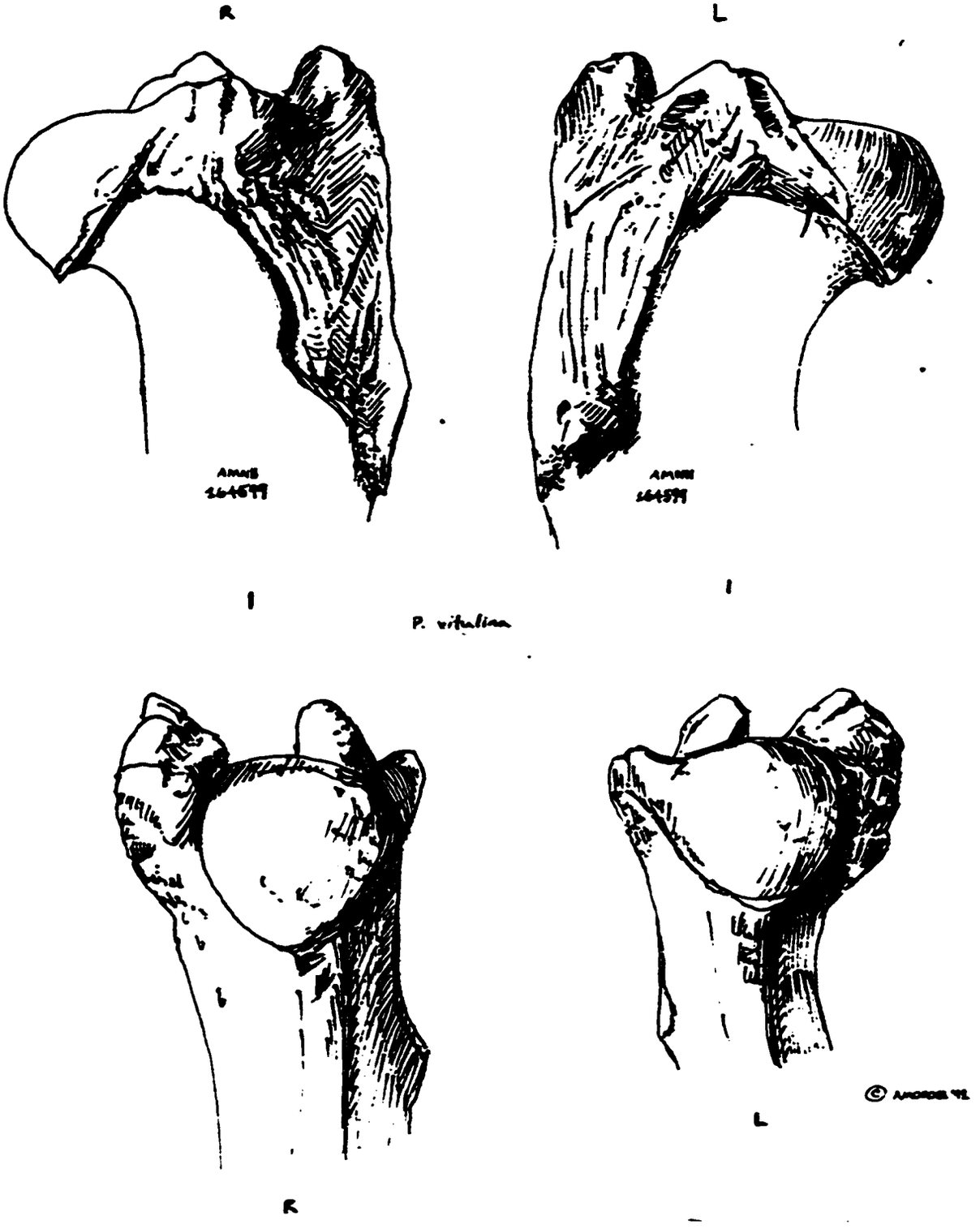

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Figure 2.22 - The distinction between *P. groenlandicus*, *P. vitulina* and *P. hispida* as seen from the trochlear notch of the ulna. Looking at the trochlear notch, the incisura semilunaris extends across and distally of the olecranon process forming an unequal bifurcate pattern which extends downward (in the ulna fragment is held so that the trochlear notch is facing the observer with the olecranon process being in the superior position) and along the lateral side of the element in both *P. vitulina* and *P. hispida*. In *P. groenlandicus* the radial notch extends medially forming a "tri-lobe like" structure of three unequal parts.

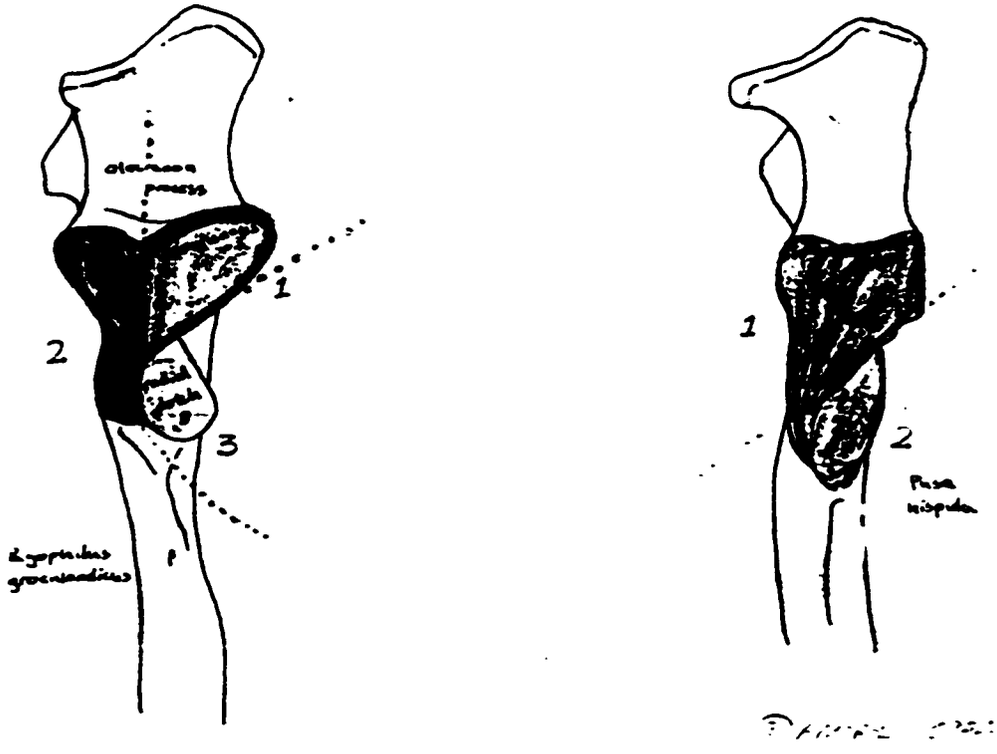

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Figure 2.23 - The distinction between *P. groenlandicus*, *P. vitulina* and *P. hispida* as seen from the olecranon process of the ulna. Point A (the thickness of the olecranon) is greater in *P. groenlandicus* than in either *P. vitulina* and *P. hispida*.

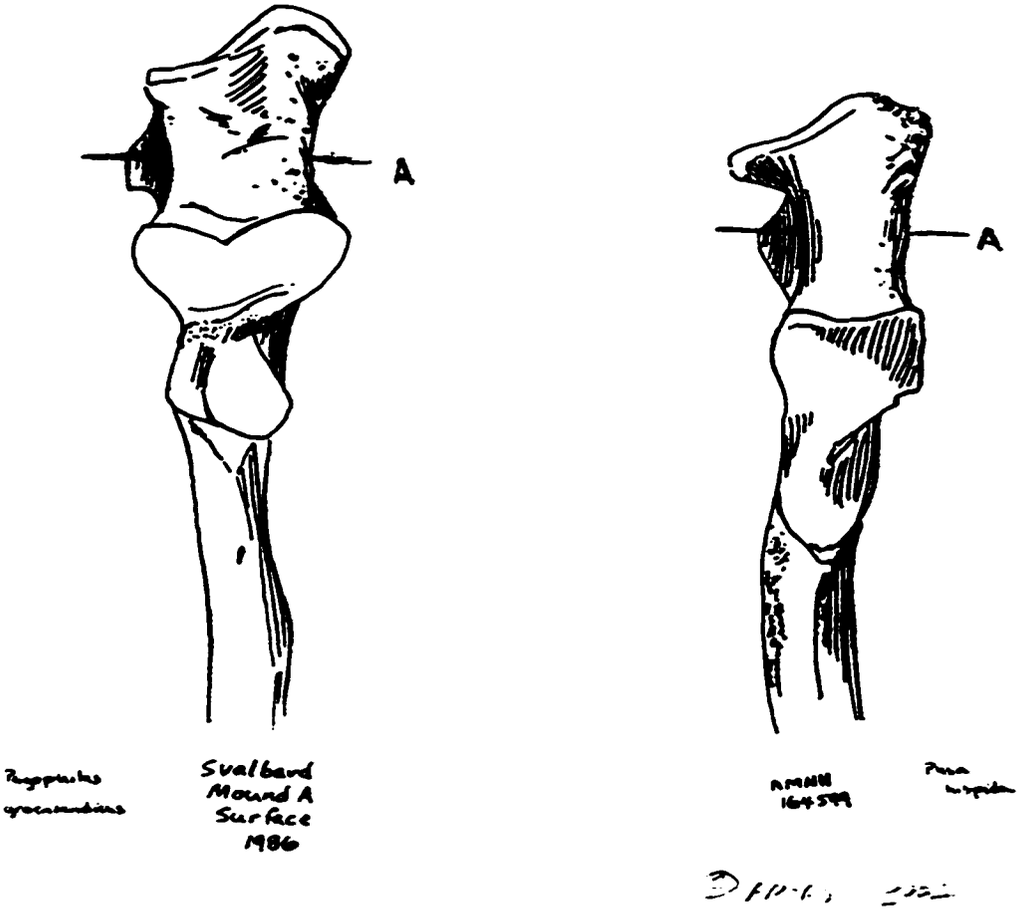

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Figure 2.24 - The femur of *P. groenlandicus* can be distinguished from other North Atlantic and Eastern Arctic phocids by a nutrient foramen located on the lateral aspect of the shaft, midway along the longitudinal axis. The foramen's size can vary from a slight to prominent opening.

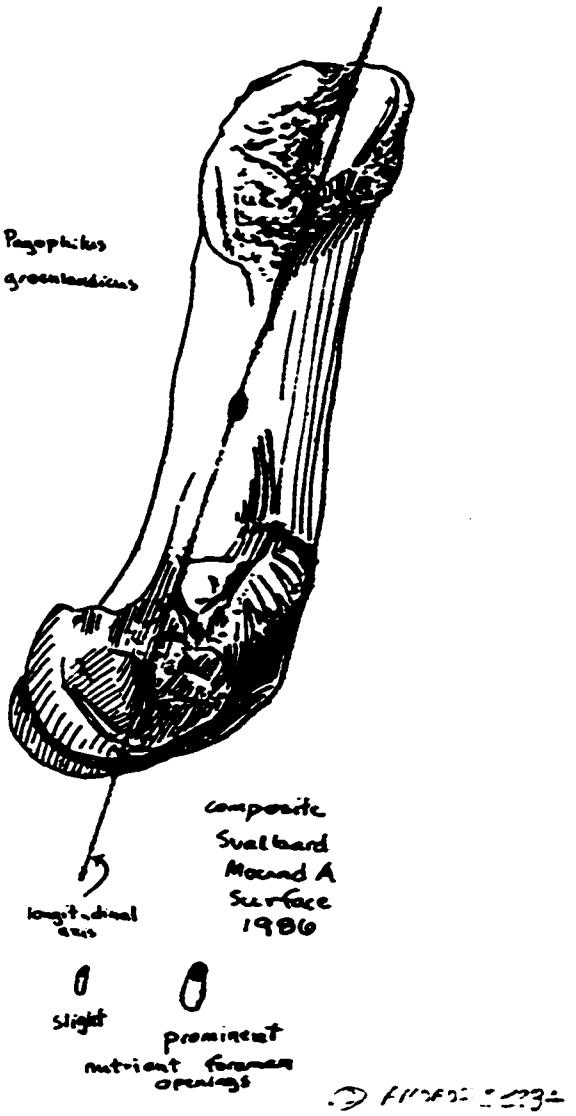

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Figure 2.25 - The "A" and "B" measurements used by Spiess and Hedden (1983) taken on the proximal end of the femur. Note also that nutrient foramen in *H. grypus* and *P. hispida* can be found on the lateral aspect, but not along the longitudinal axis.

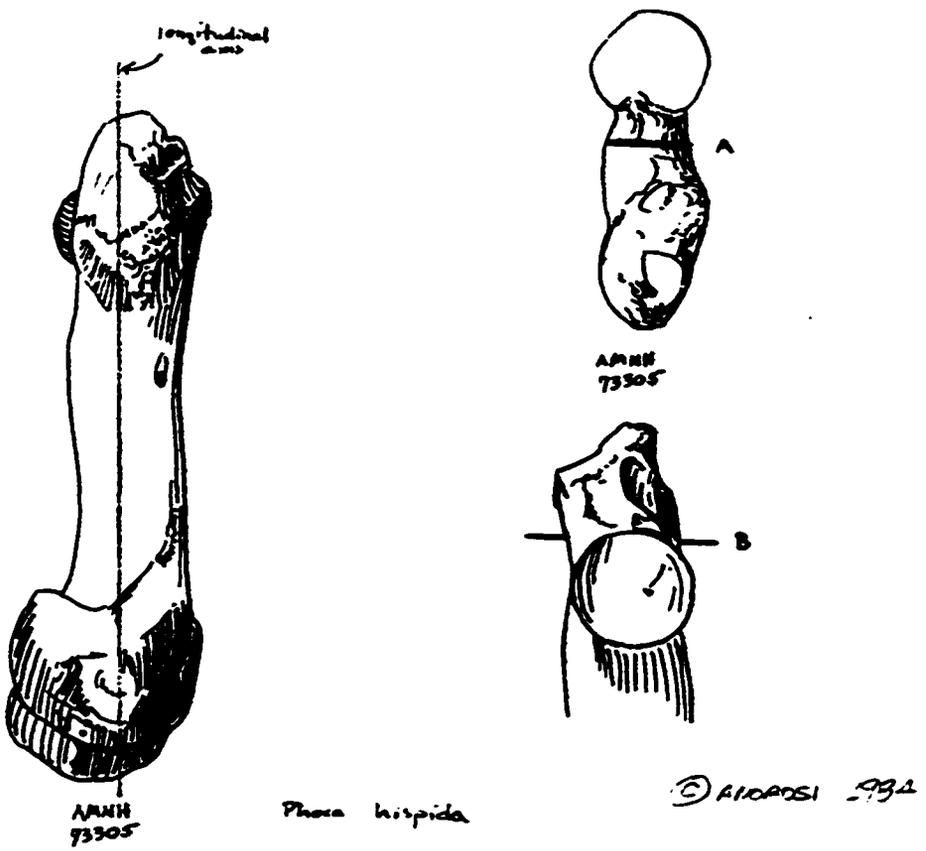

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Figure 2.26 - The distinction between *R. rattus* and *R. norvegicus* seen on molar 1 and in relation to the molar series.

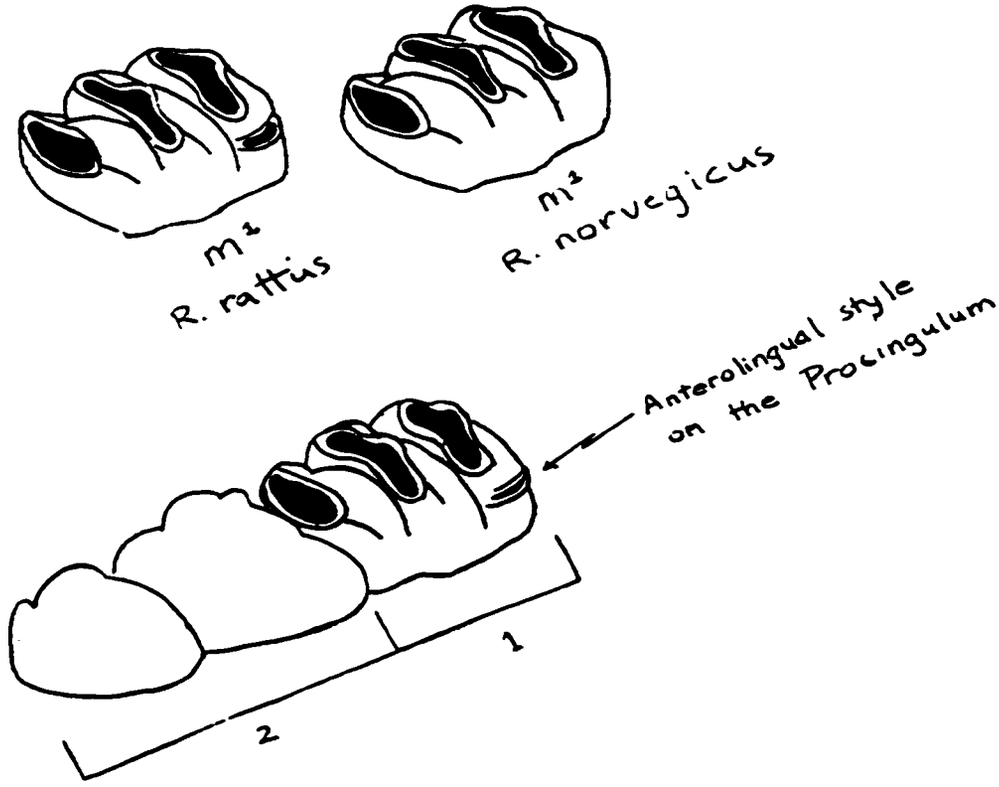

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Figure 2.27 - The distinguishing cranial characters between *R. rattus* and *R. norvegicus*.

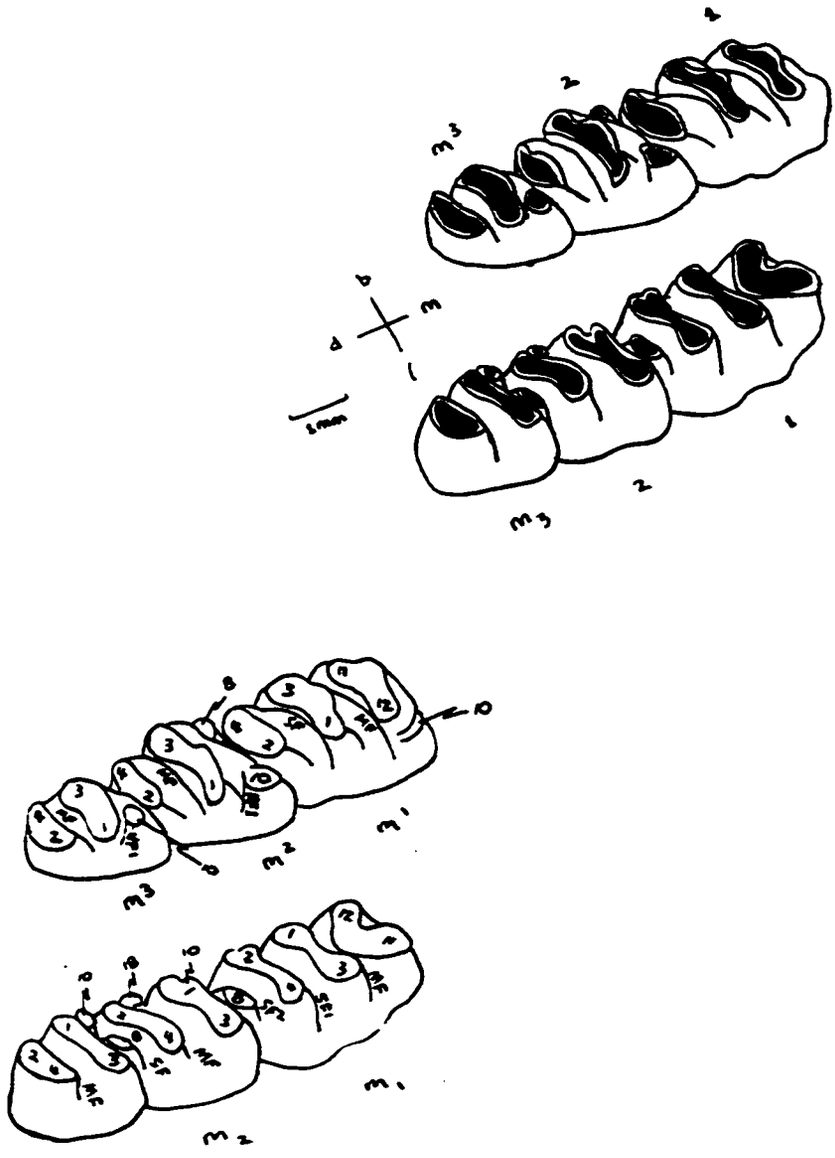

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Figure 2.28 - The dental landmarks on *Rattus* dentition.

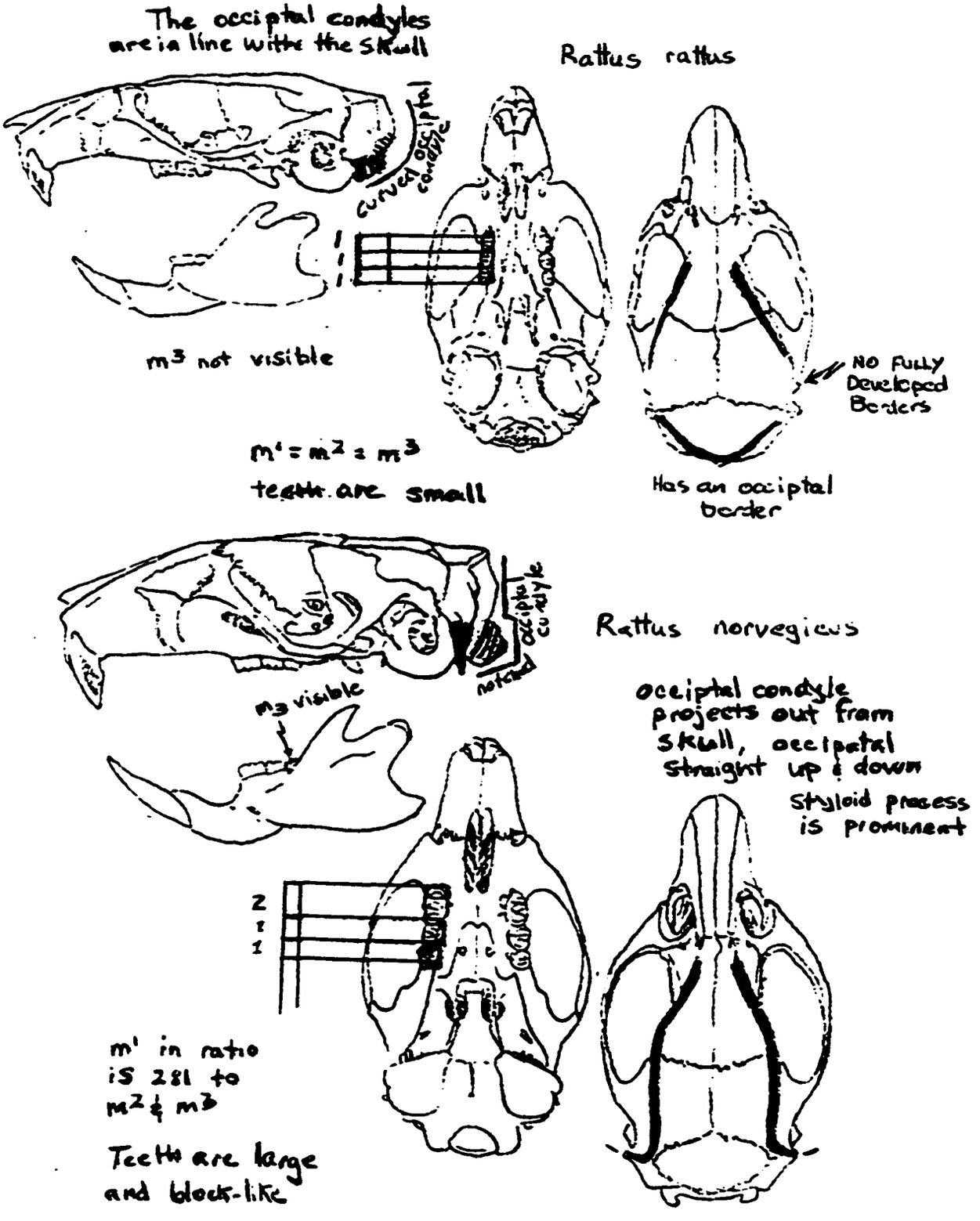

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Figure 2.29 - The occipital characters used to distinguish *R. rattus* and *R. norvegicus*.

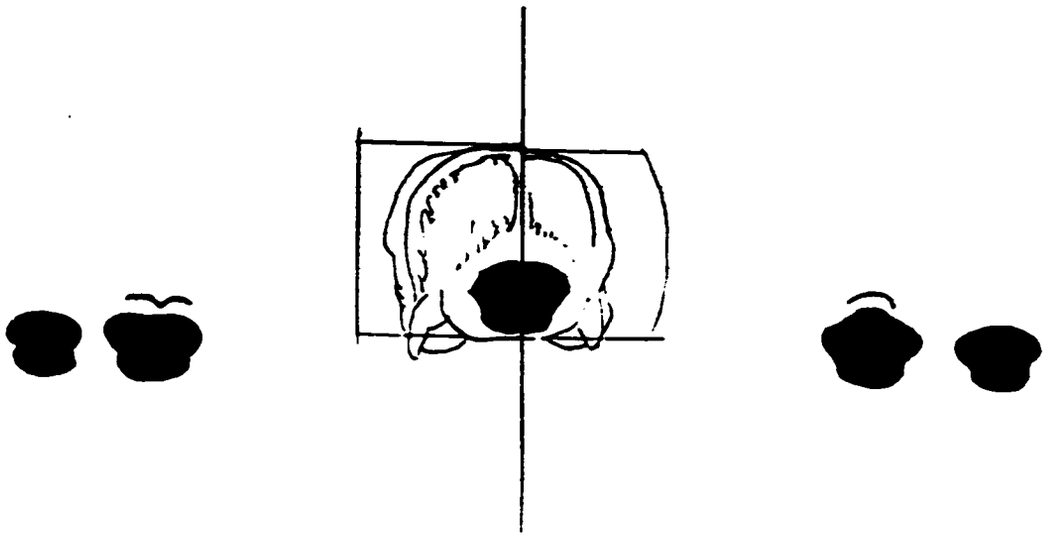

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Figure 2.30 - The neuro-branchiocranium elements commonly recovered from Icelandic archaeofauna.

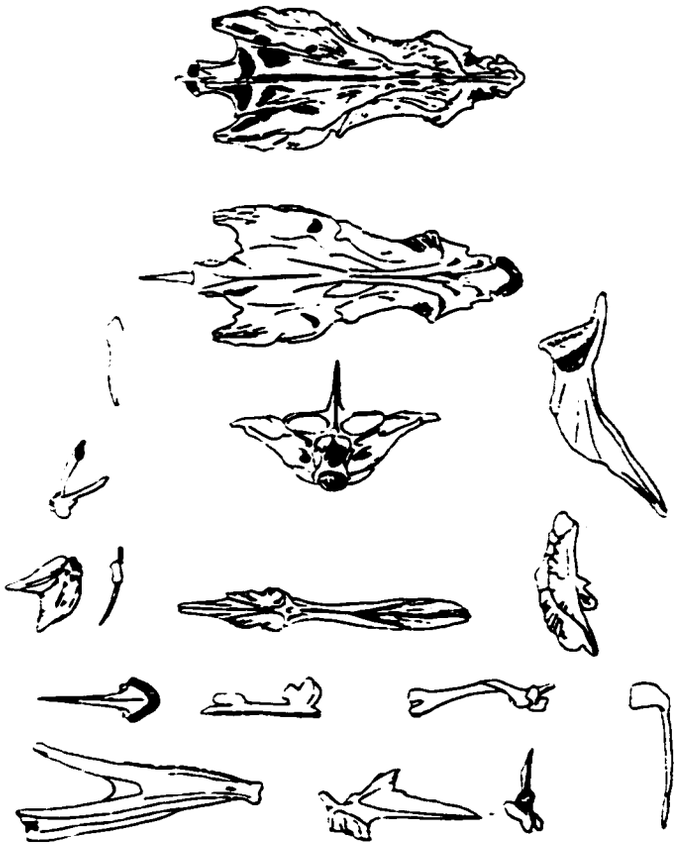

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Figure 2.31 - The orientation planes in fish (illustration modified from Morales and Rosenlund 1979:9).

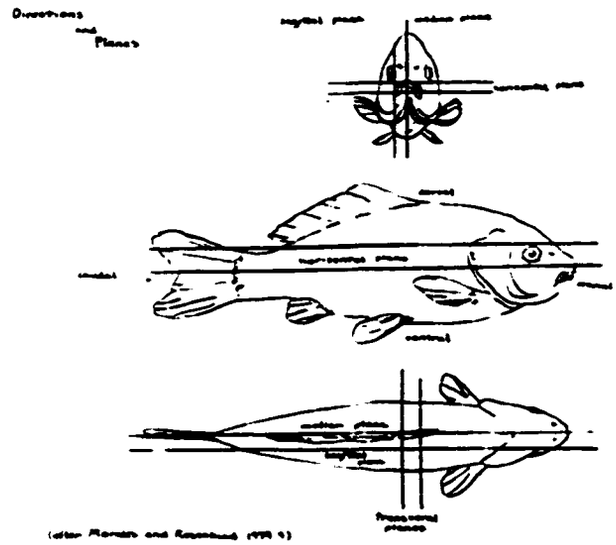

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Figure 2.32 - A fleshed ***Gadus morhua*** skull, showing both lateral and dorsal views.

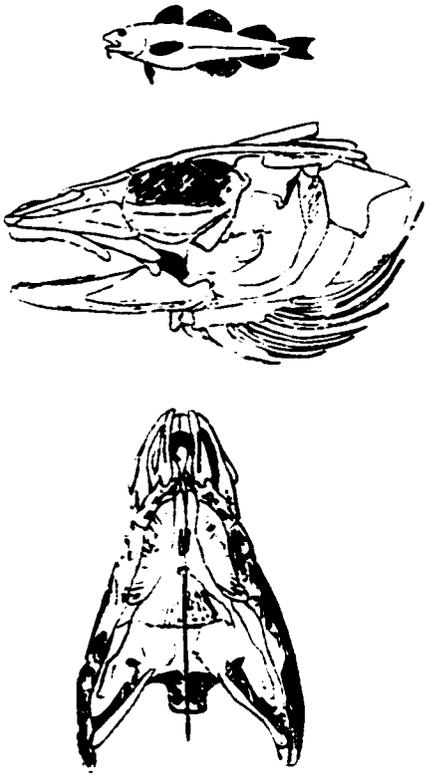

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Figure 2.33 - A exploded ***Gadus morhua*** skull, the shaded elements are described in the text (illustration modified from Jones 1986).

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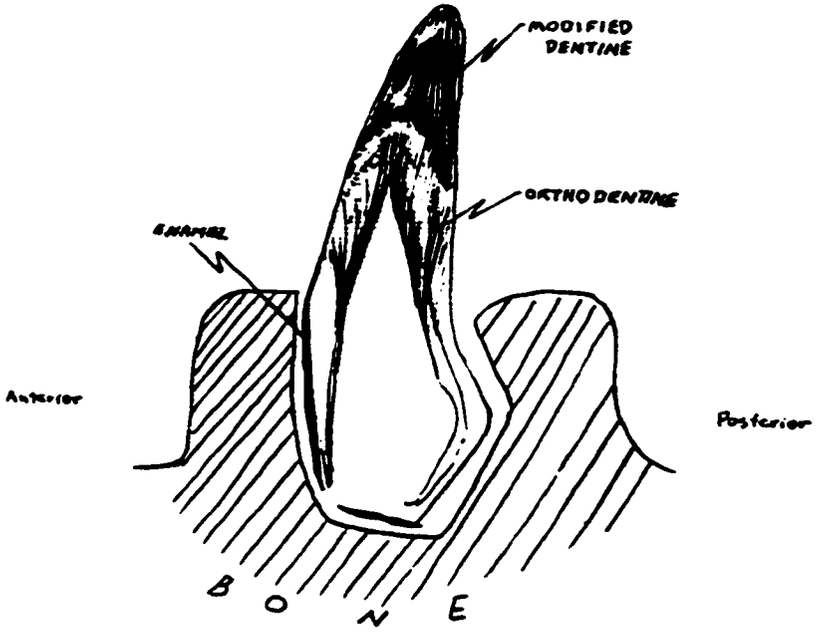
Figure 2.34 - A cross-section of a thecodont pit with a tooth.



Cross-section of a thecodont pit with tooth, terminology after Peyer 1968.

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Figure 2.35 - The prevomers of ***Gadus morhua***, ***Pollachius virens***, ***Molva molva*** and ***Merlangius merlangius*** compared.

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Figure 2.36 - The landmarks found on a prexmaillary of *Gadus morhua*.

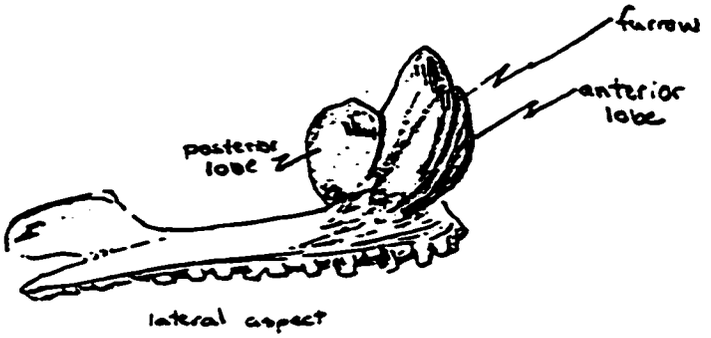

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Figure 2.37 - The premaxillaries of *Gadus morhua*, *Pollachius virens*, *Molva molva* and *Merlangius merlangius* compared.

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Figure 2.38 - The landmarks found on a dentary of ***Gadus morhua***.

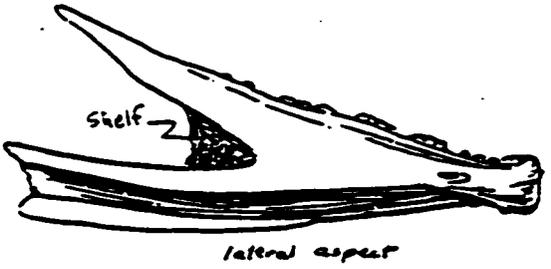

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Figure 2.39 - The dentaries of ***Gadus morhua***, ***Pollachius virens***, ***Molva molva*** and ***Merlangius merlangius*** compared.

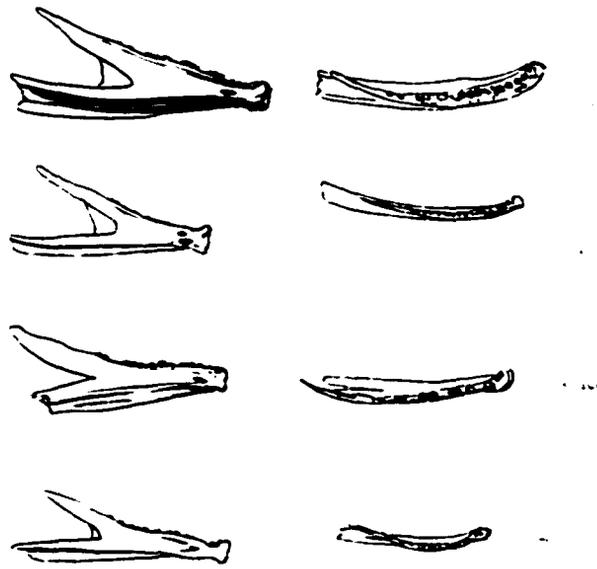

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Figure 2.40 - a -- A comparison of *Gadus morhua* and *G. macrocephalus* dentaries. b -- A comparison of the anterior portion of the dentary between *G. morhua* and *M. merlangius*.

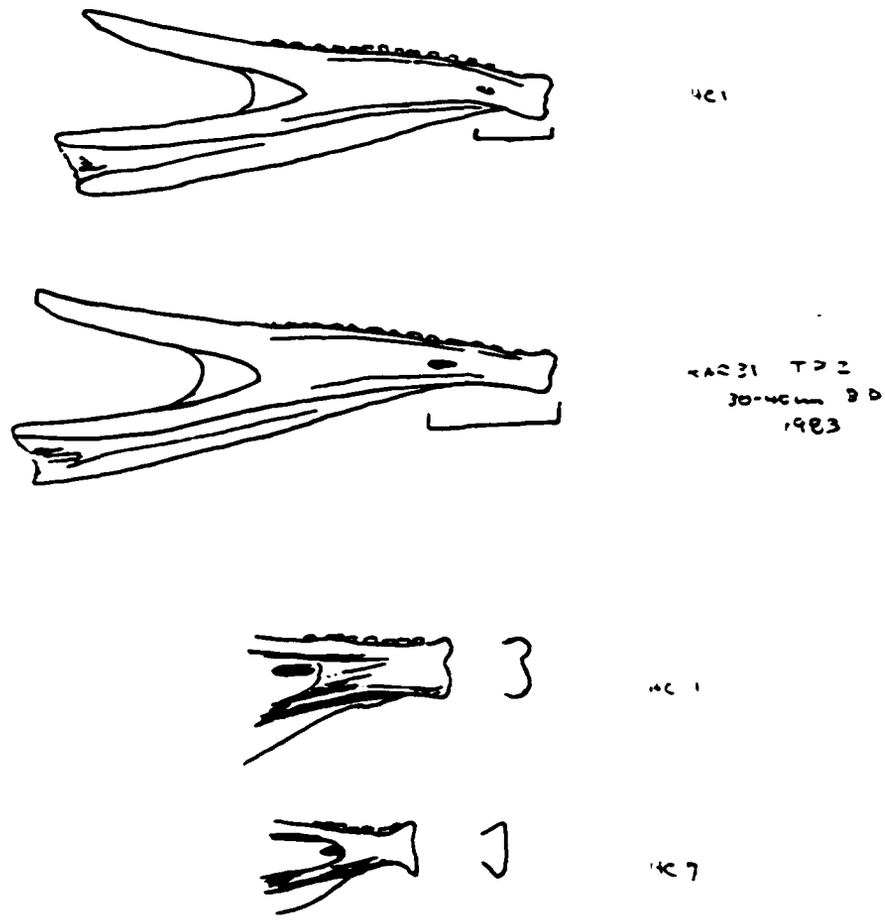

Figure 2.41 - The landmarks found on an articular of *Gadus morhua*.

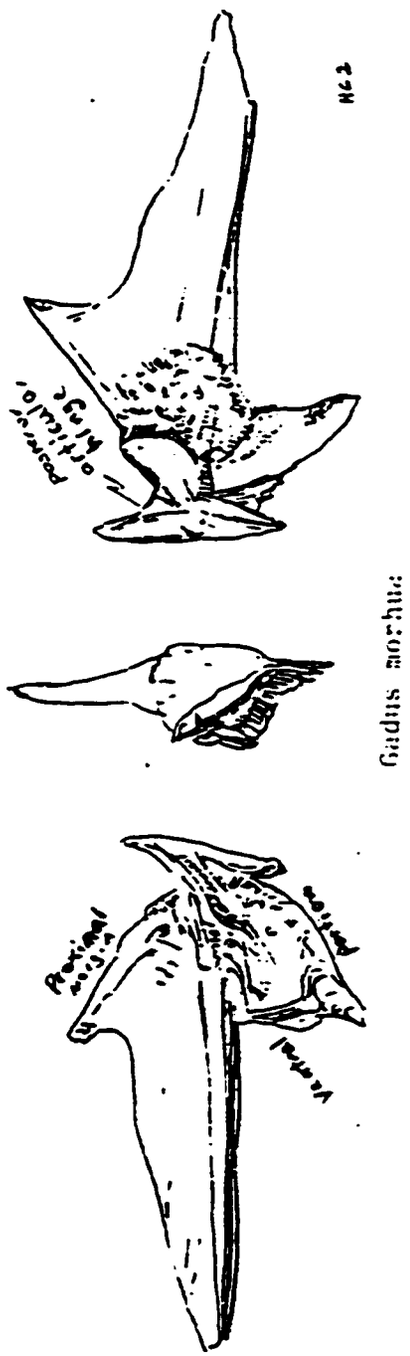

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Figure 2.42 - The articulars of ***Gadus morhua***, ***Pollachius virens***, ***Molva molva*** and ***Merlangius merlangius*** compared.

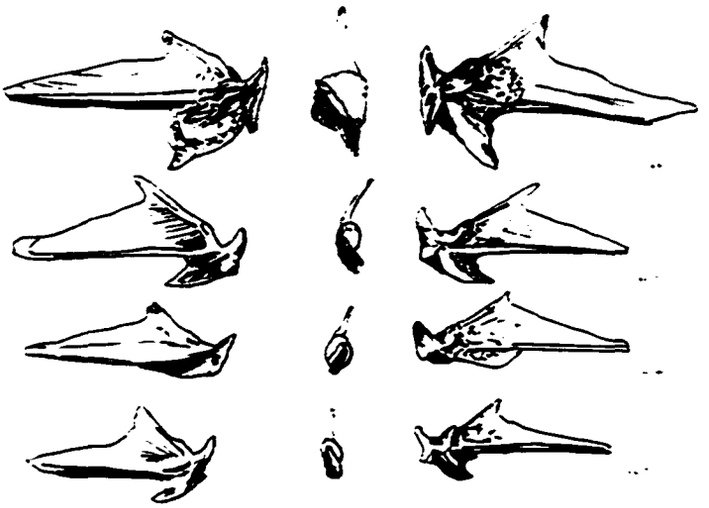

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Figure 2.43 - The landmarks found on a cleithrum of *Gadus morhua*.

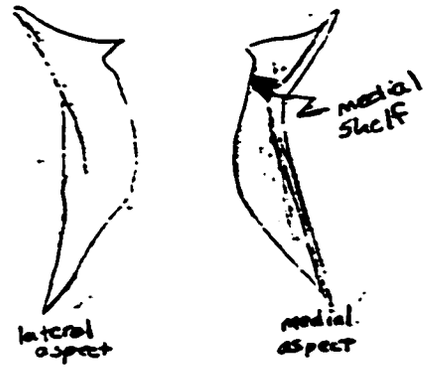

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Figure 2.44 - The cliethrums of ***Gadus morhua***. ***Pollachius virens***, ***Molva molva*** and ***Merlangius merlangius*** compared.

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Figure 2.45 - The maxillary of *Gadus morhua*.

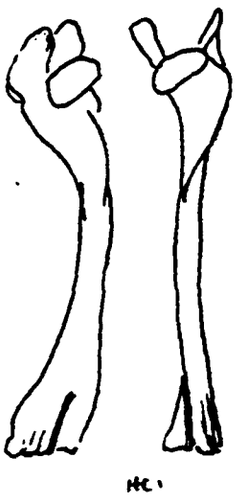

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Figure 2.46 - The opercular of ***Gadus morhua***, ***Molva molva*** and ***Merlangius merlangius*** compared.

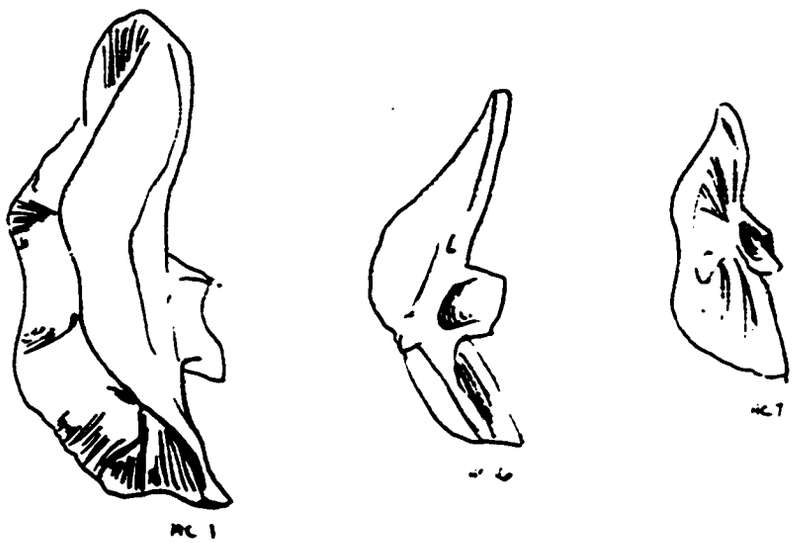

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Figure 2.47 - The landmarks found on an otolith of ***Gadus morhua*** and ***Merlangius merlangius***.

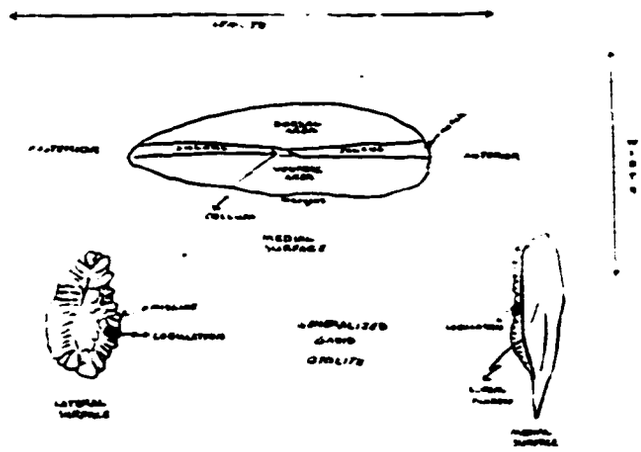

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Figure 2.48 - The otoliths of ***Gadus morhua***, ***Pollachius virens***, ***Molva molva*** and ***Merlangius merlangius*** compared.

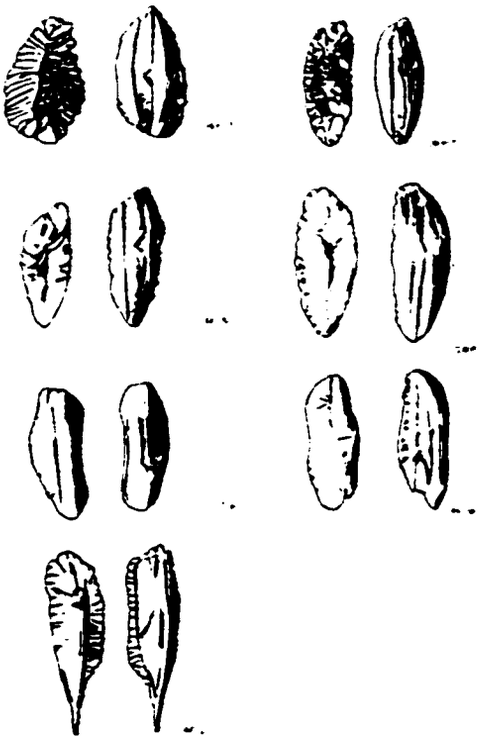

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Figure 2.49 - A comparison of Gadid and Salmonid vertebrae.

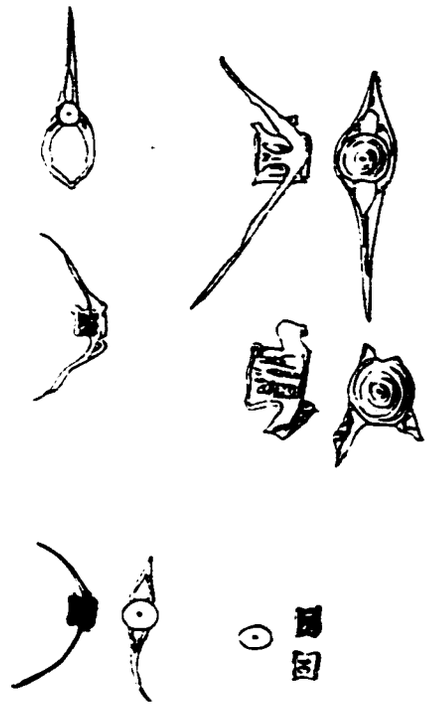

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Figure 2.50 - "High/Low" plot of the calibrated radiocarbon dates for the Granastadir site.

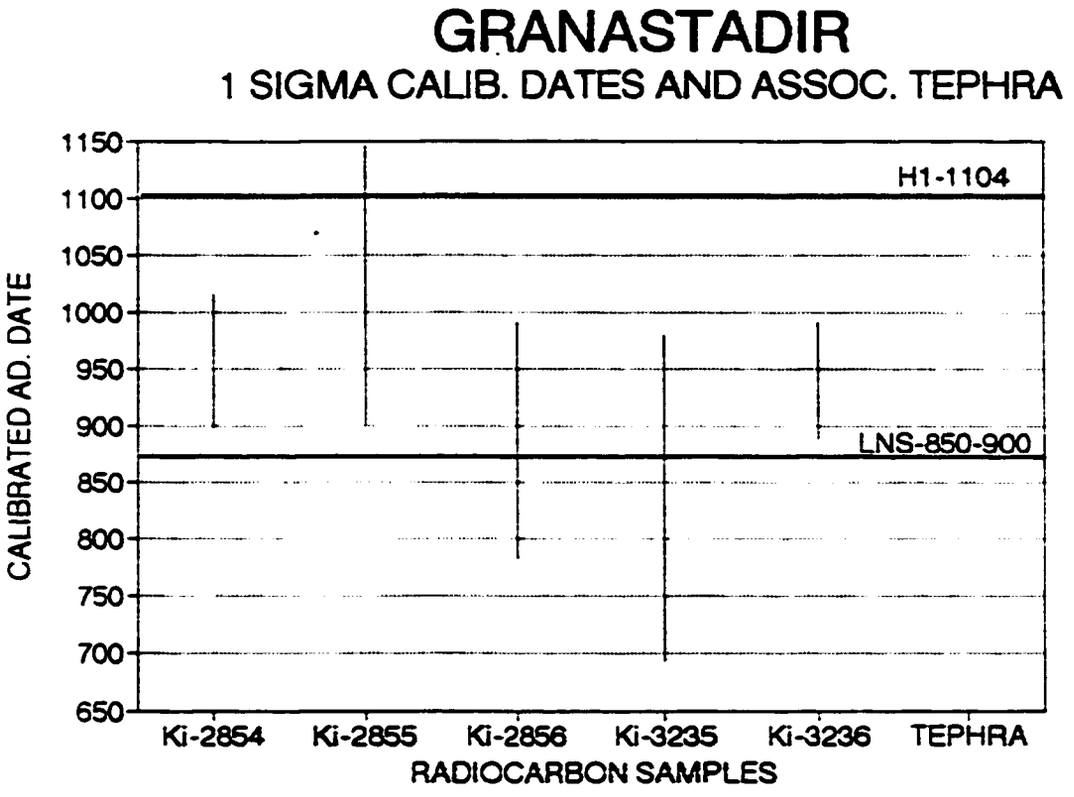

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Figure 2.51 - "High/Low" plot of the calibrated radiocarbon dates for the Herjolfsdalur site.

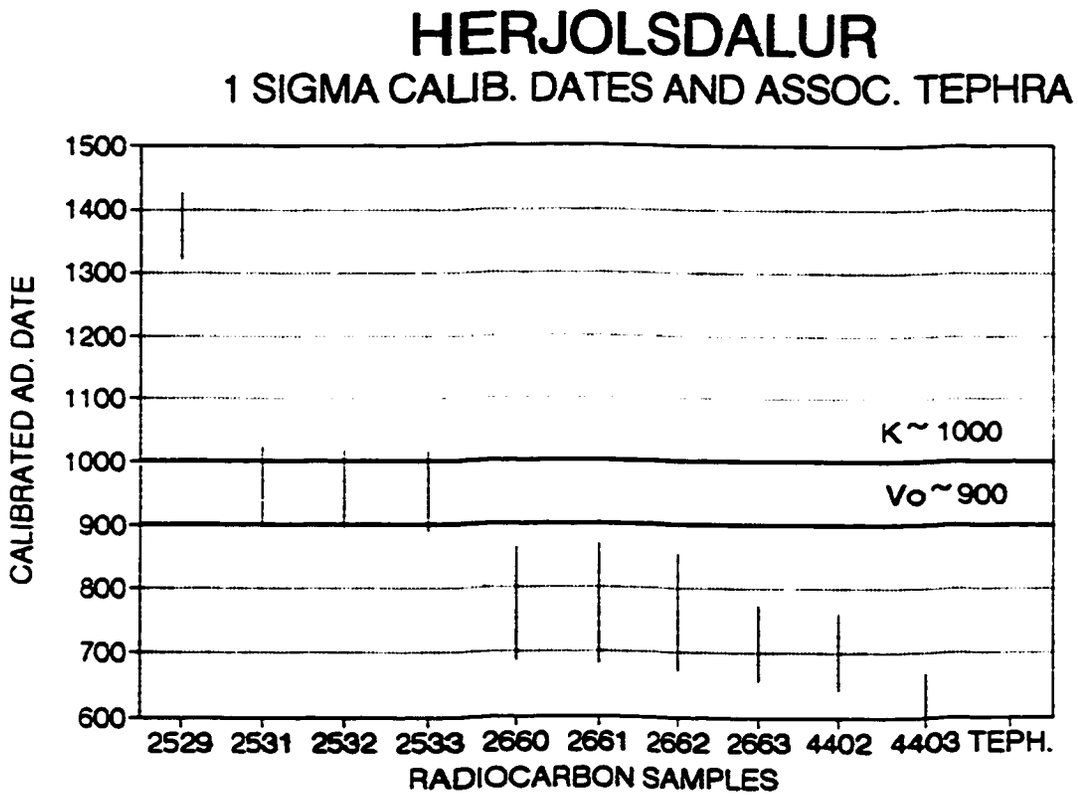

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Figure 2.52 - "High/Low" plot of the calibrated radiocarbon dates for the Midbaer site.

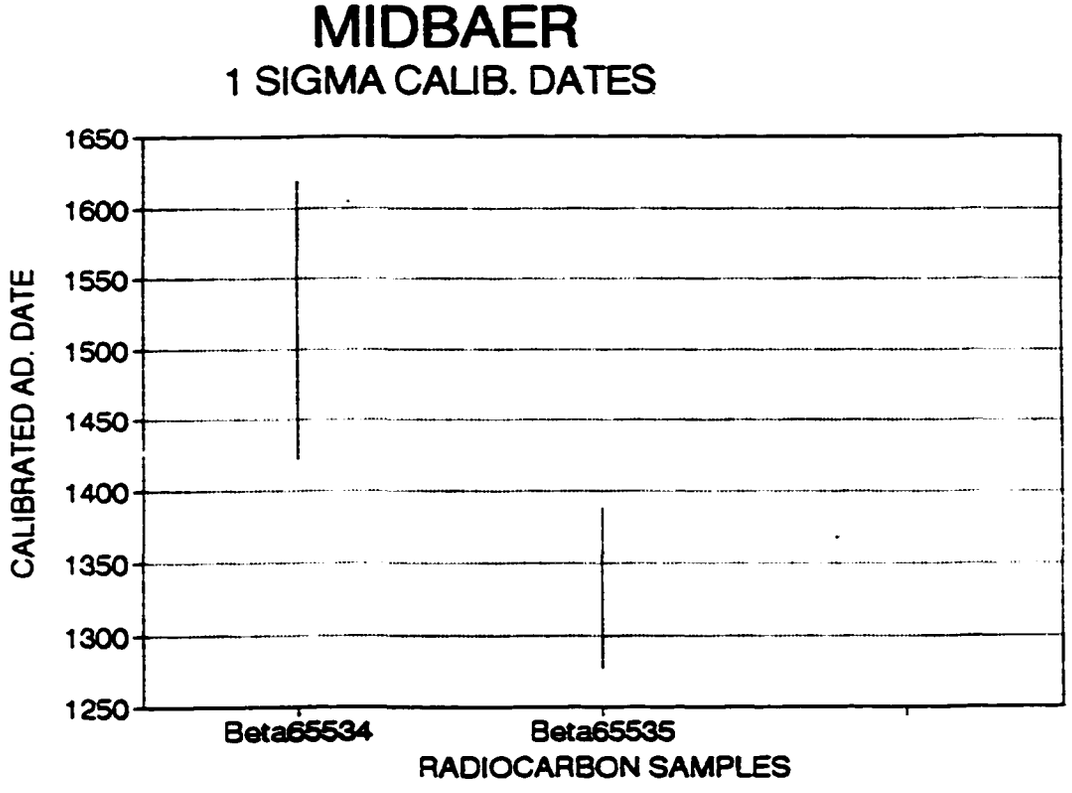

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Figure 2.53 - "High/Low" plot of the calibrated radiocarbon dates for the Strong site.

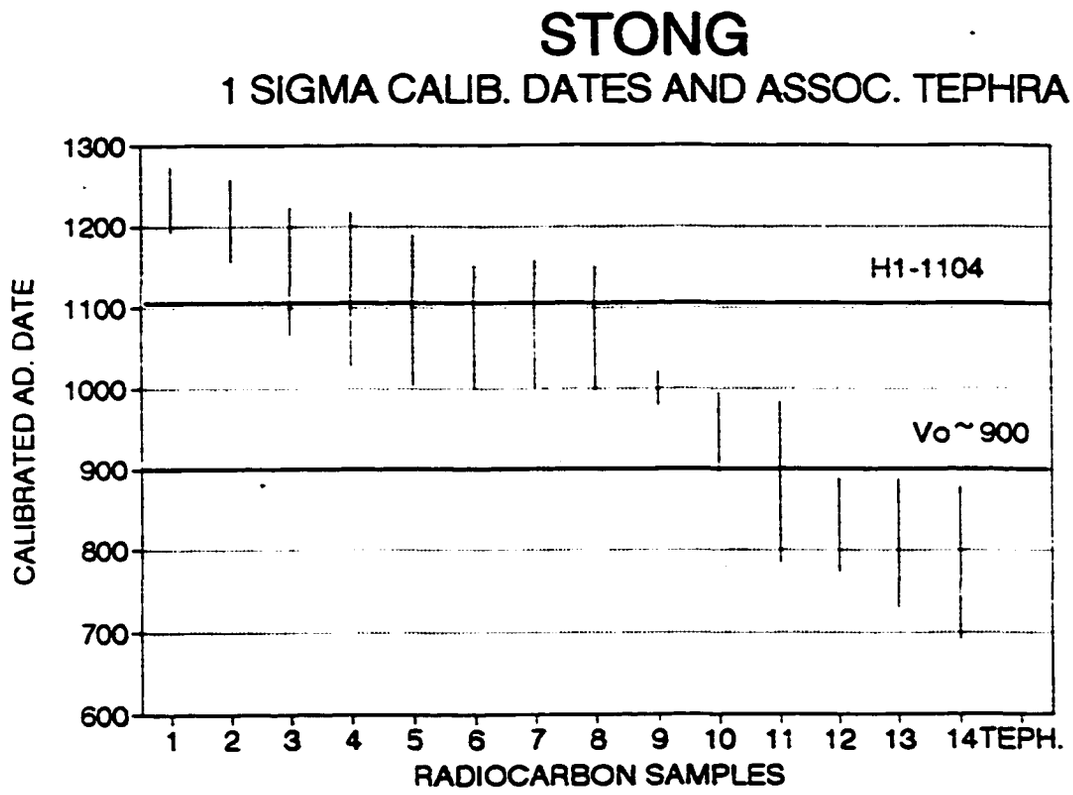

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Figure 2.54 - "High/Low" plot of the calibrated radiocarbon dates for the Svalbard site.

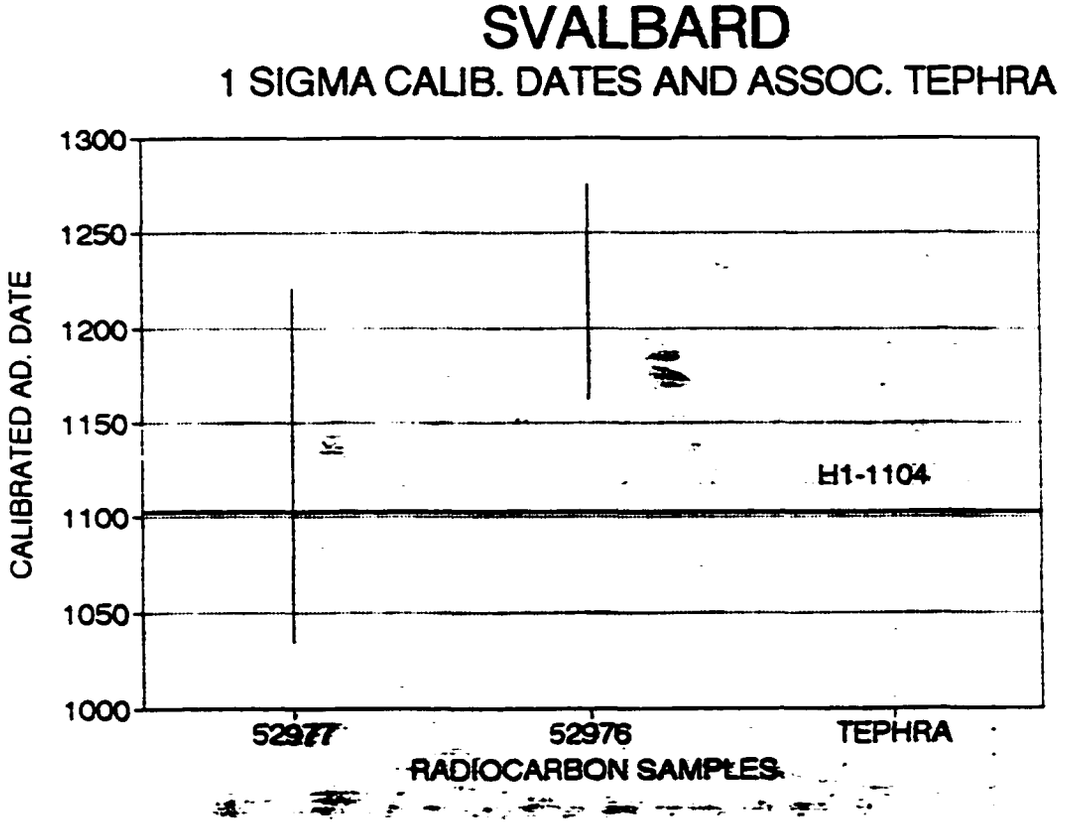

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Figure 2.55 - "High/Low" plot of the calibrated radiocarbon dates for the Tjarnargata 4 site.

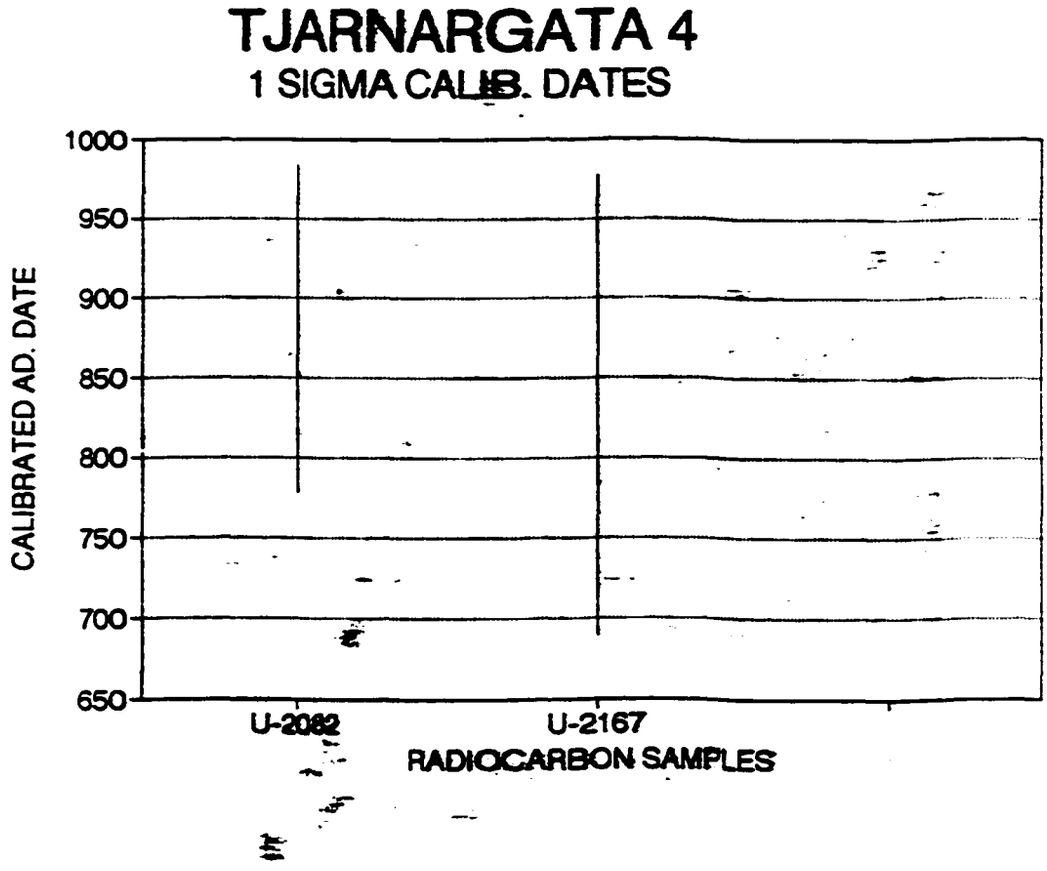

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Figure 2.56 - "High/Low" plot of the calibrated radiocarbon dates for the Videy site.

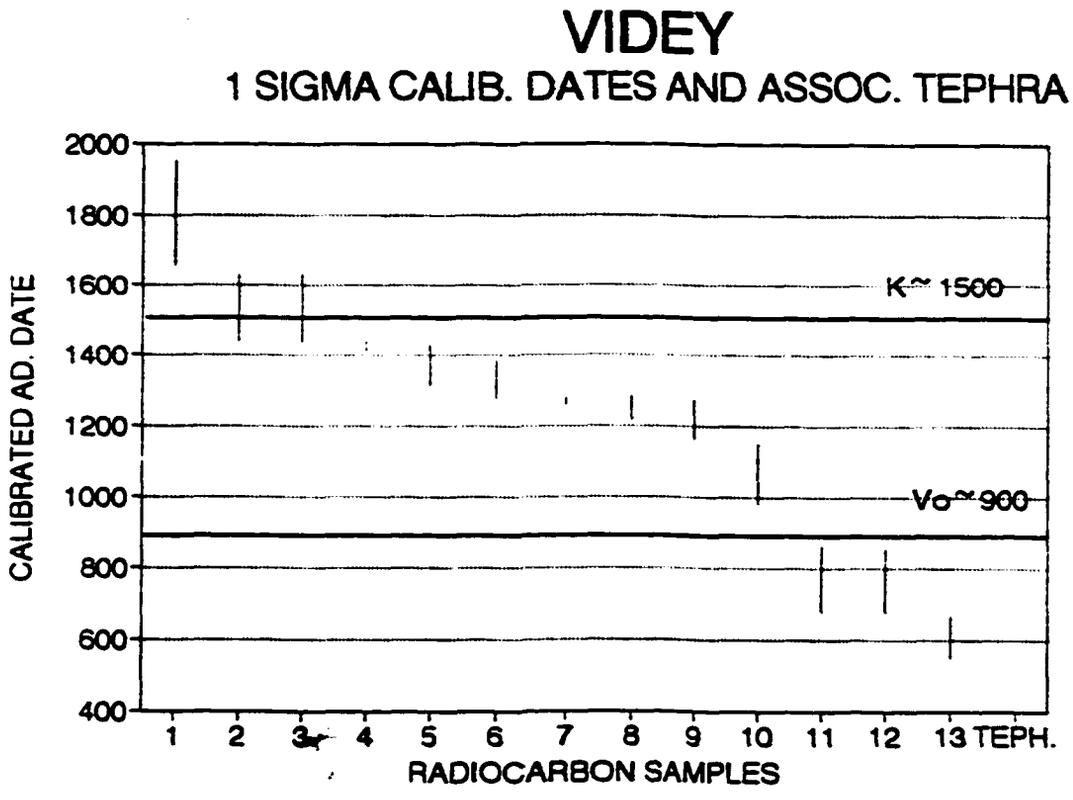

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Figure 3.1 - The distribution of Viking/ Norse to Early Medieval graves in Iceland. The dotted lines indicate the sysla boundaries, circled dots indicate cemeteries with five or more graves (these include: 1= Ranga, 2= Fellsmuli, 3= Hafurbjarnarstadir, 4= Berufjordur, 5= Skerdingsstadir, 6= Thorljotsstadir, 7= Ytra-Grdshron and 8= Dalvik, from Einarsson 1994:47).

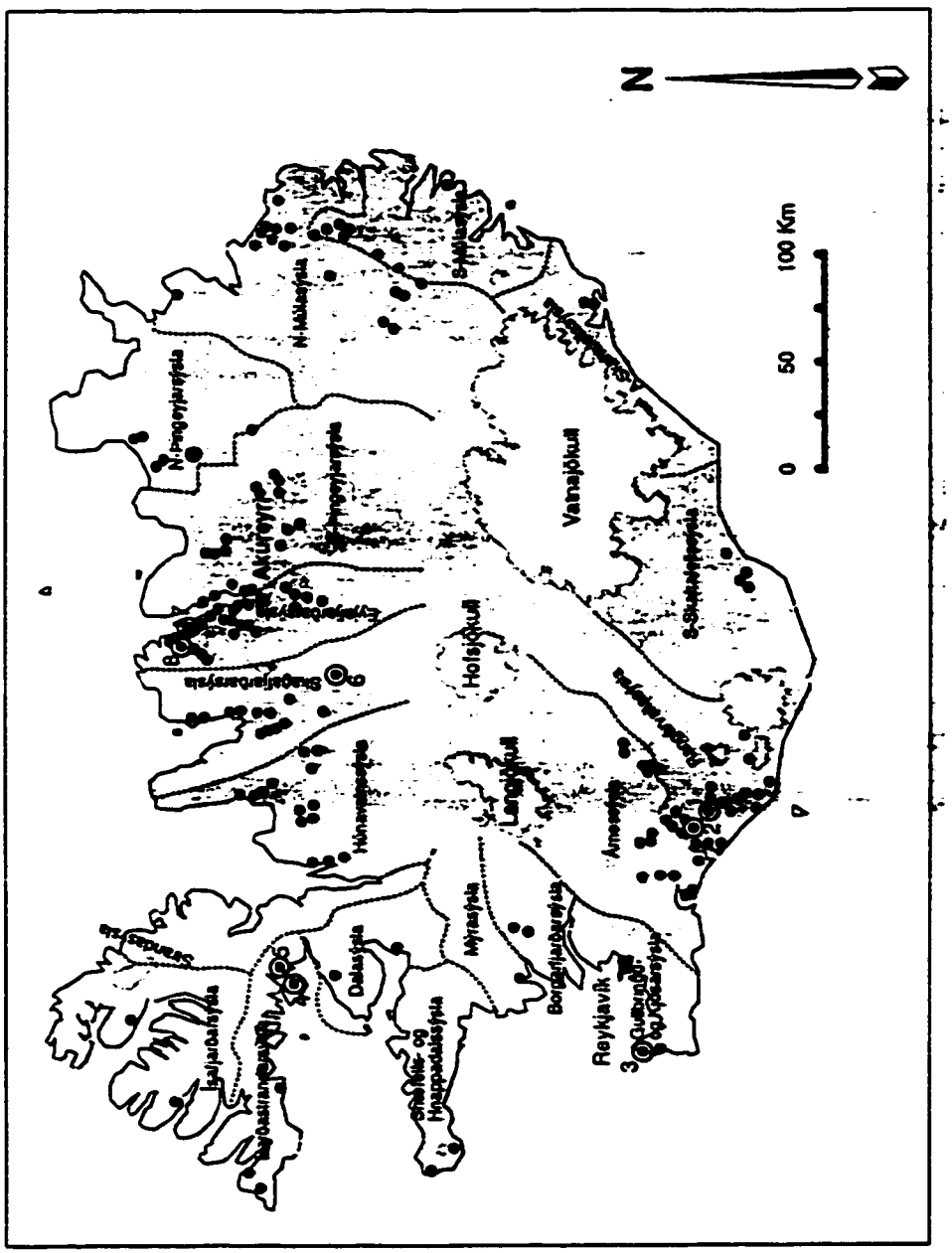

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Figure 3.2 - The site area of the Granagil grave (Jonsson 1909).

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Figure 3.3 - Photograph of the site area of the Austariholl grave. The circle indicated the location of the grave (Eldjarn 1965a:23).

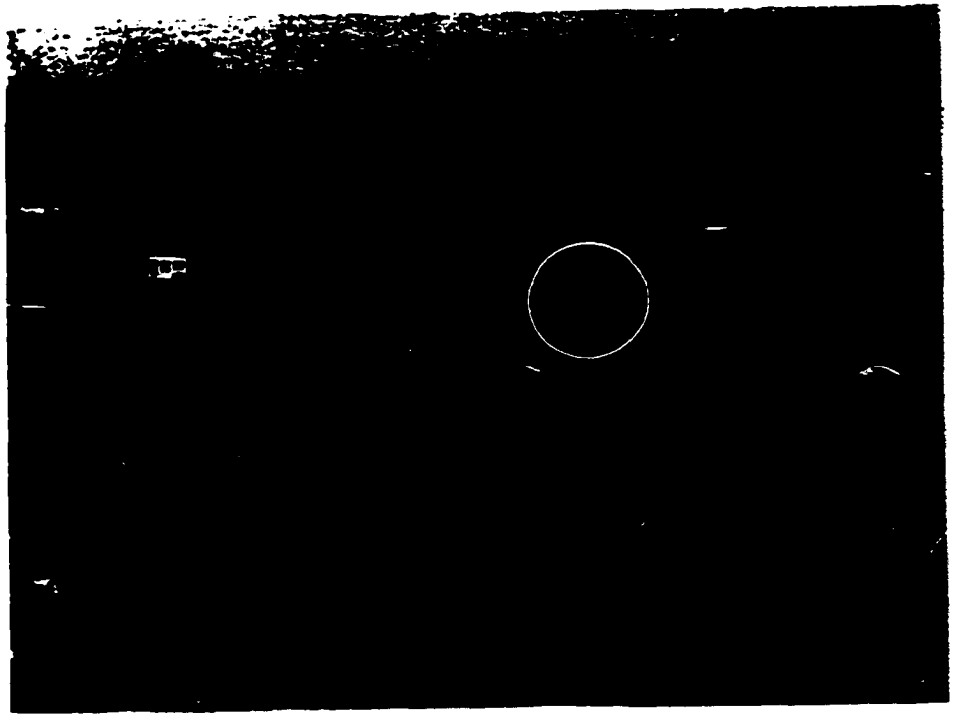

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Figure 3.4 - Photograph of the Austariholl grave as viewed from the east. The horse remains (bundle burial) are in the foreground of the photograph (Eldjarn 1965a:25).

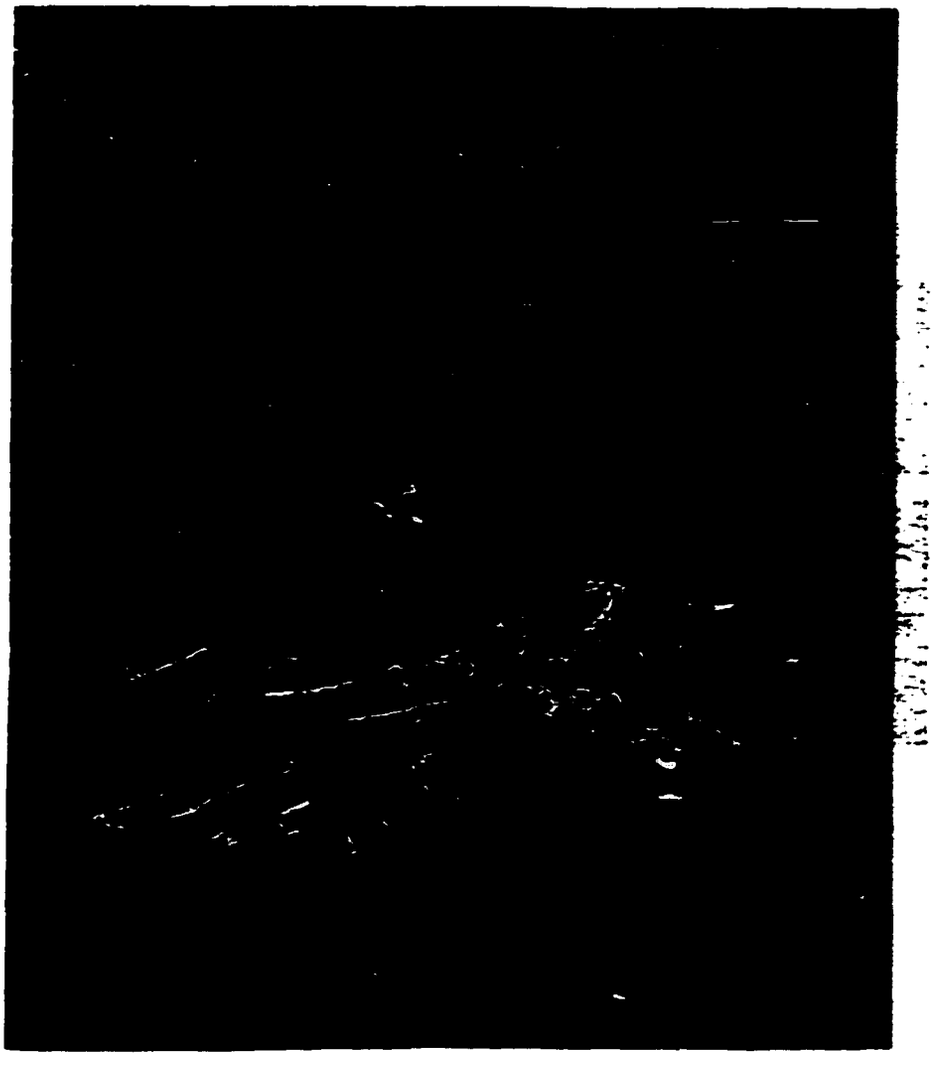

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Figure 3.5 - Plan view of the Austariholl grave (Eldjarn 1965a:25).

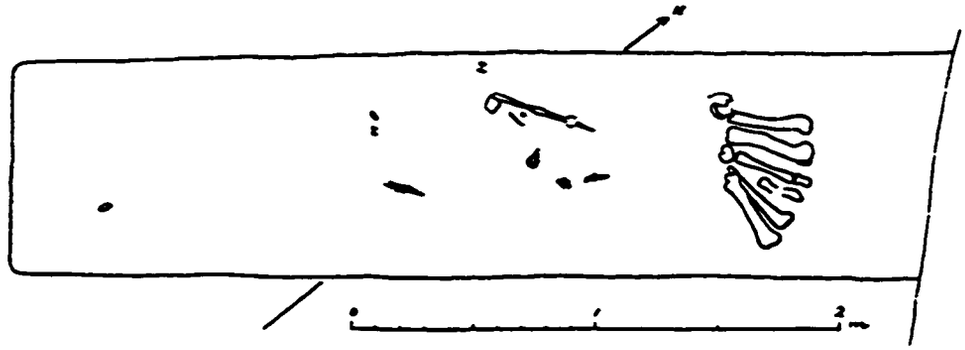

Figure 3.6 - Photograph of the view from the Bransstadir grave to the farm house (Eldjarn 1967:96).

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Figure 3.7 - Site plan of the Bransstadir grave area, which illustrated the relationship of the then "newly" built barn and the grave (Eldjarn 1967:97).

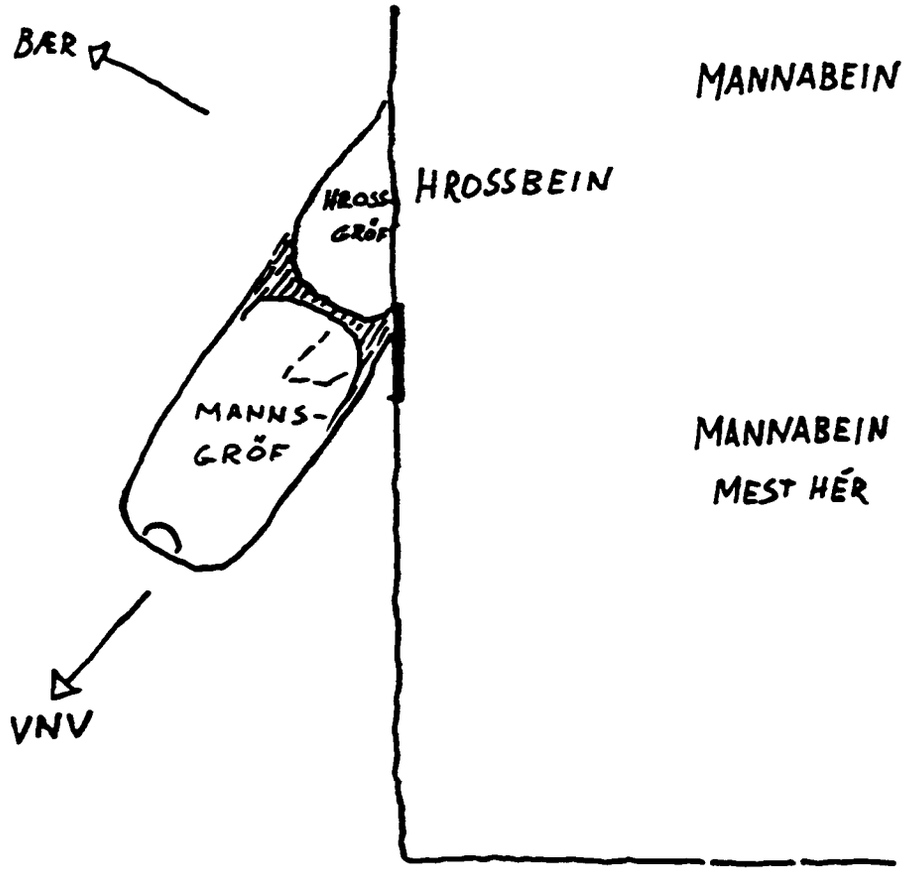

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Figure 3.8 - Site plan of the Elivogar grave (Eldjarn 1957-58:133).

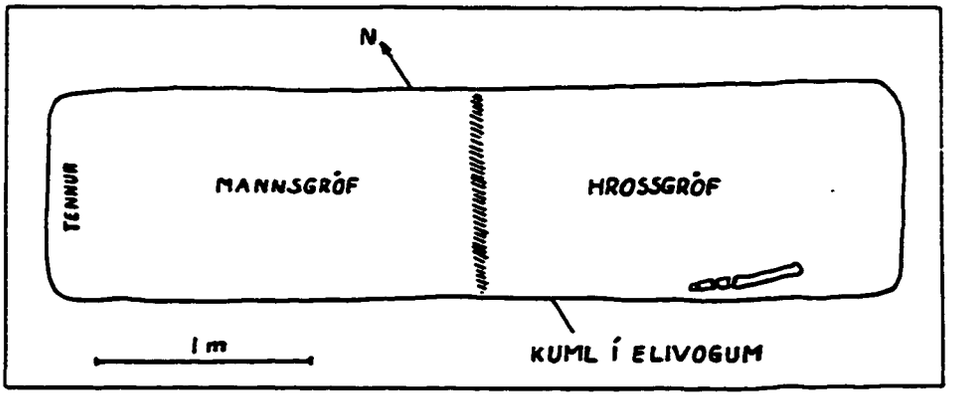

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Figure 3.9 - Photograph of a plan view of the two horses found in the Grimstadir grave (Eldjarn 1967:100).

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Figure 3.10 - The 1958 view of the Hrifunes home field (Eldjarn 1983a:7).

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Figure 3.11 - Photograph of the 1958 Hrifunes grave, taken on November 3, 1958, before excavation (Eldjarn 1967:59).

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Figure 3.12 - Photograph of the 1958 Hrifunes grave, taken on November 3, 1958, before excavation (Eldjarn 1983a:11).

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Figure 3.13 - Profile of the 1958 Hrifunes grave, demonstrating the relationship of the dated tephera. The unlabeled tephera immediately above the grave is the "E-1" tephera dated at AD. 934 +/- 2 (Eldjarn 1967:61).

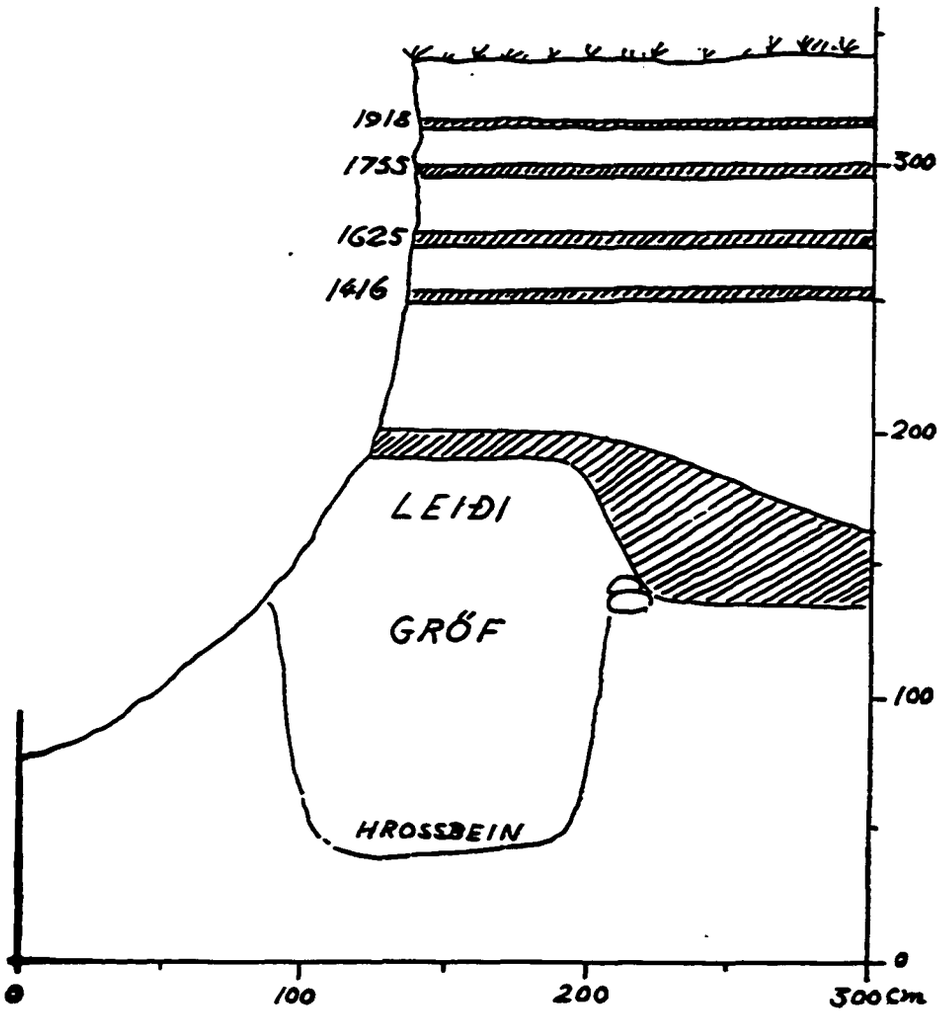

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Figure 3.14 - Plan view of the 1958 Hrifunes grave (Eldjarn 1967:60).

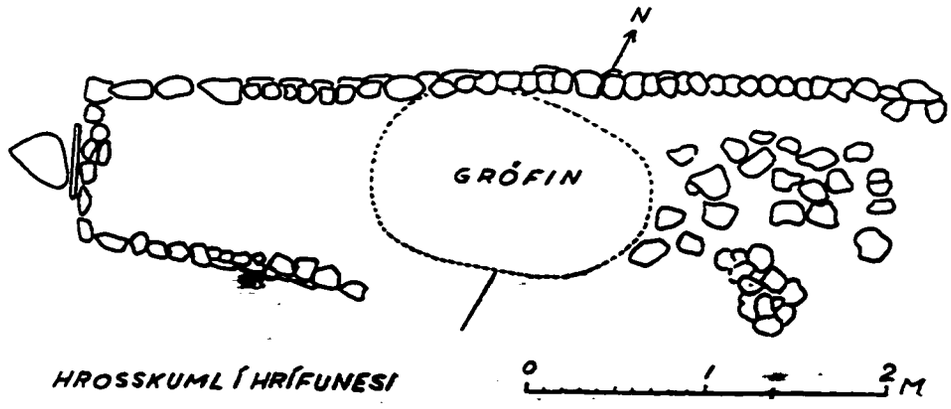

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Figure 3.15 - Map of the site area for the 1982 Hrifunes graves. Hrifunes II was located on the bottom right corner of the map (Eldjarn 1983a:22).

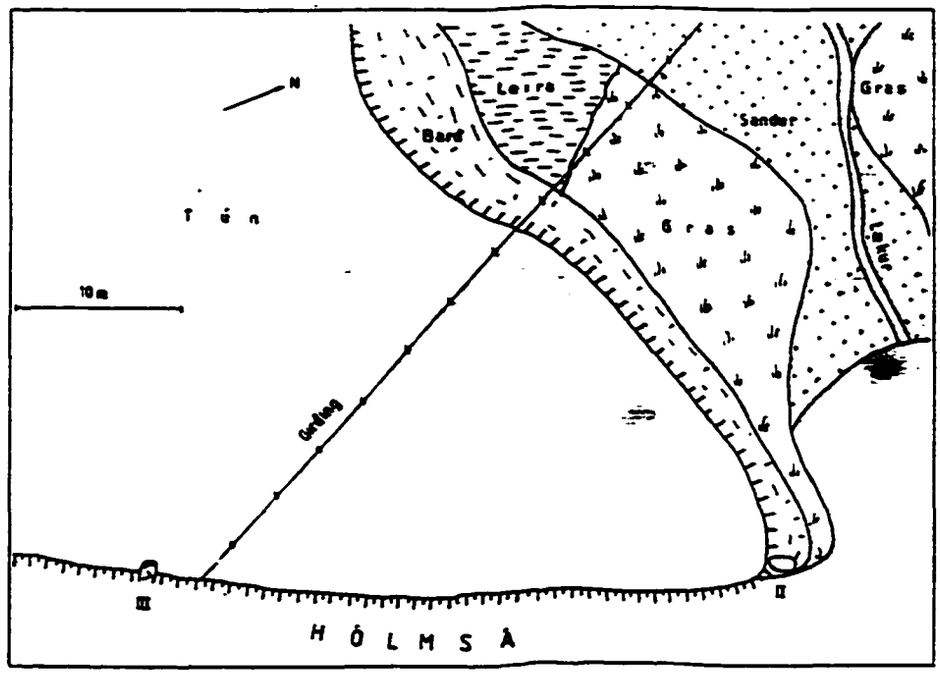

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Figure 3.16 - Photograph of the eroded horse remains at the Hrifunes II grave, taken before excavation (Eldjarn 1983a:23).

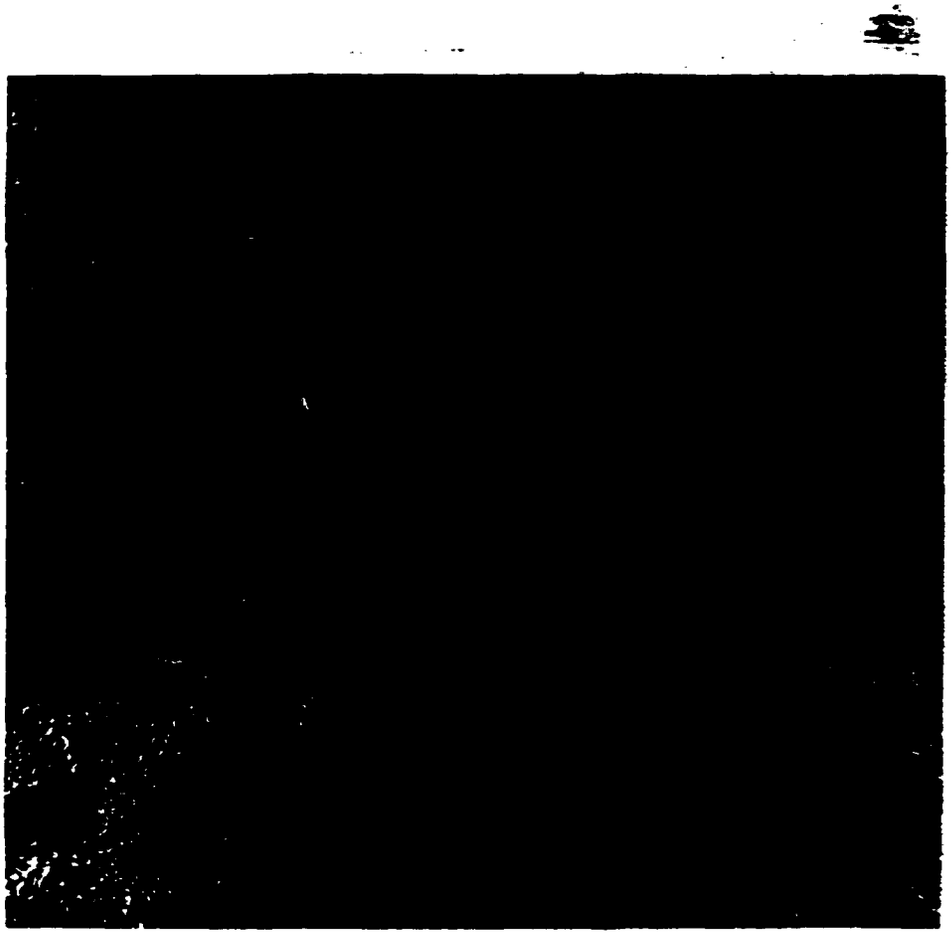

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Figure 3.17 - Photograph of the top of the Hrifunes II grave, which illustrated the relationship of the grave to the stratigraphic profile (Eldjarn 1983a:14).

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Figure 3.18 - Plan view of the Hrifunes II grave, which illustrated the stone cairn covering the grave (Eldjarn 1983a:26).

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Figure 3.19 - Photograph of the plan view of the Hrifunes II horse remains *in situ* (Eldjarn 1983a:24).

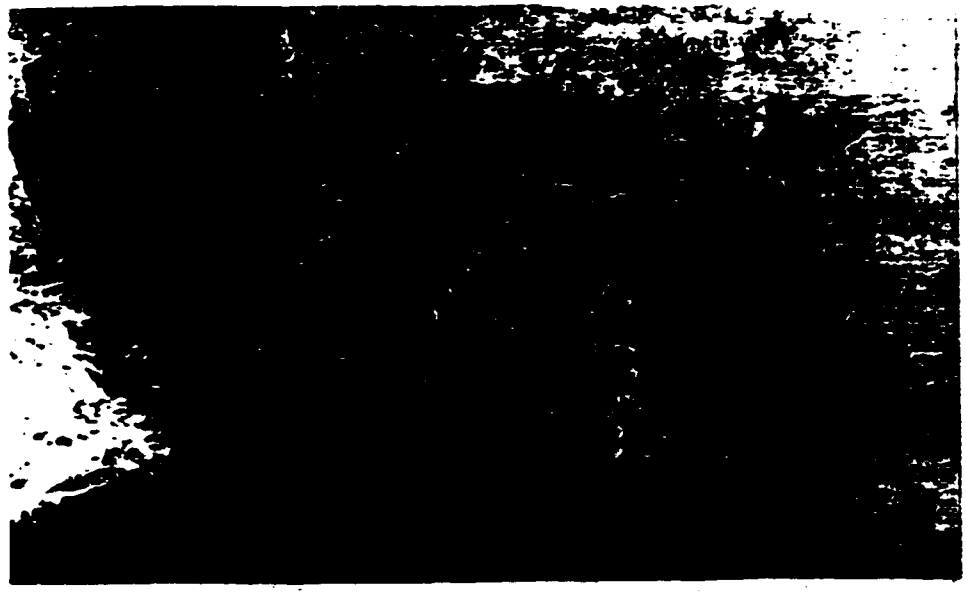

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Figure 3.20 - Photograph of the Oxnadalsheidi grave, situated near the 1960's road. The circle indicated the location of the grave (Eldjarn 1965a:15).

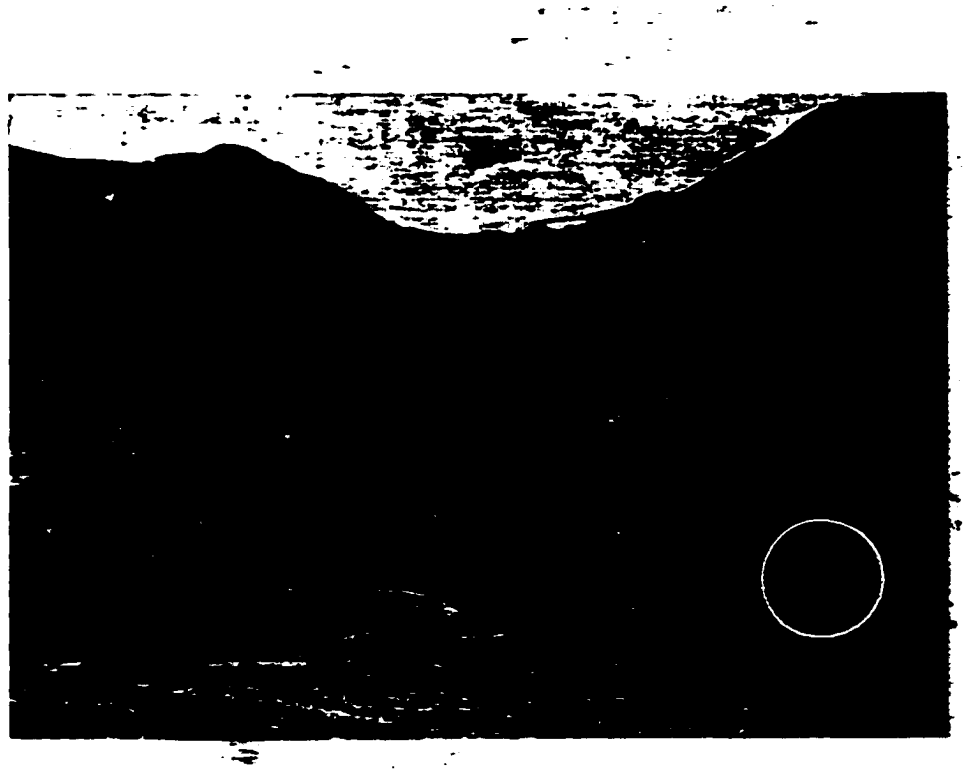

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Figure 3.21 - Photograph of the Oxandalsheidi grave as viewed from the east. The horse remains (bundle burial) are in the foreground of the photograph (Eldjarn 1965a:17).

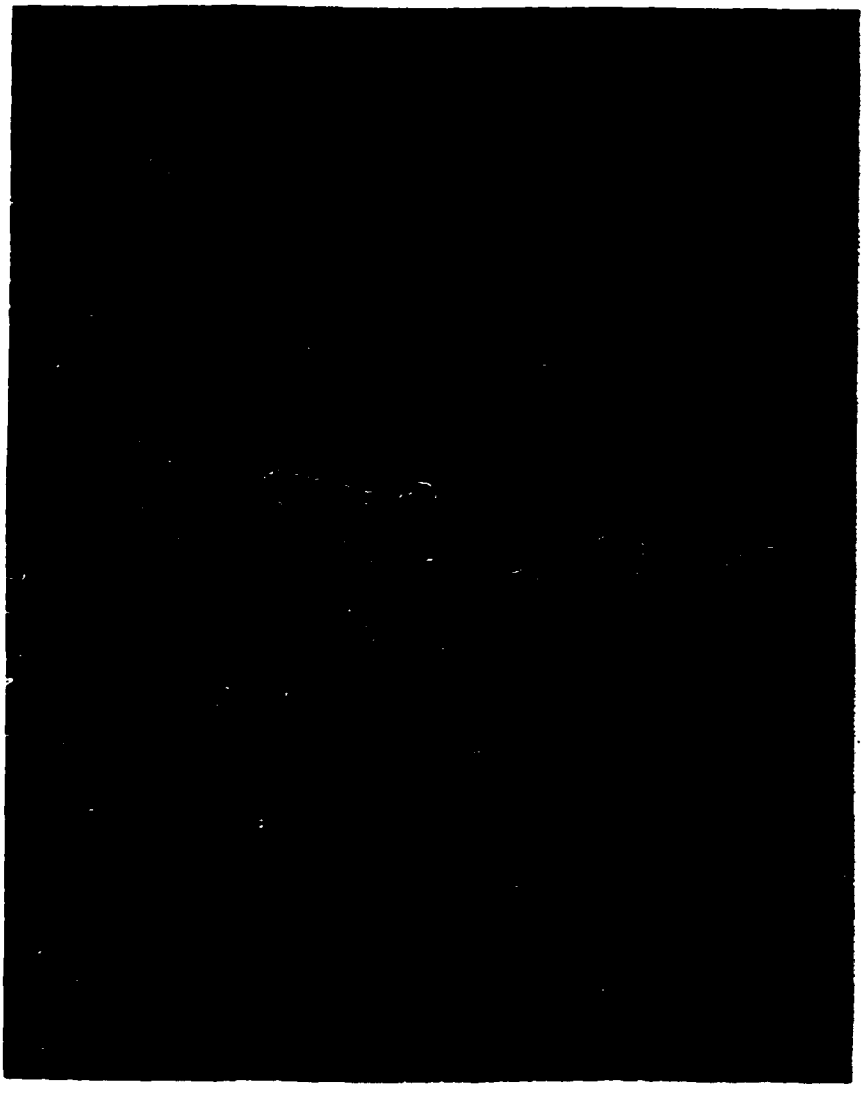

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Figure 3.22 - Plan view and profile of the Solheimar grave (Eldjarn 1957-58:131).

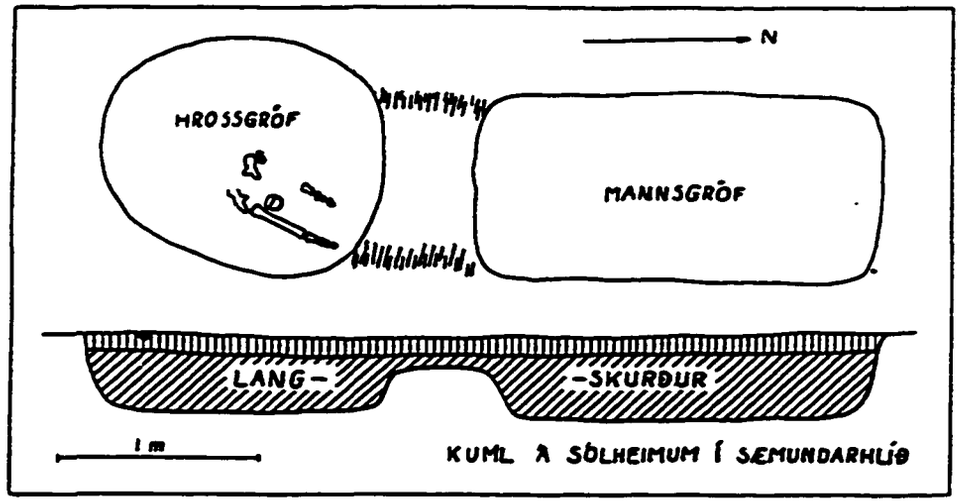

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Figure 3.23 - Site map of the Ytra-Gardshorn cemetery (Eldjarn 1965a:32).

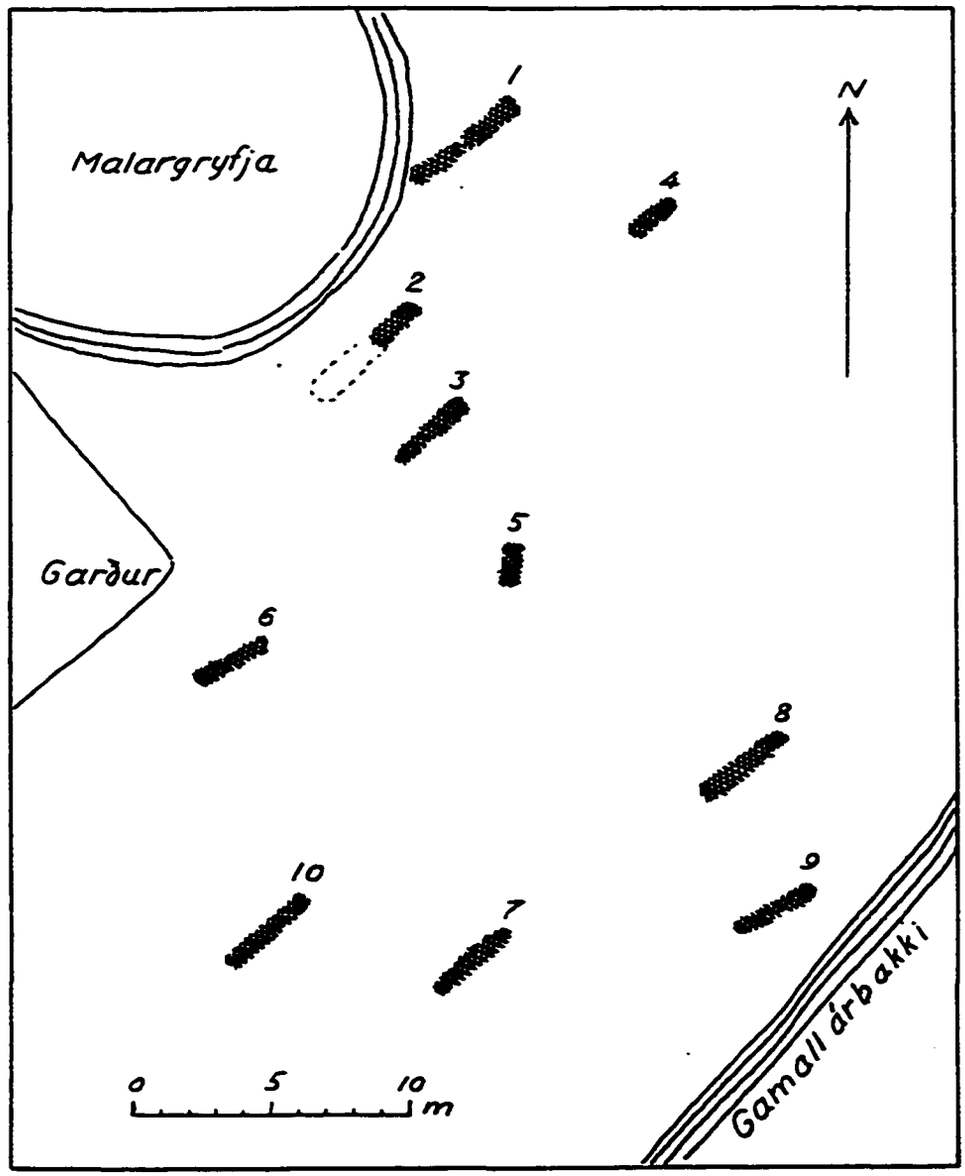

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Figure 3.24 - Photograph of the Ytra-Gardshorn cemetery area (Eldjarn 1965a:34).

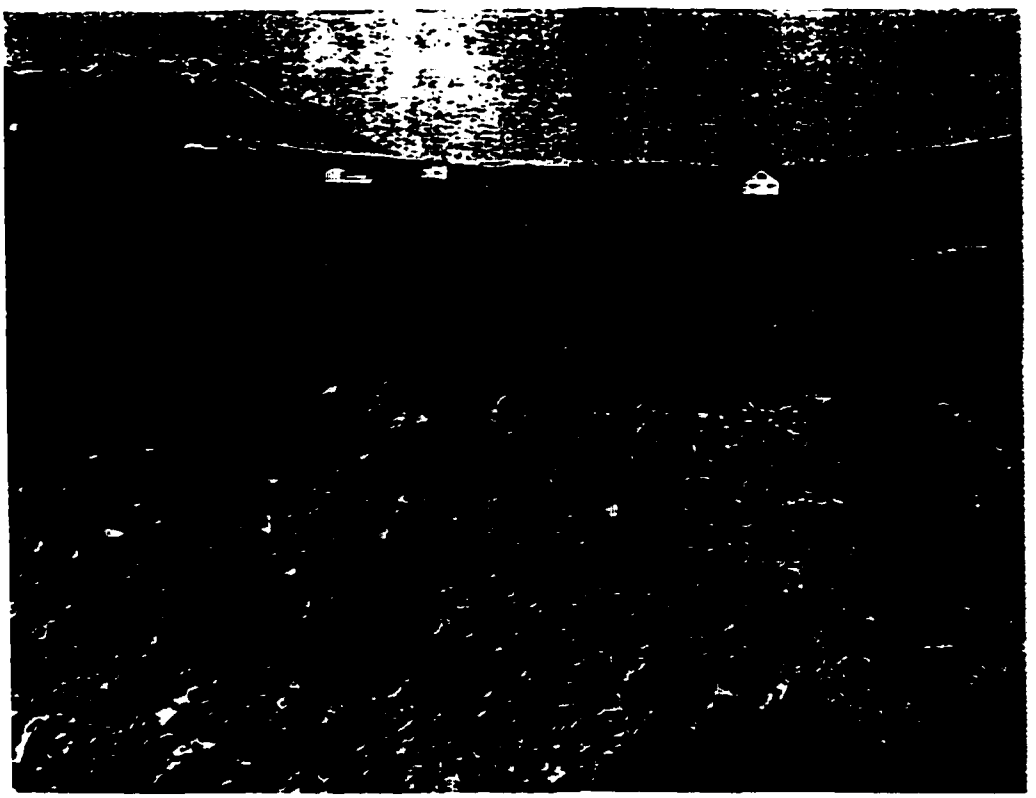

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Figure 3.25 - Photograph of the Ytra-Gardshorn Grave No. 1. The horse burial is in the foreground (Eldjarn 1965a:35).

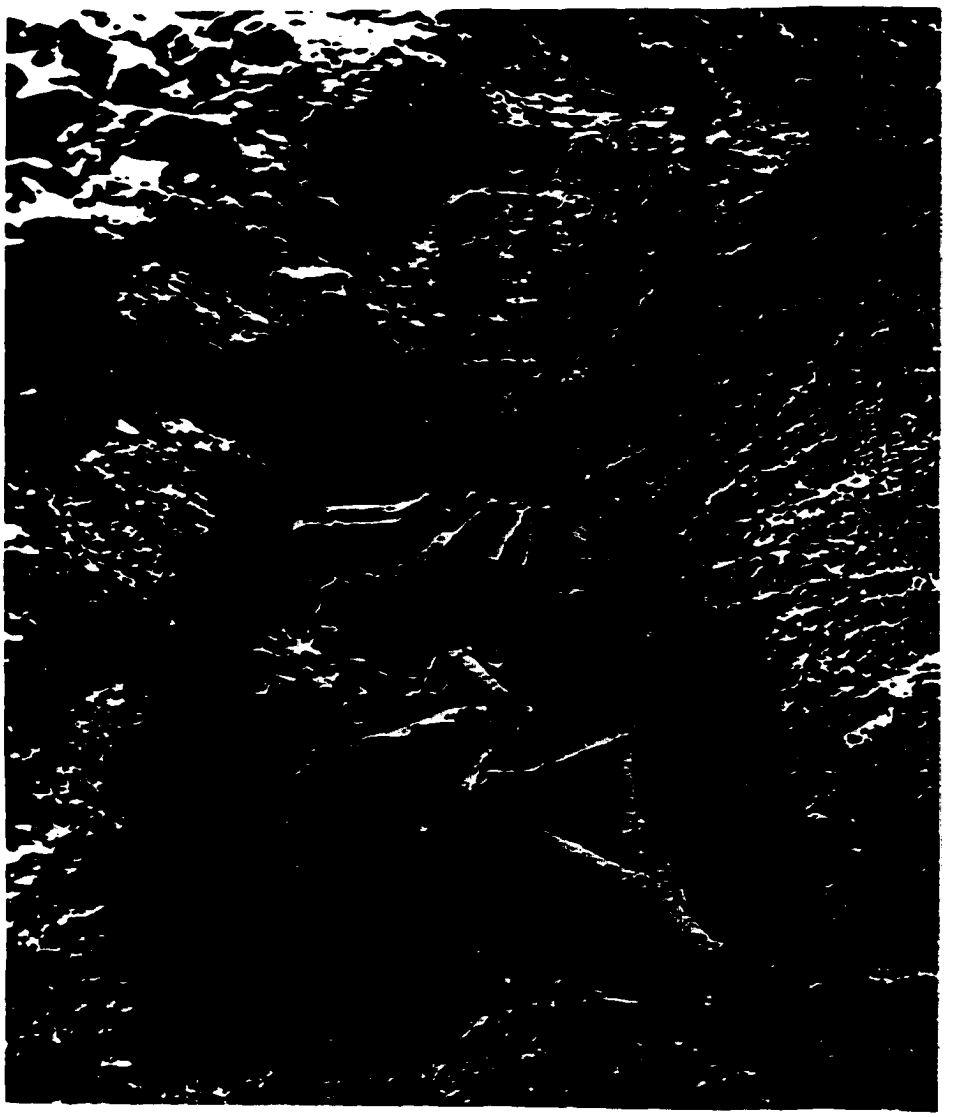

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Figure 3.26 - Plan view of the Ytra-Gardshorn Grave No. 3 (Eldjarn 1965a:37).

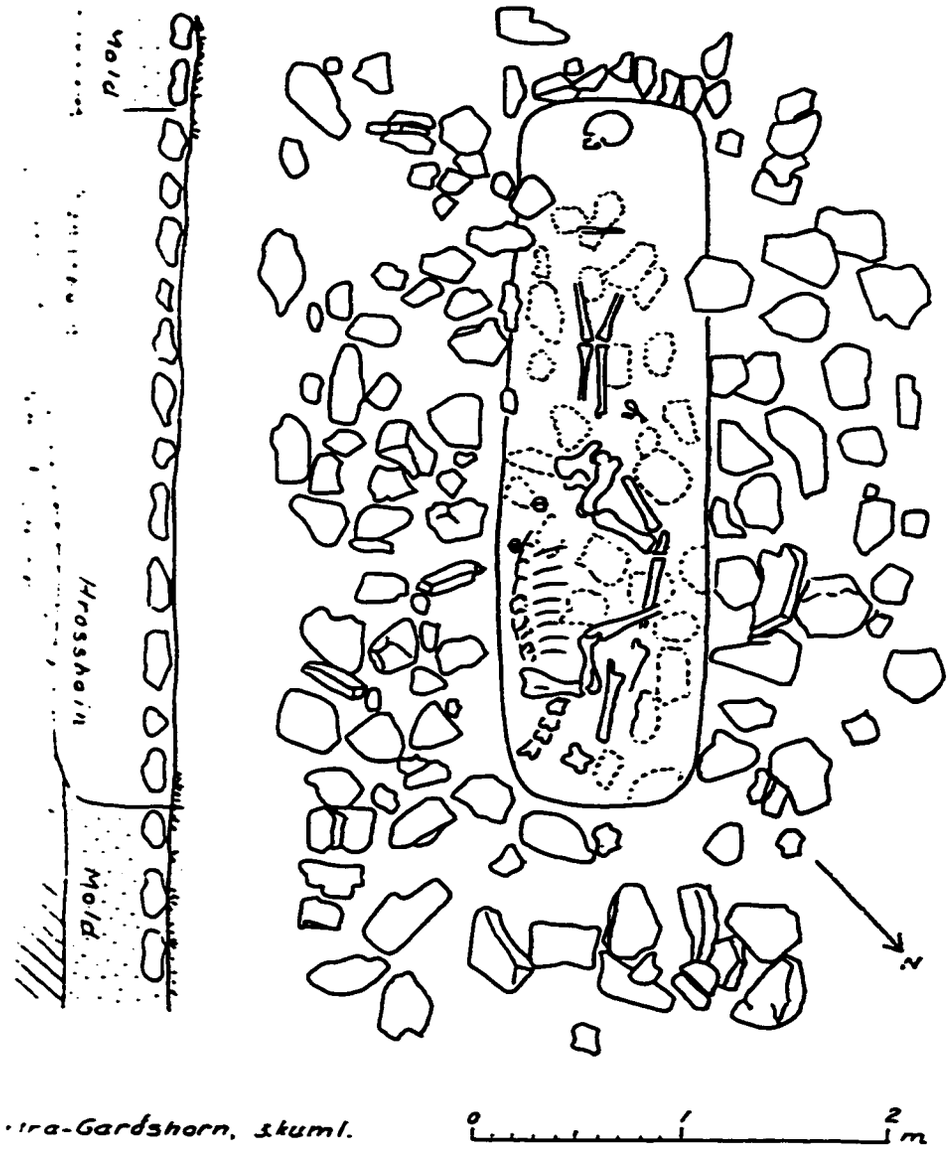

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Figure 3.27 - Plan view of the Ytra-Gardshorn Grave No. 7 (Eldjarn 1965a: 42).

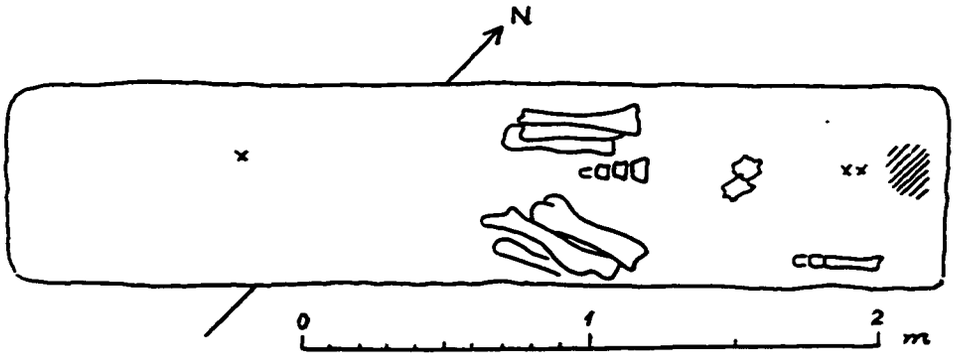

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Figure 3.28 - Plan view and profile of the Ytra-Gardshorn Grave No. 8 (Eldjarn 1965a:45).

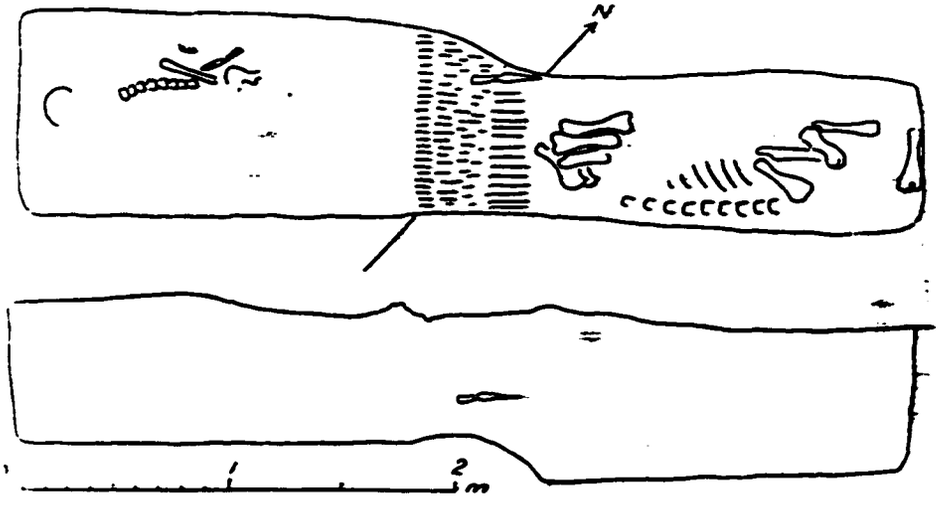

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Figure 3.29 - Plan view and profile of the Ytra-Gardshorn Grave No. 10 (Eldjarn 1965a:45).

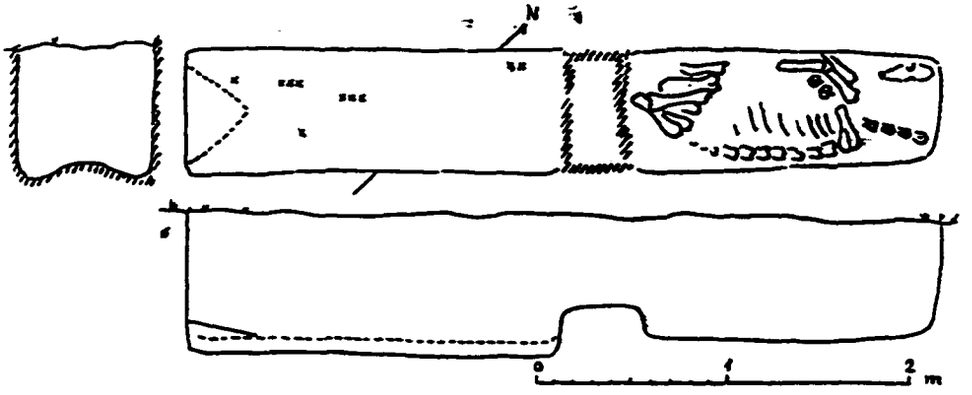

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Figure 3.30 - Map of the site area of the Vad grave (Kristinsdottir 1987:90).

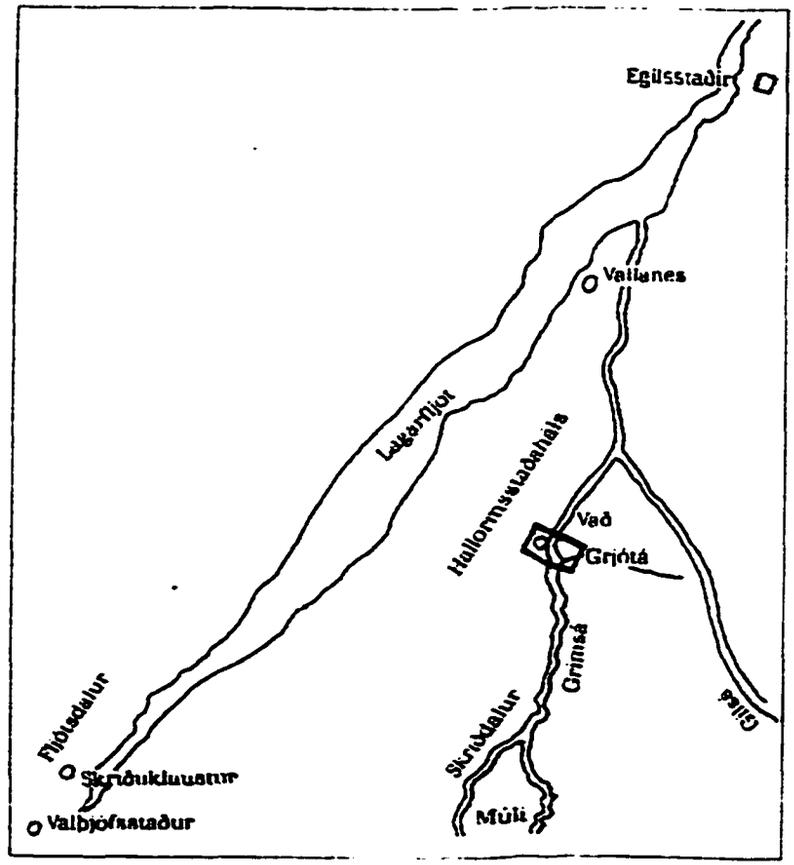

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Figure 3.31 - Map of the Baerjarhus farmstead where the Vad grave (kuml) was discovered (Kristinsdottir 1987:91).

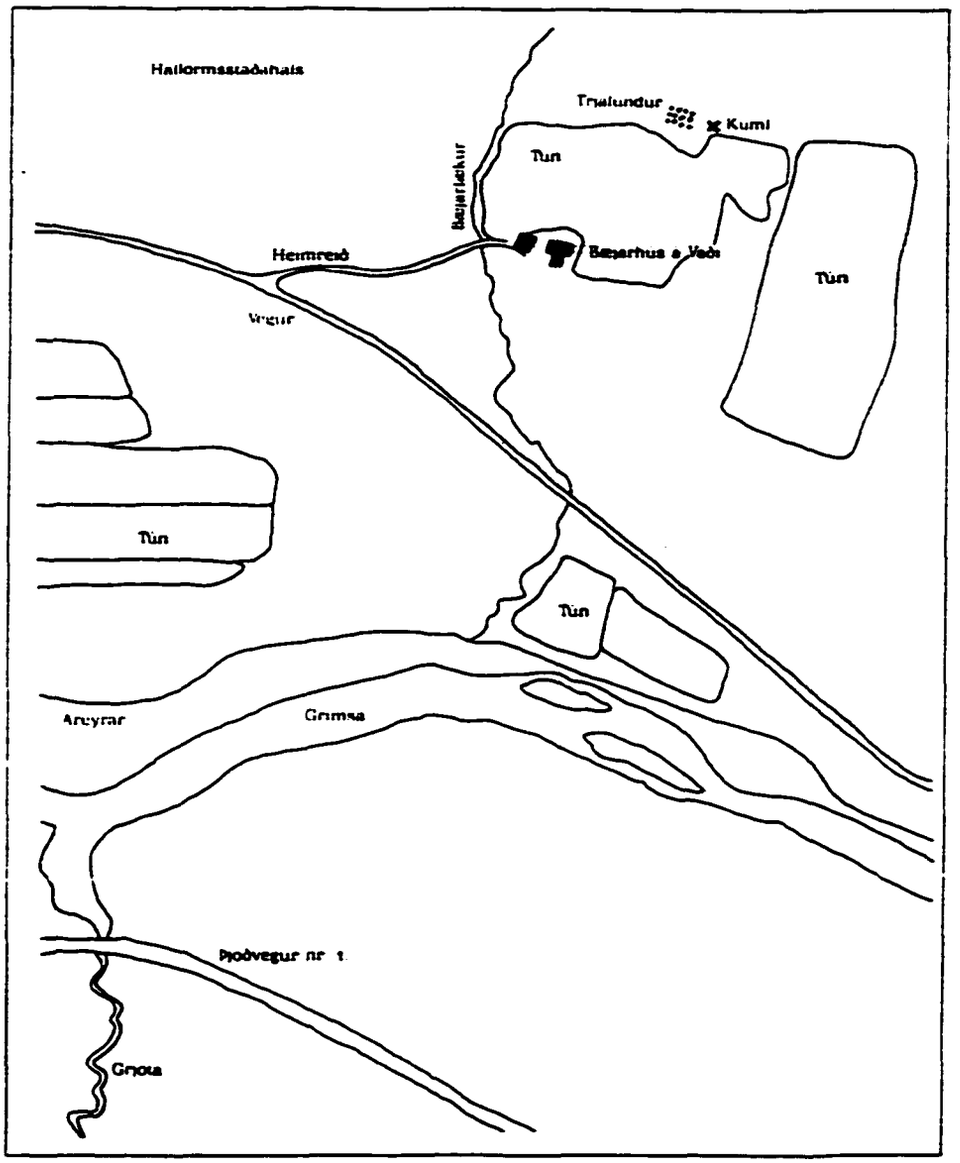

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Figure 3.32 - Plan view of the rock cairn that covered the Vad grave (Kristinsdottir 1987:92).

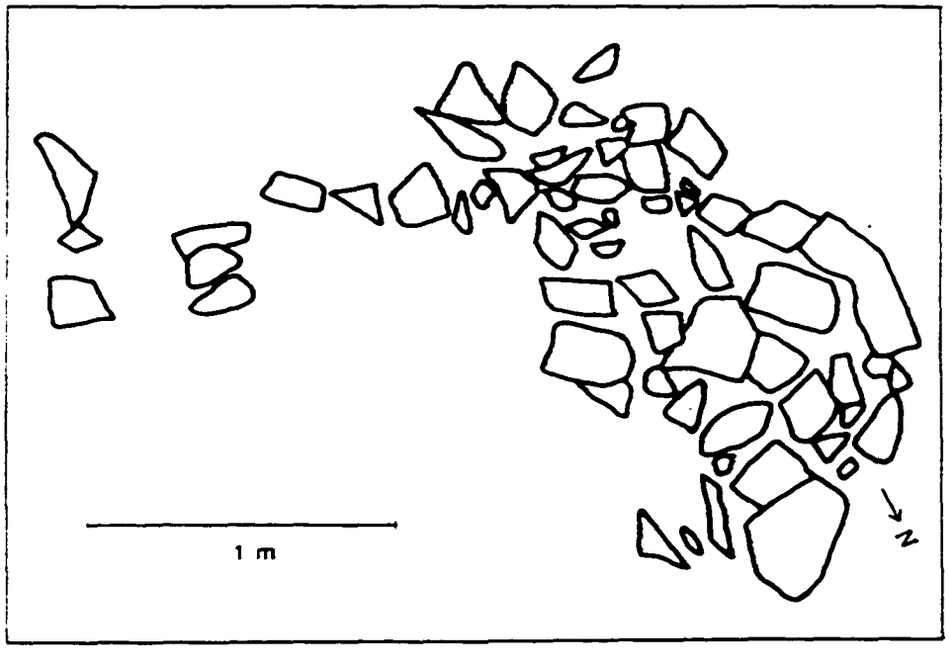

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Figure 3.33 - Plan view of the Vad grave (Kristinsdottir 1987:93).

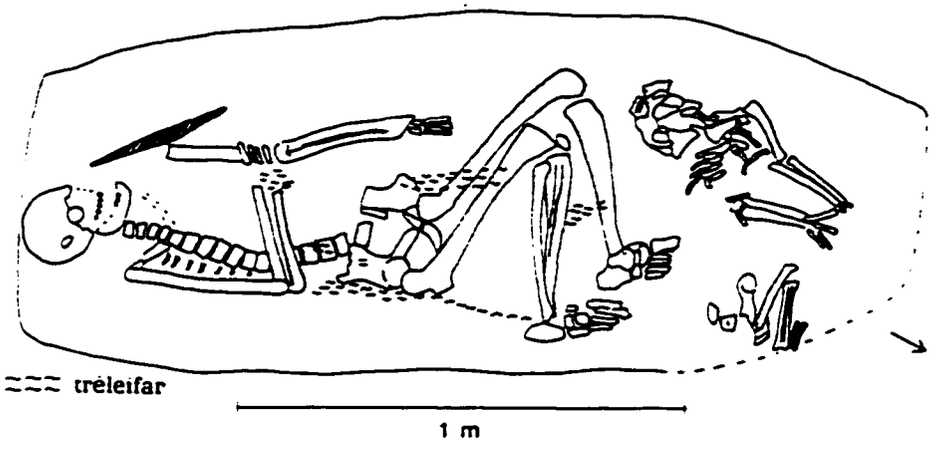

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Figure 3.34 - Sketch map of the animal burial at the Hallfredarstadir farmstead. The material was located on mound A, note that the drawing is not to scale (Amorosi 1987:30).

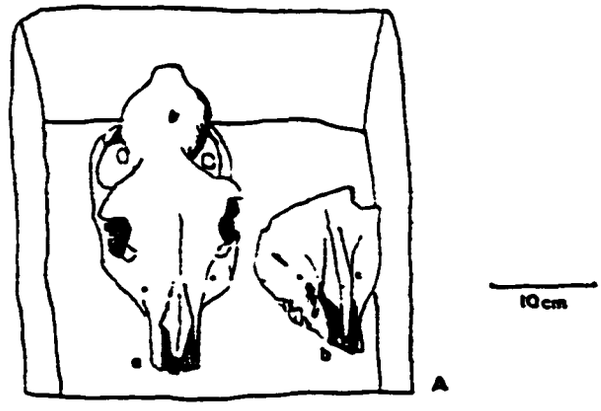
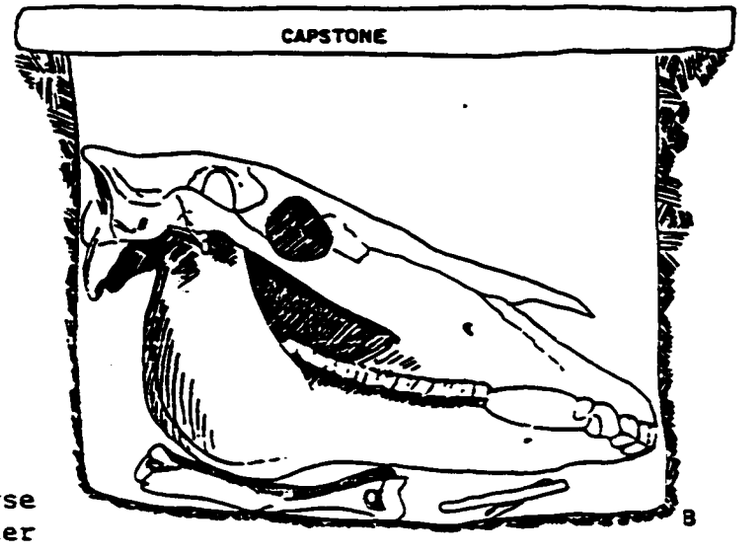


Figure 16. Hallfredarsatdir animal burial.

A - In situ view, showing the two horse skulls.



B - Profile view, showing horse skull a and remains found under the skull.

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Figure 3.35 - Plan view and profile field sketches of the animal grave at Hallfredarstadir. The top drawing illustrates the *in situ* position of horse skulls A & B. The bottom drawing shows horse skull A and some of the remains found under the skull (Amorosi 1987:31).

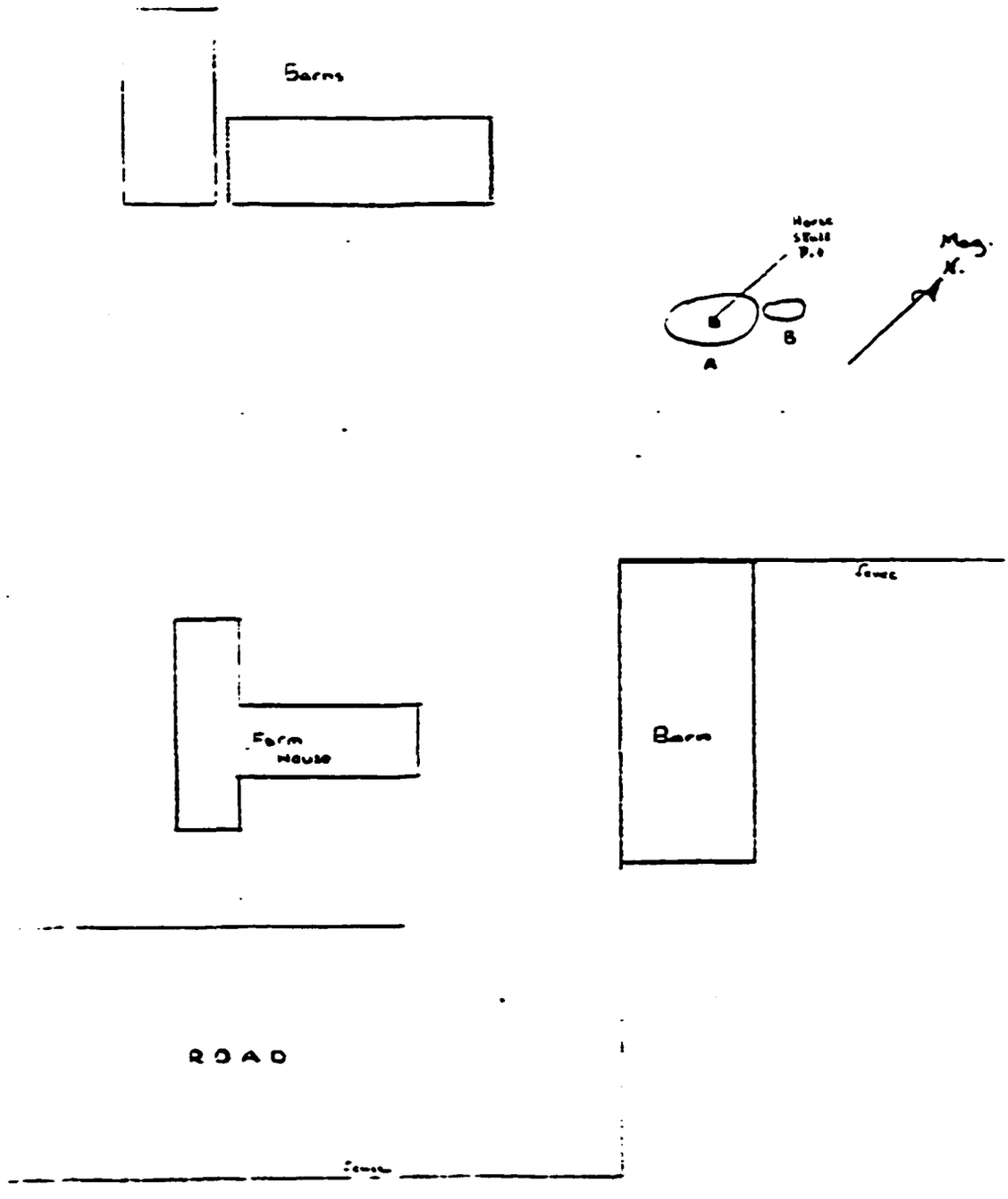

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Figure 4.1 - Sketch site plan of the Baegisstadir site.

BAEGISSTADIR

A - Sheep Holding Area
B - Dwelling Structure
C - Collapsed Structures

NOTE: NOT DRAWN TO SCALE

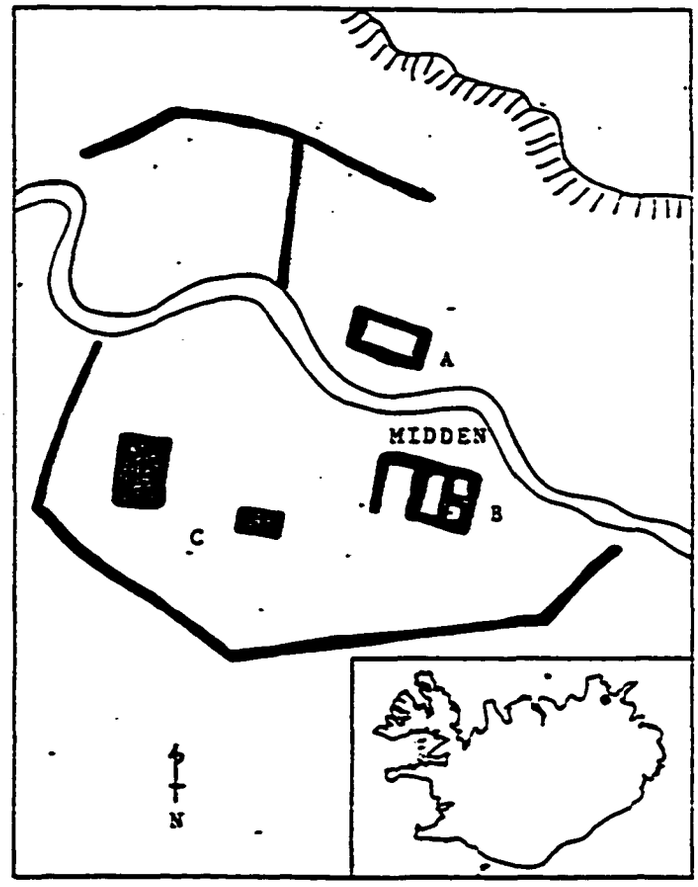

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Figure 4.2 - Site plan of the Eldvorp cave. Site plan is from Gestsson (1983).

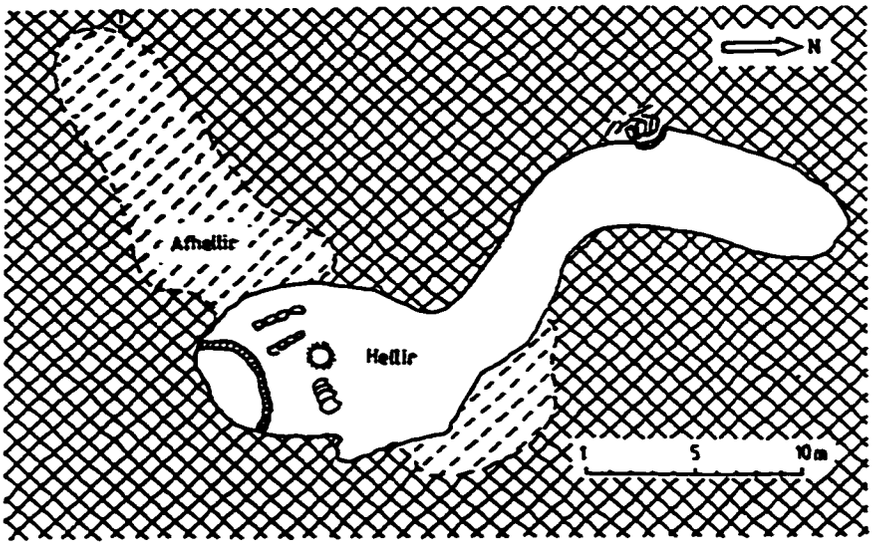

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Figure 4.3 - Illustration of a sheep, *Ovis aries* proximal humerus exhibiting the pathology of lasped epipyhseal fusion.

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Figure 4.4 - Profile for the Grunnasundsnes site. The bone materials were recovered 2.40 meters below the ground surface. Field notes are courtesy of Gudmundur Olafsson.

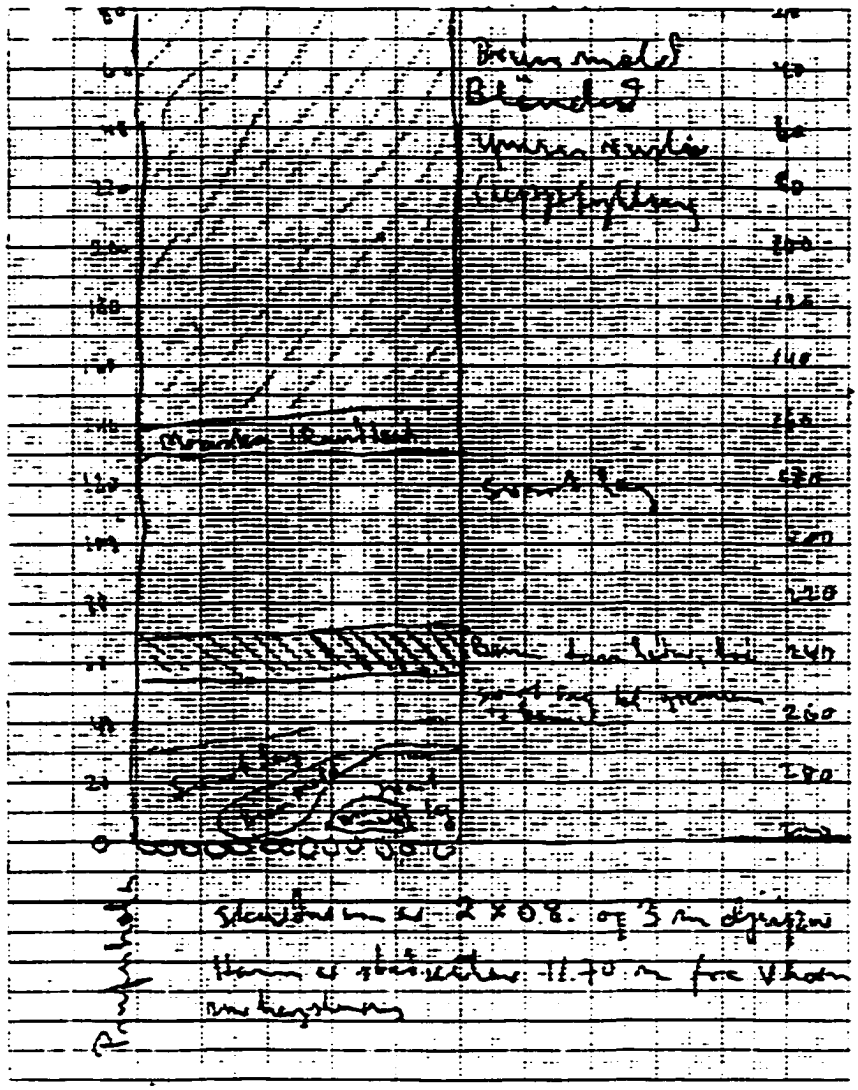

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Figure 4.5 - Illustration of a Bos taurus lower molar 1 from the site of Grunnasundsnes. The tooth exhibits an odd pattern of wear consistent with chronic fluorosis poisoning. Also visible are growth arrest lines indicating the condition of dental hypoplasia.

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Figure 4.6 - Site plan of the Holar church. The shaded area indicates the pit where the animal remains were recovered. The illustration is after Snaesdottir (1991: 167).

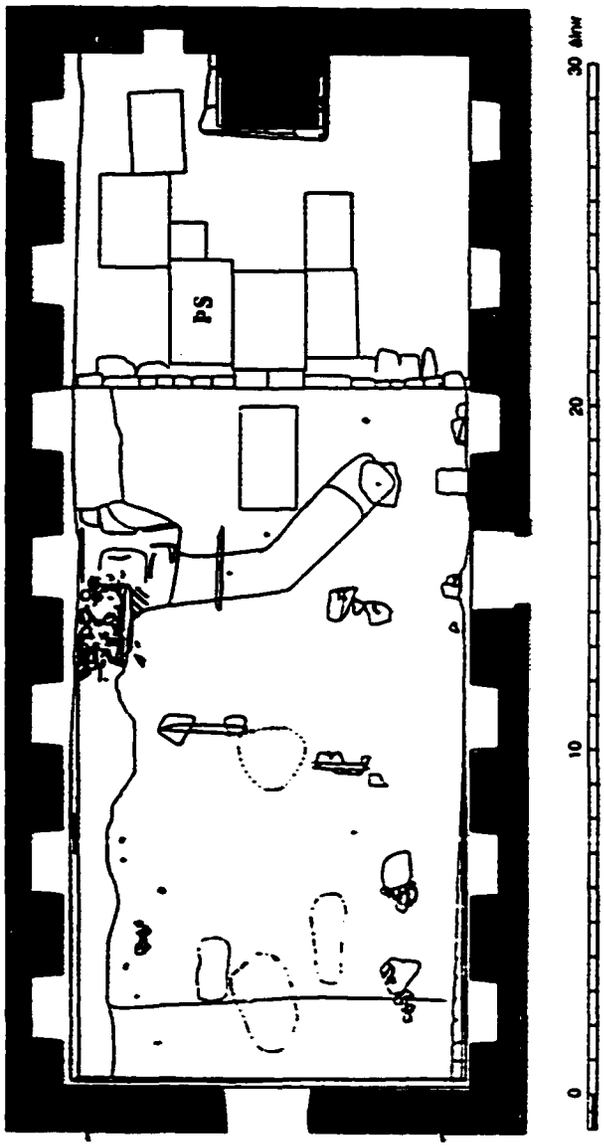

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Figure 4.7 - Site plan of the Reykholt site. The bone materials were recovered from the western side of the East-West trench, excavated in 1987. The illustration is from Buckland, Sadler and Sveinbjarnardottir (1992: 151).

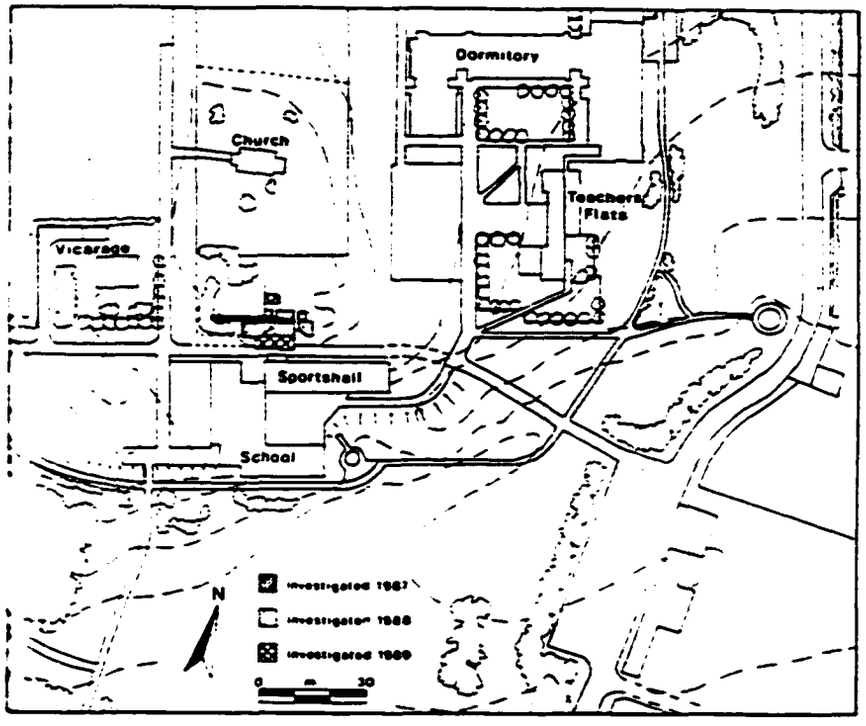

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Figure 4.8a - Illustration of a Bos taurus upper molar 3 from the Skalholt site, exhibiting the pathology of wrinkled enamel.

Figure 4.8b - Illustration of a Bos taurus distal tibia from the Skalholt site, exhibiting a healed lesion on the articular surface.

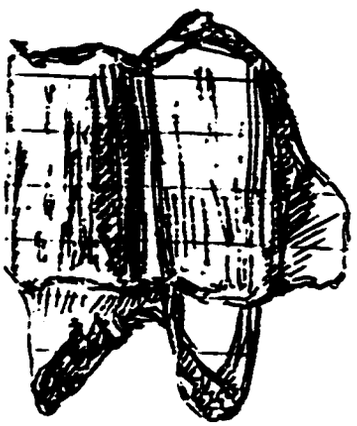

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Figure 4.9 - Site plan of the Adalstraeti 8 excavation. The rubbish pit feature was encountered on coordinate X12, Y12. The Icelandic word Klopp translates to bedrock or in this instance culturally sterile deposits. The closing elevations (below ground surface) are listed in each excavation square. Site plan is after Hallgrimsdottir (1987: 10).

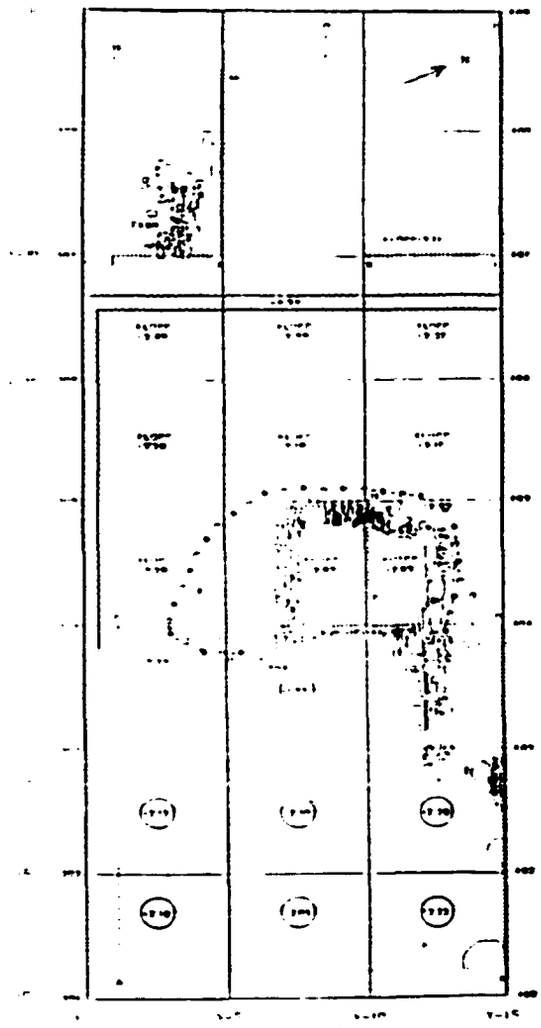

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Figure 4.10 - Sketch map of the Nyibaer site.

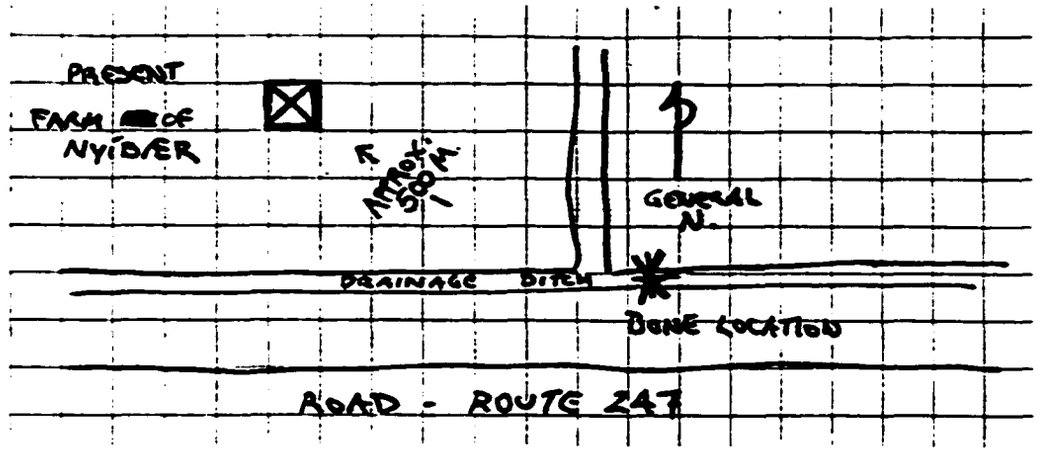

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Figure 5.1 - The relative percentage of the major taxa recovered in the 1958 "pit-like" feature from the Adalbol site, Hrafnkelsdalur, Fljotsdalhreppur, Nordur-Mulasysla, Eastern Iceland.

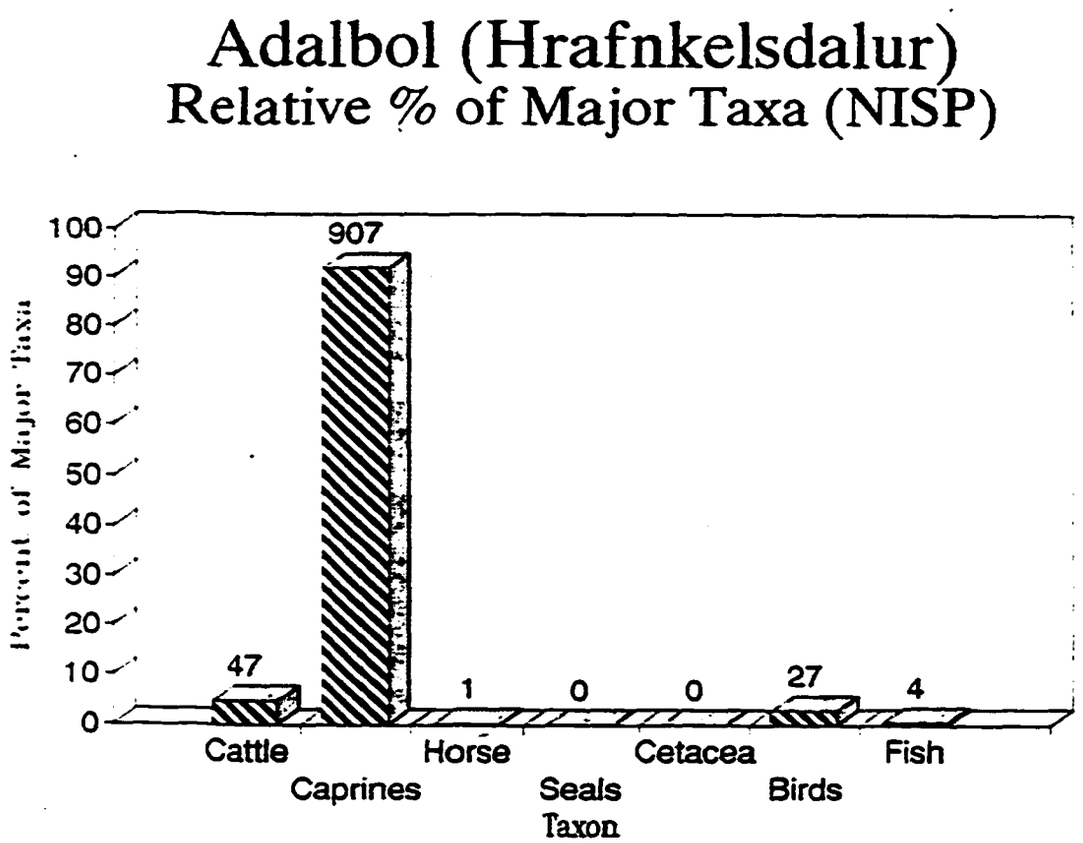

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Figure 5.2 - The relative percentage of the domestic mammals recovered in the 1958 "pit-like" feature from the Adalbol site.

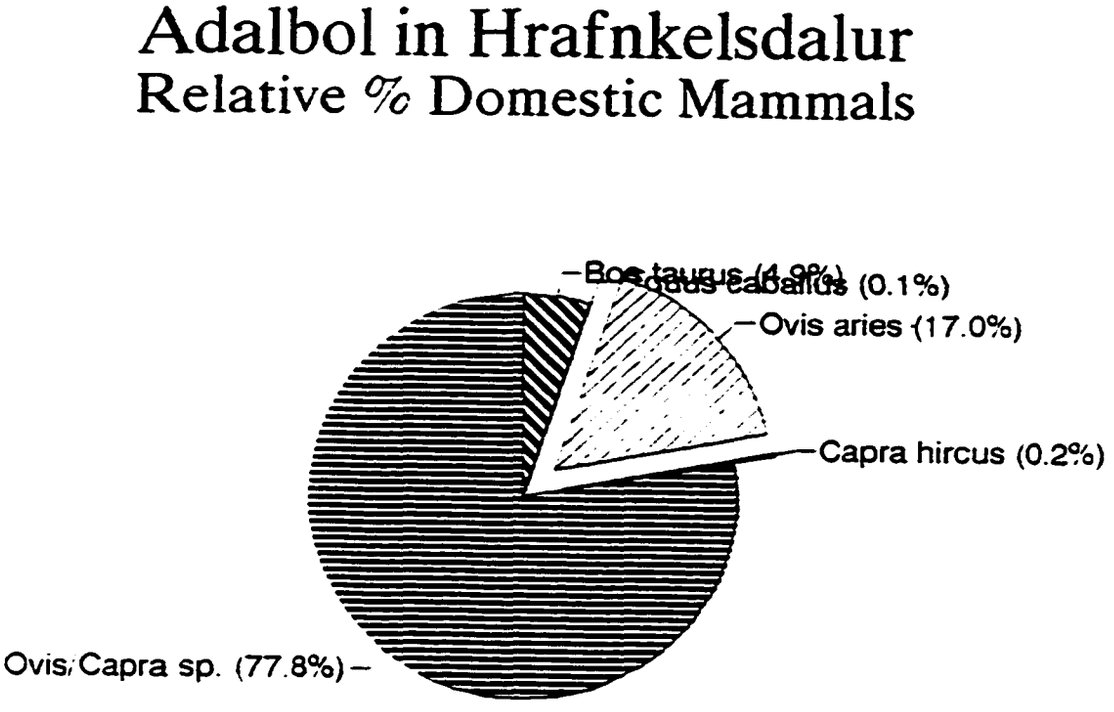

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Figure 5.3 - Map showing the location of the Vestmannaeyjar or Westman Islands. The visible large island is the island of Heimey where the Herjolfsdalur site is located (illustration is from Fridriksson 1994, map is drawn by O. Vesteinsson).

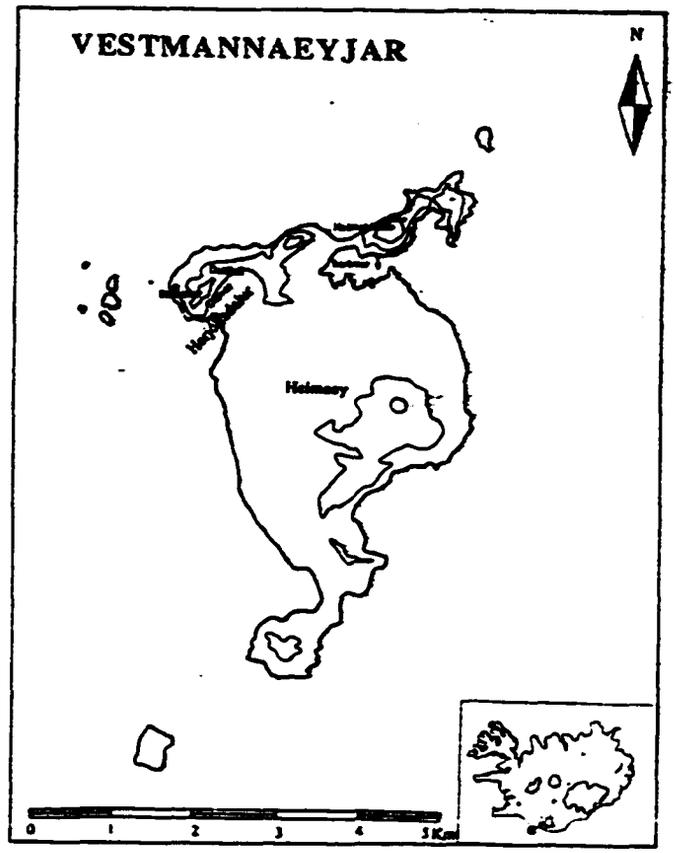

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Figure 5.4 - Site Plan of the Herjolfsdalur site illustrating the major structural turf buildings (illustration is from Hermanns-Audardottir 1991).

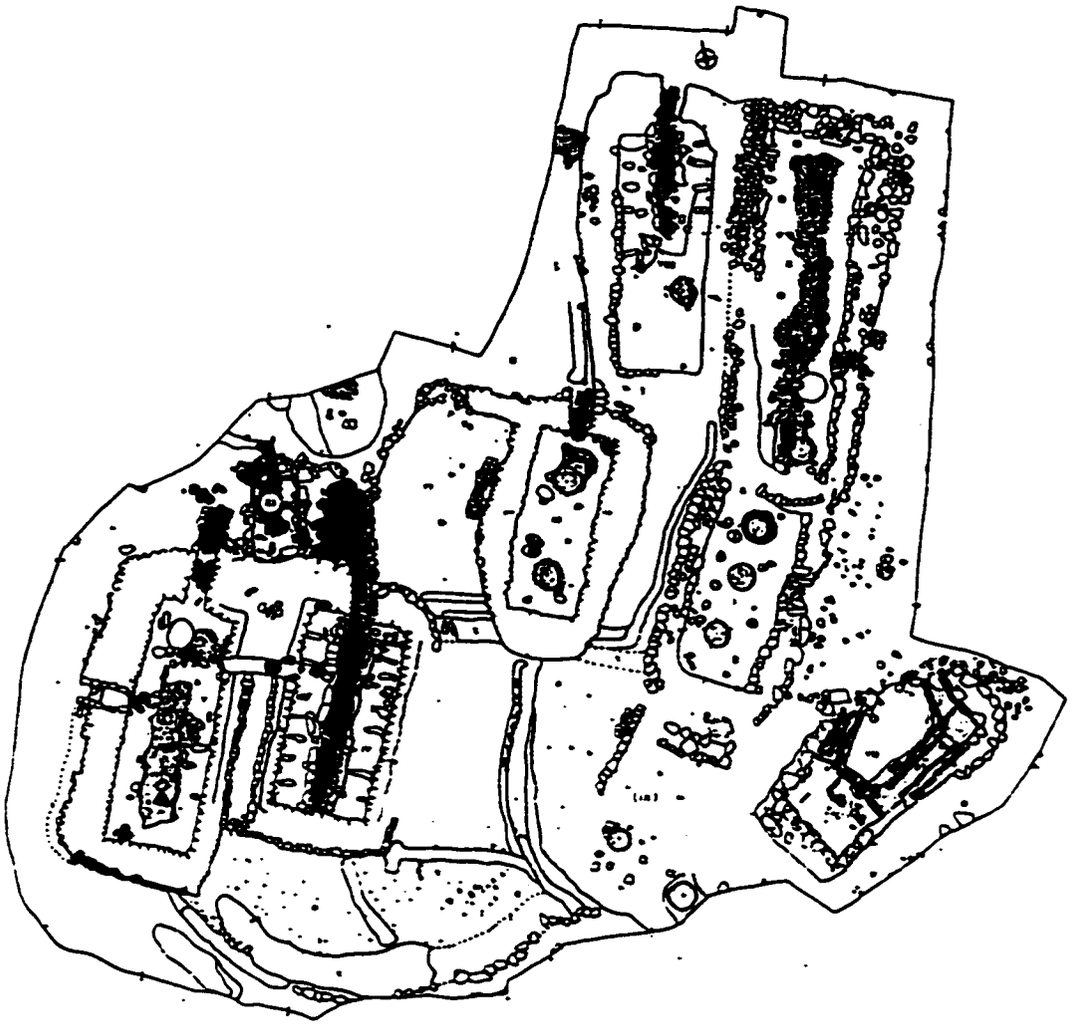

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Figure 5.5 - The relative percentage of the major taxa recovered from the Herjolfsdalur site.

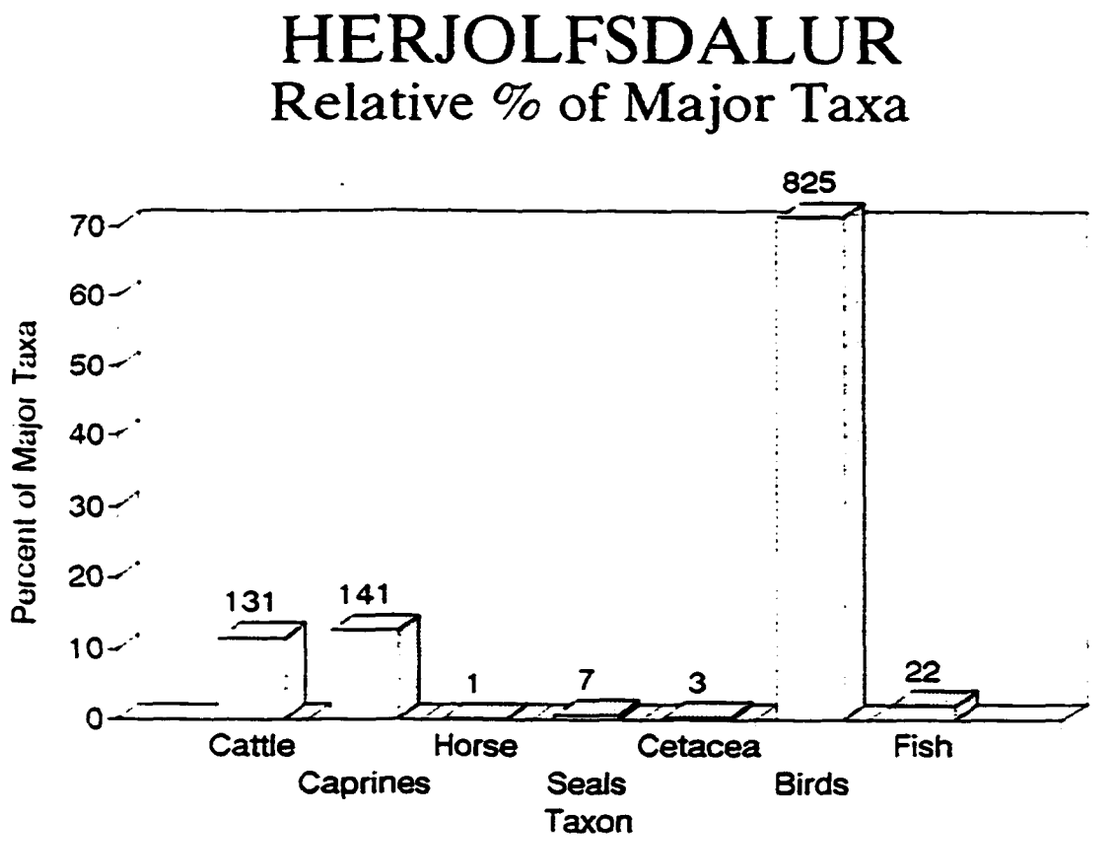

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Figure 5.6 - The relative percentage of the domestic mammals from the Herjolfsdalur site.

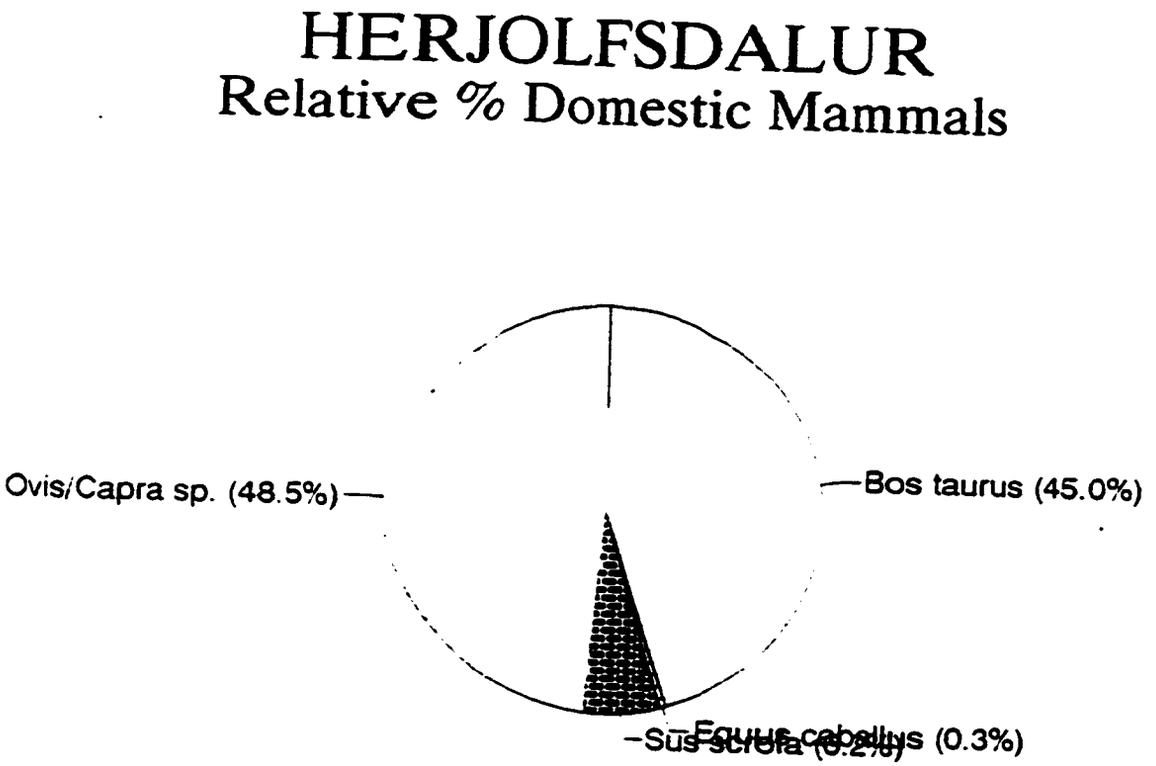

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Figure 5.7 - The relative percentage of the major mammalian groups from the Herjolfsdalur site.

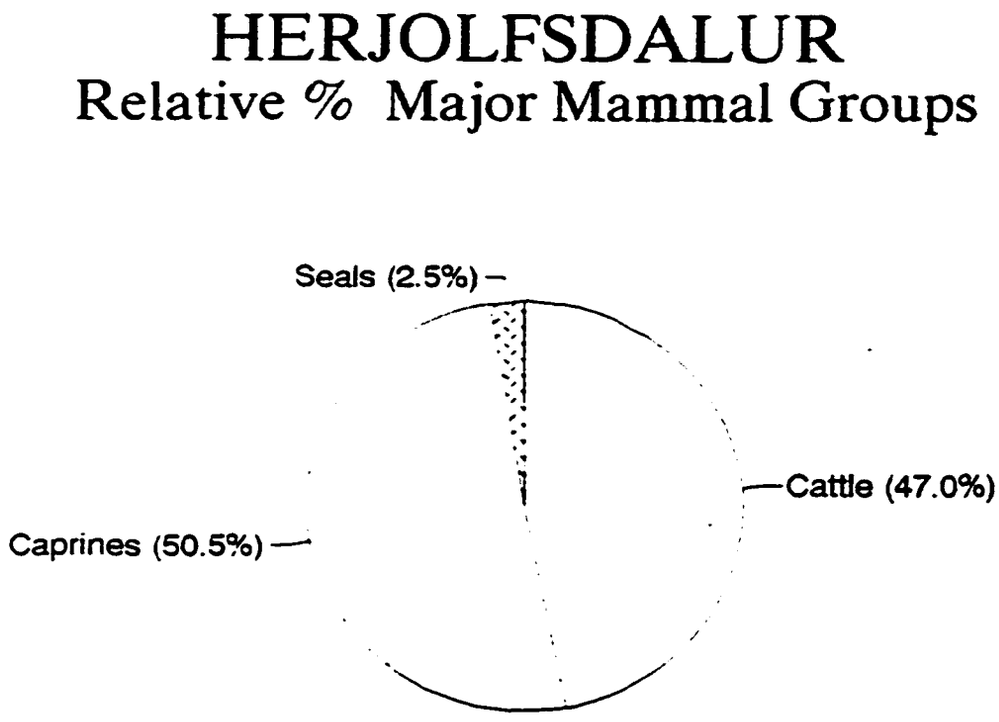

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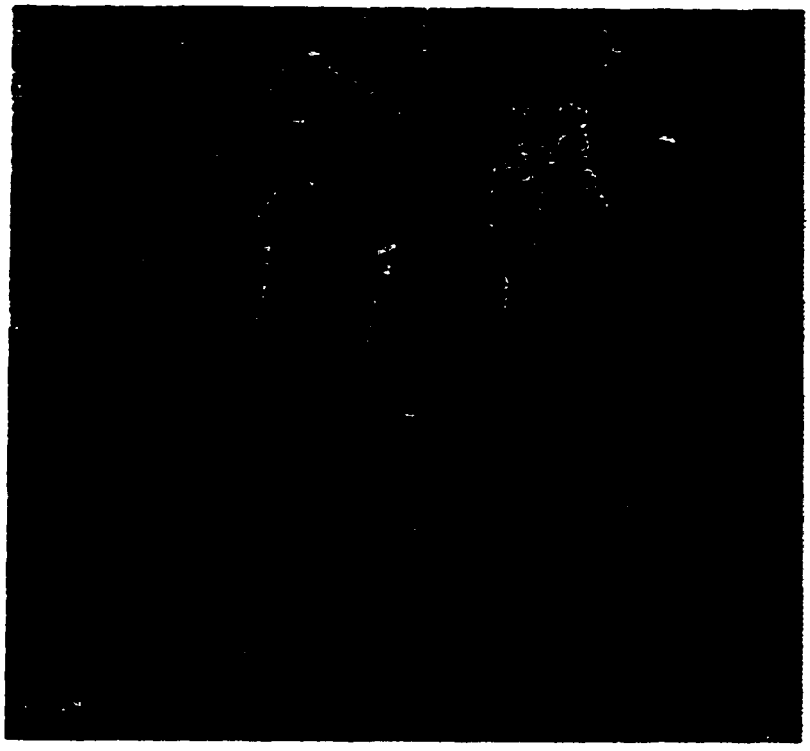
Figure 5.8 - The "fire-box" pit, lined with stone slabs, at the Tjarnargata 4 site located in downtown Reykjavik. The photo graph was taken in 1944 (photograph is from Grimsson and Einarsson 1969).



4. mynd. Steinþró (eldstó) grafin ofan í möl í grunninum að Tjarnargötu 4. Myndin tekin vorið 1944. — Pit made of slabs, observed in the ground gravel at Tjarnargata 4. Photo from 1944.

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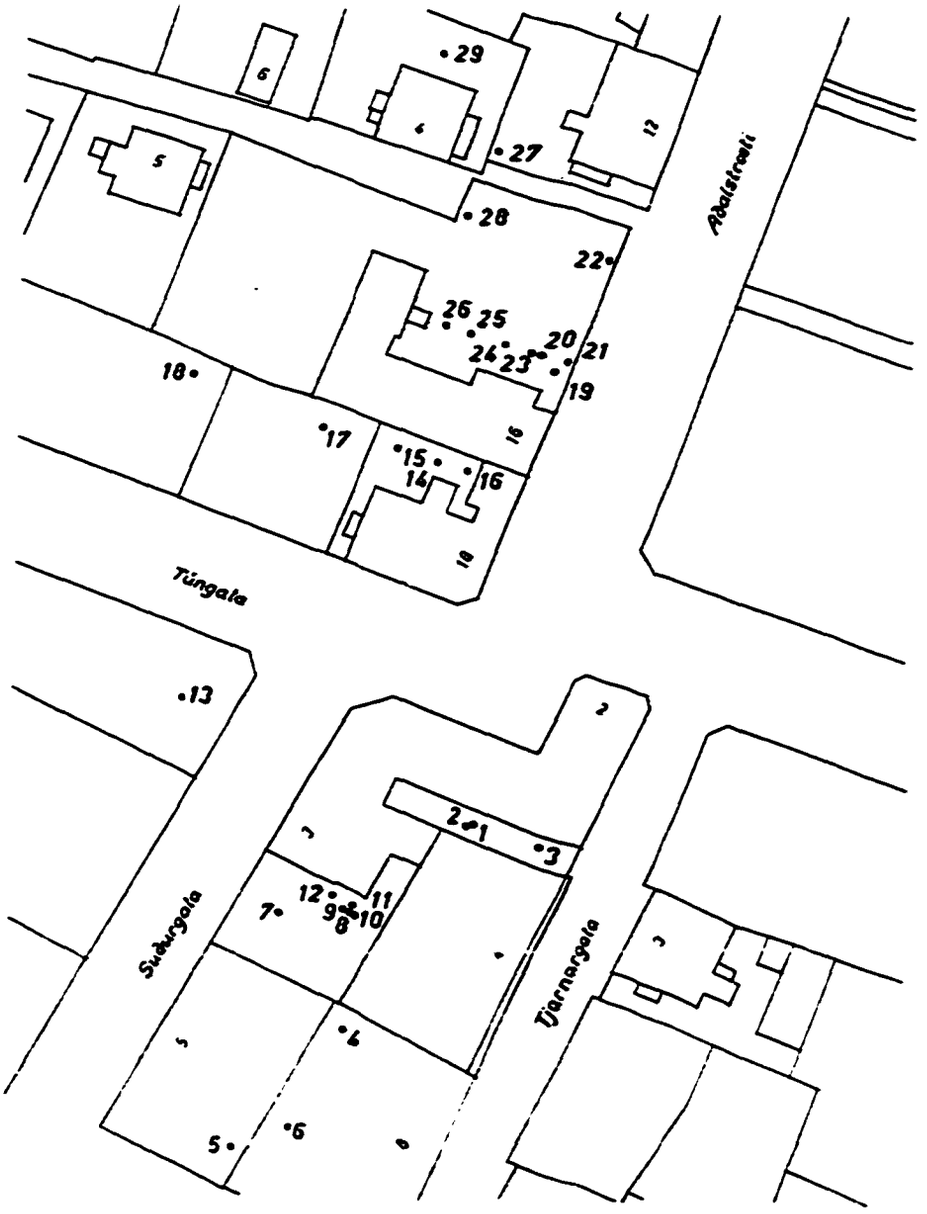
Figure 5.9 - The site location of the Tjarnargata 4 site in downtown Reykjavik. The 1960's coring are also illustrated on the site map (map is from Grimsson and Einarsson 1969).



2. mynd. Kort af svæðinu við sunnanvert Aðalstræti. Norður er upp. Inn á kortið eru settar könnunarholur frá 1962, merktar í númeraröð. — Map of reconnaissance area with drill holes and pits marked on it.

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Figure 5.10 - The large male pig mandible recovered from the 1944 excavations at the Tjarnargata 4 site (photograph is from Grimsson and Einarsson 1969).

1. mynd. Kjálki úr svíni með vígtönn, fundinn að Tjarnargötu 4 vorið 1944. Kjálkinn er 18,5 sm að lengd. — Lower jaw of pig, found at Tjarnargata 4, spring of 1944. Length 18.5 cm.

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Figure 5.11 - The relative percentage of the major taxa recovered from the Tjarnargata 4 site located in downtown Reykjavik. The table is based upon Magnus Degerbol's 1954 analysis of this assemblage.

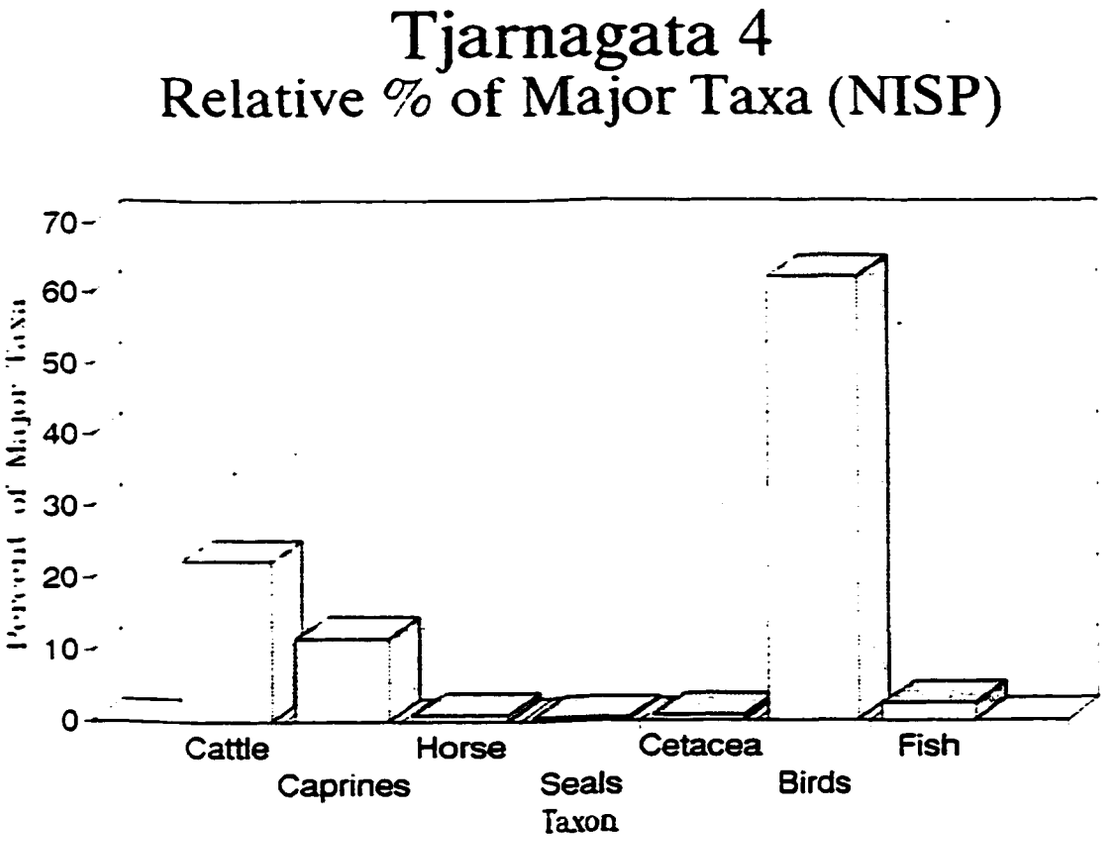

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Figure 5.12 - The relative percentage of the major taxa recovered from the Tjarnargata 4 site. This chart is based upon the author's analysis of this assemblage.

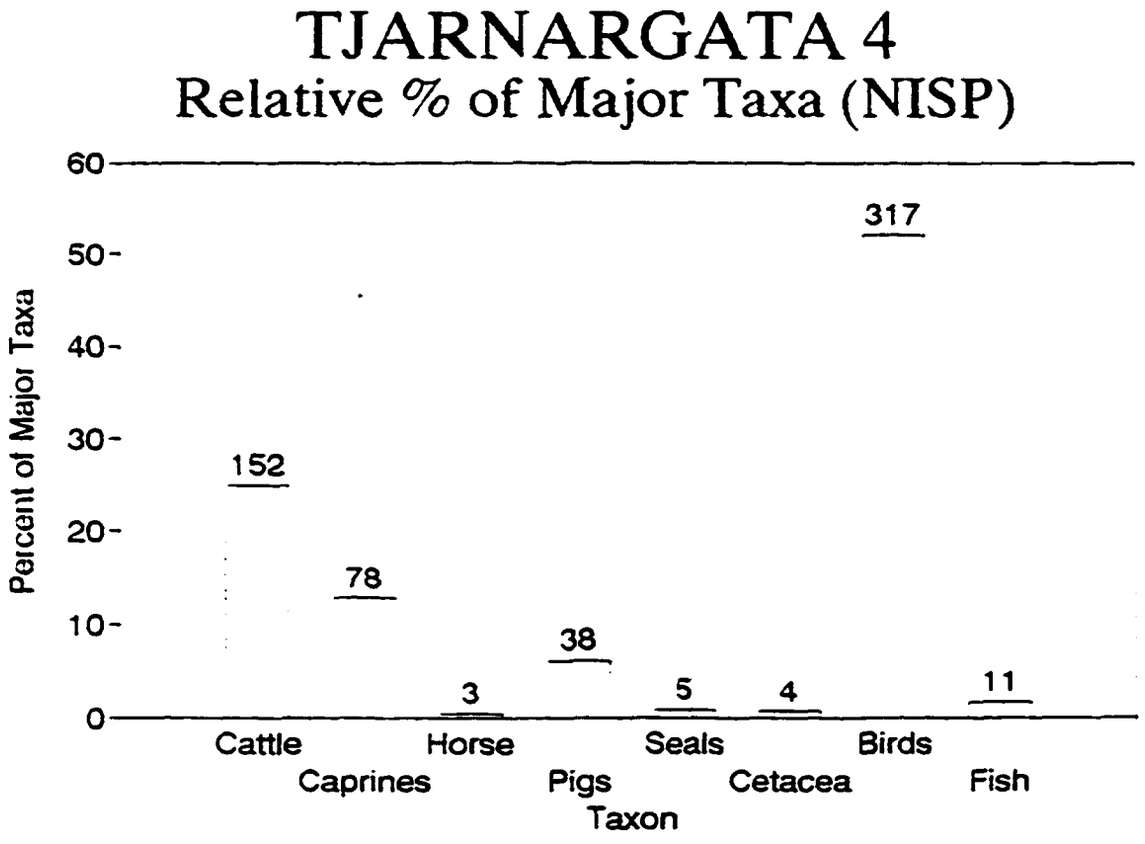

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Figure 5.13 - The relative percentage of the domestic mammals recovered from the Tjarnargata 4 site.

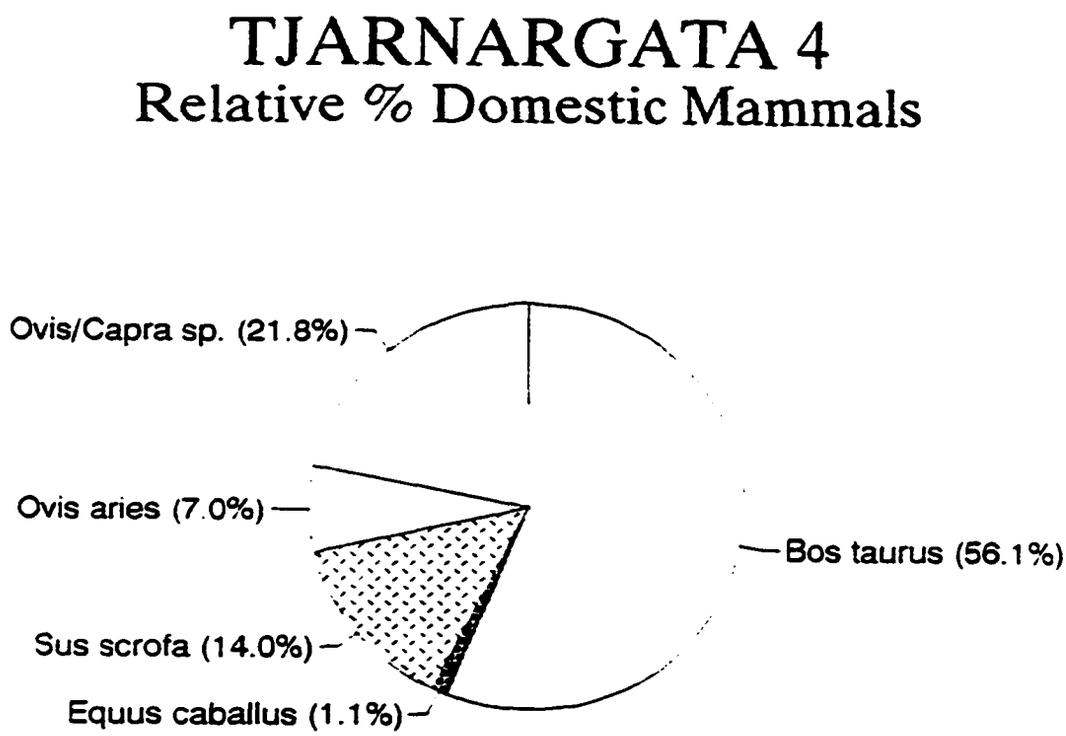

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Figure 5.14 - The relative percentage of the avian component of the Tjarnargata 4 assemblage.

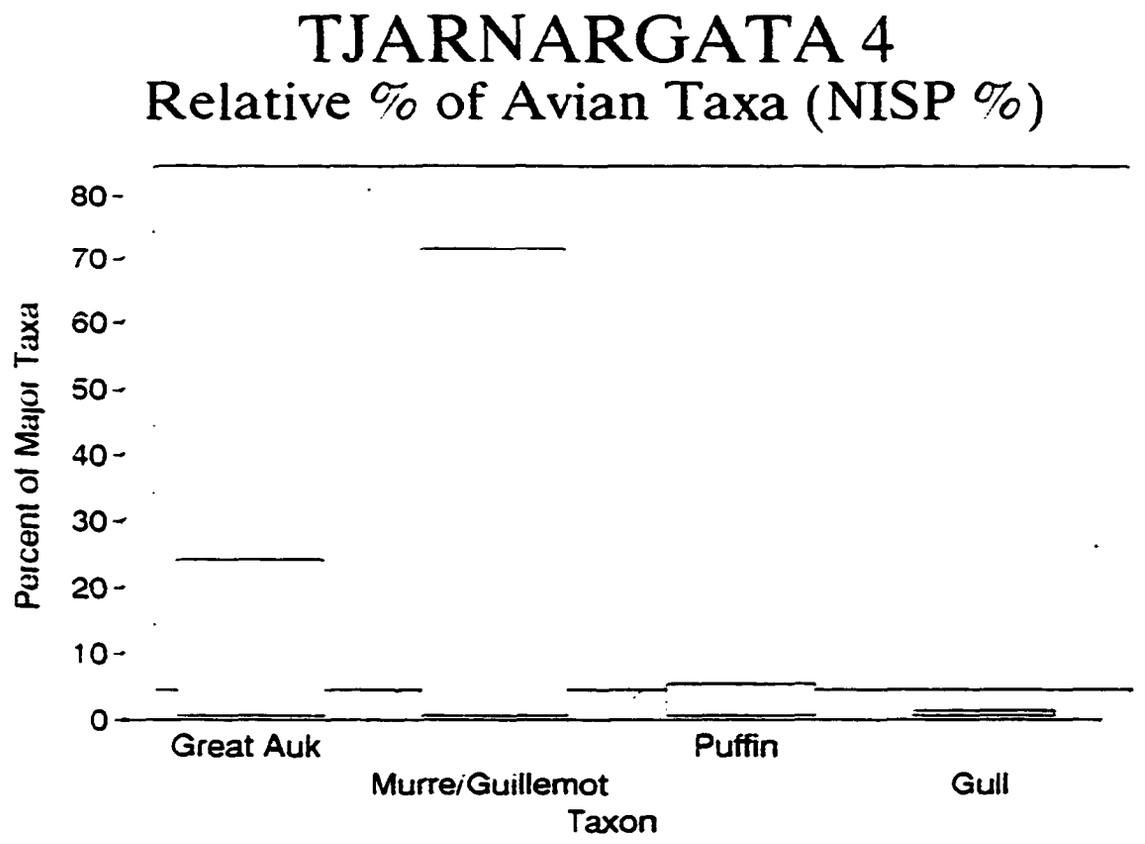

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Figure 5.15 - The map illustrates the known North Atlantic range of the great auk (*Pinguinus impennis*). The detail shows the location of the known Icelandic breeding colonies, Eldey, Eldeyjardrangar, Geirfuglasker and Geirfugladrangar (map is from Bardson 1986).

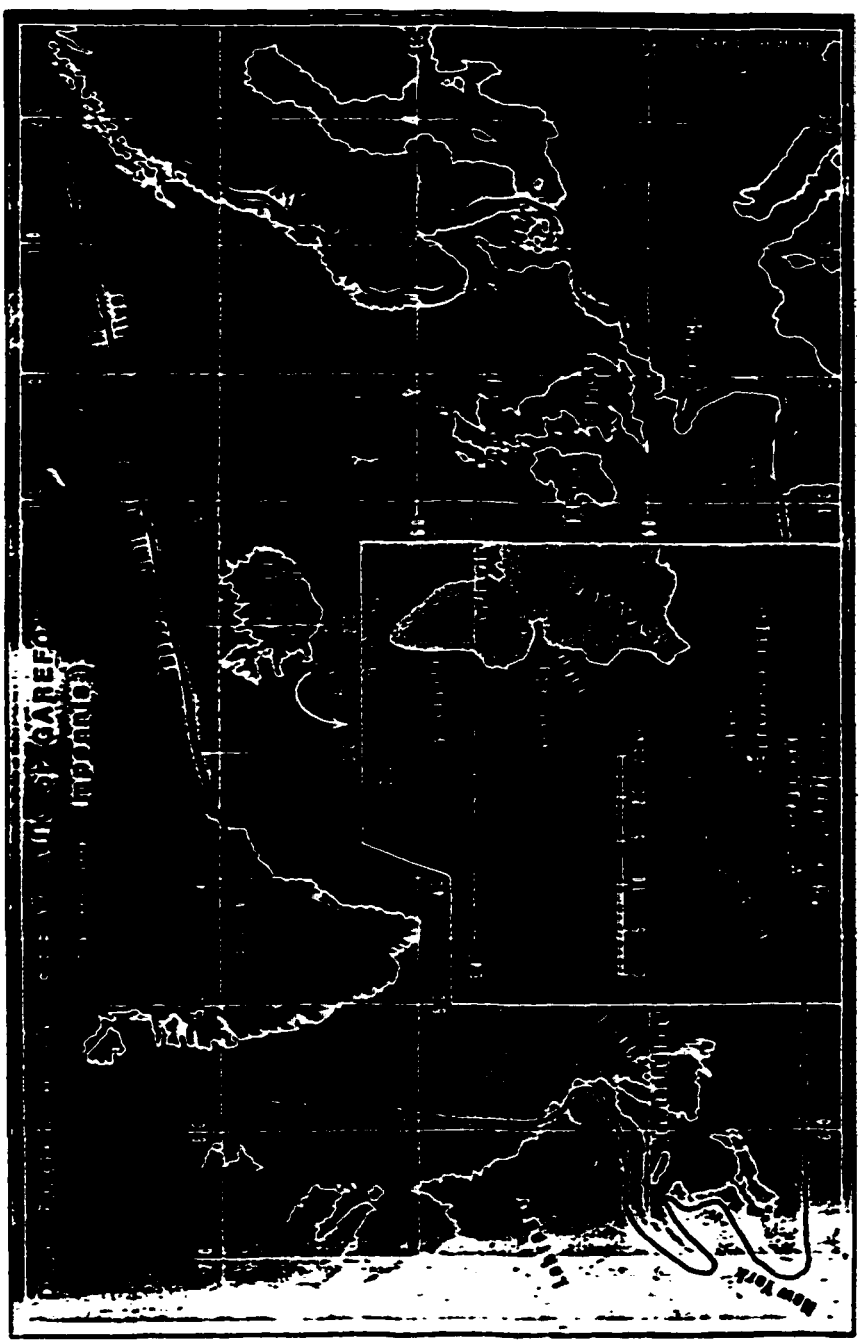

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Figure 5.16 - The skeletal element frequency of the great auk remains recovered from the Tjarnargata 4 site.

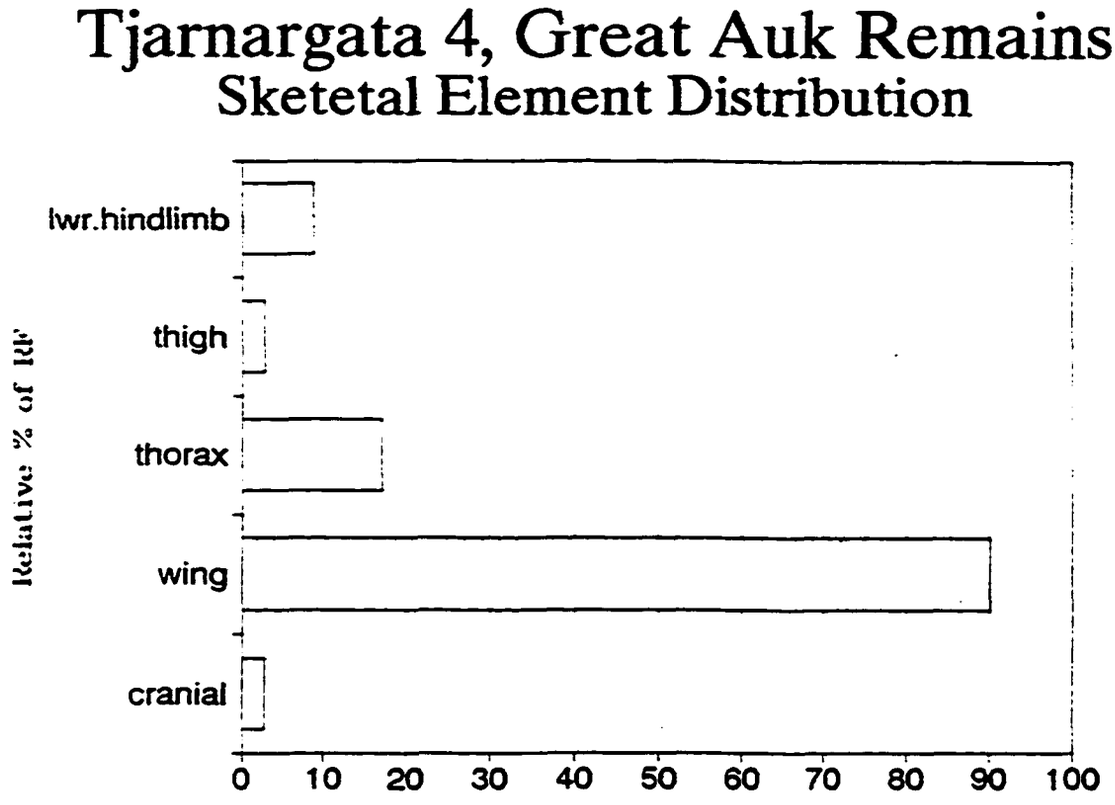

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Figure 5.17 -The skeletal element frequency of the atlantic puffin (*Fratercula arctica*) from the Tjarnargata 4 site.

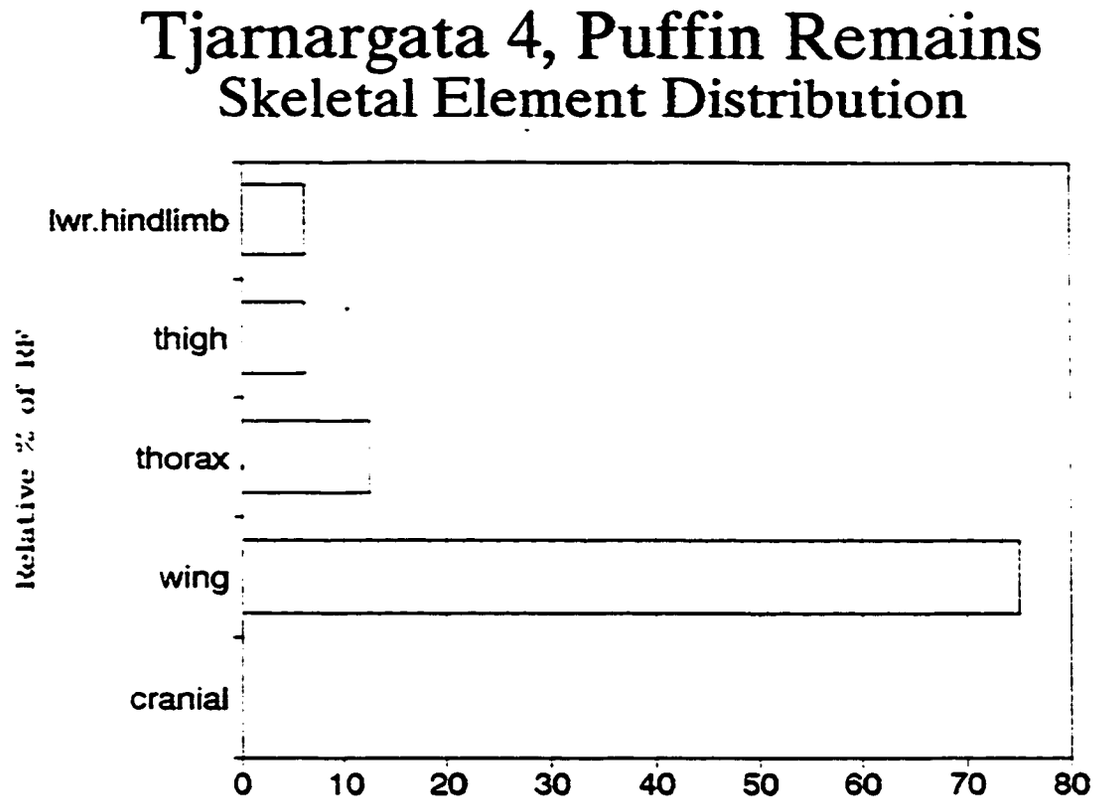

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Figure 5.18 - The skeletal element frequency of the murre species (*Uria sp.*) from the Tjarnargata 4 site.

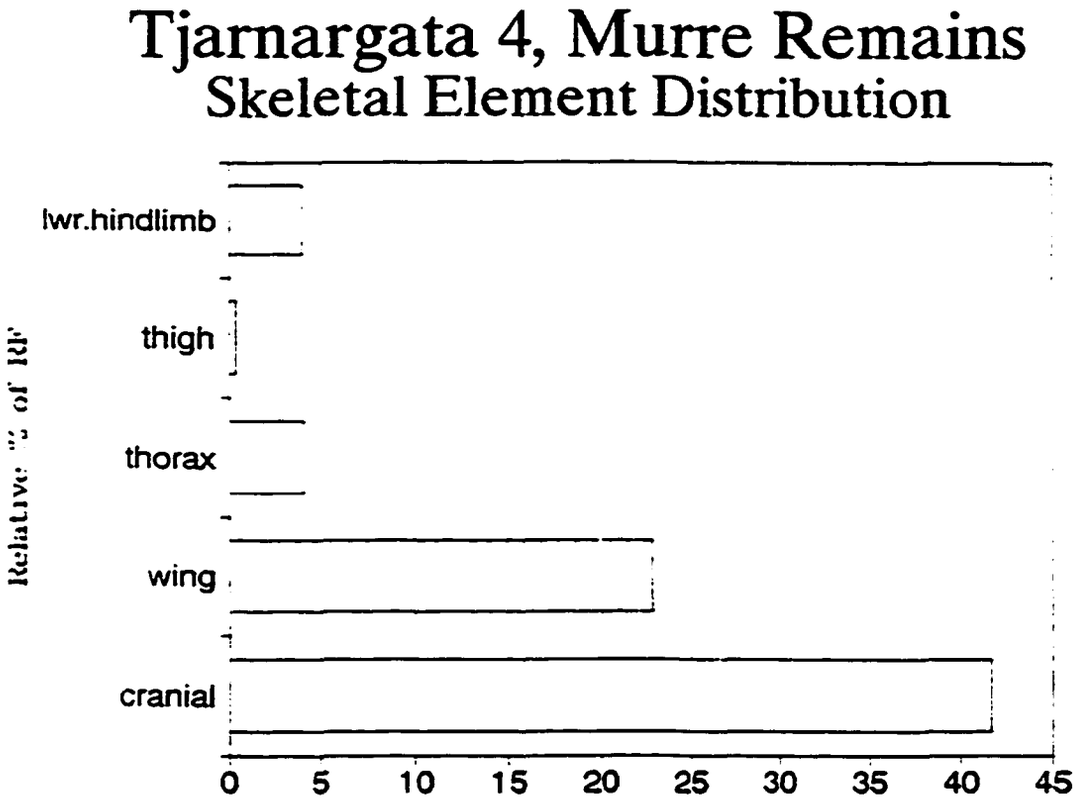

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Figure 5.19 - Comparison of the great auk humeri from Funk Island and the Tjarnargata 4 site. The measurement being compared is the greatest length of the humerus.

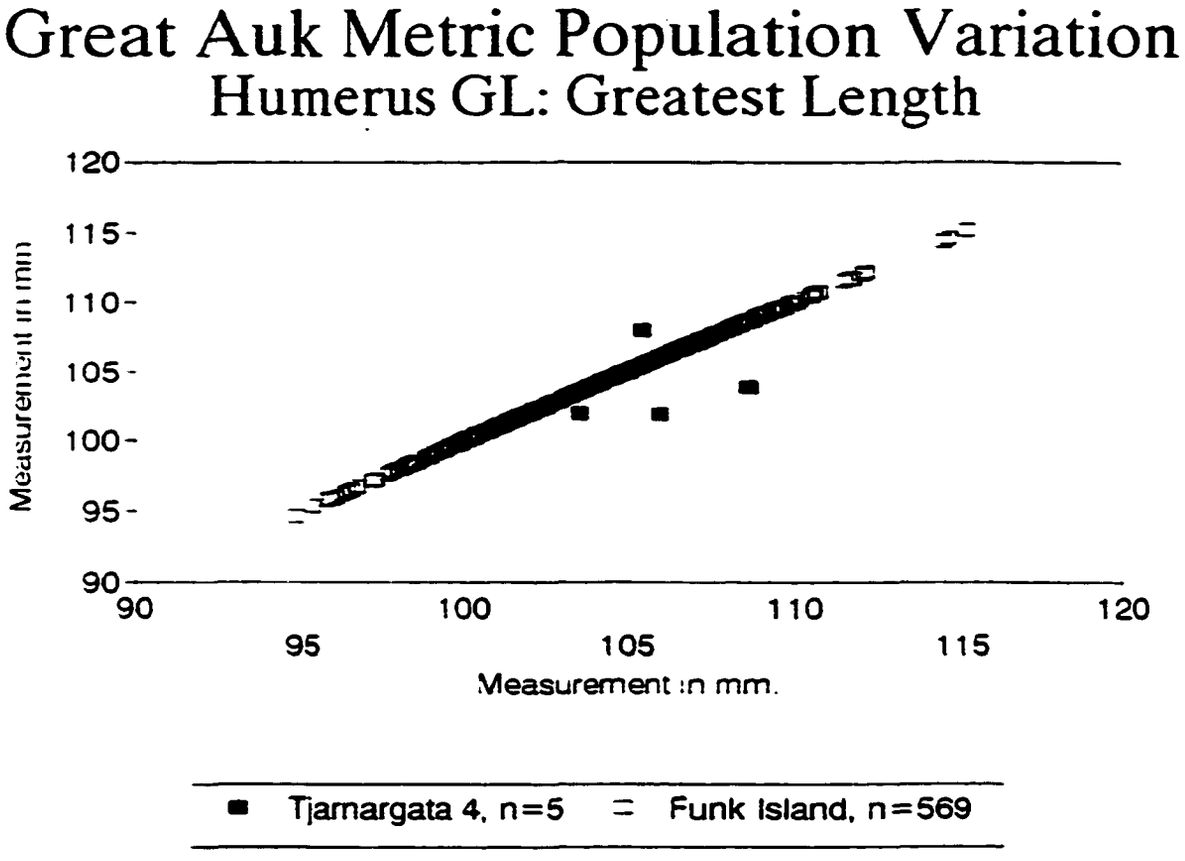

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Figure 5.20 - Composite bone combs recovered from the western erosion face at the Hjallholl site in Bogarfjord-esystri, Nordur-Mulasysla.

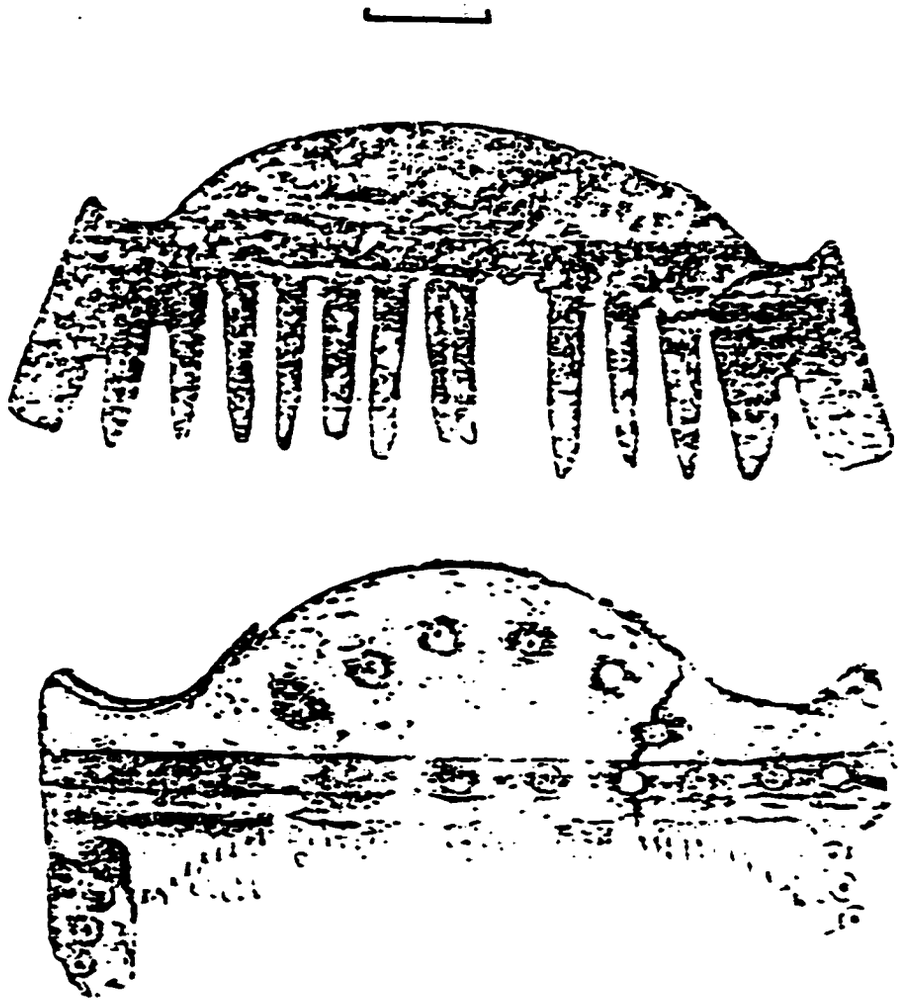

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Figure 5.21 - The site location of the Hjallholl site in the town of Bakkagerdi, Bogarfjord-eystri, Nordur-Mulasysla.

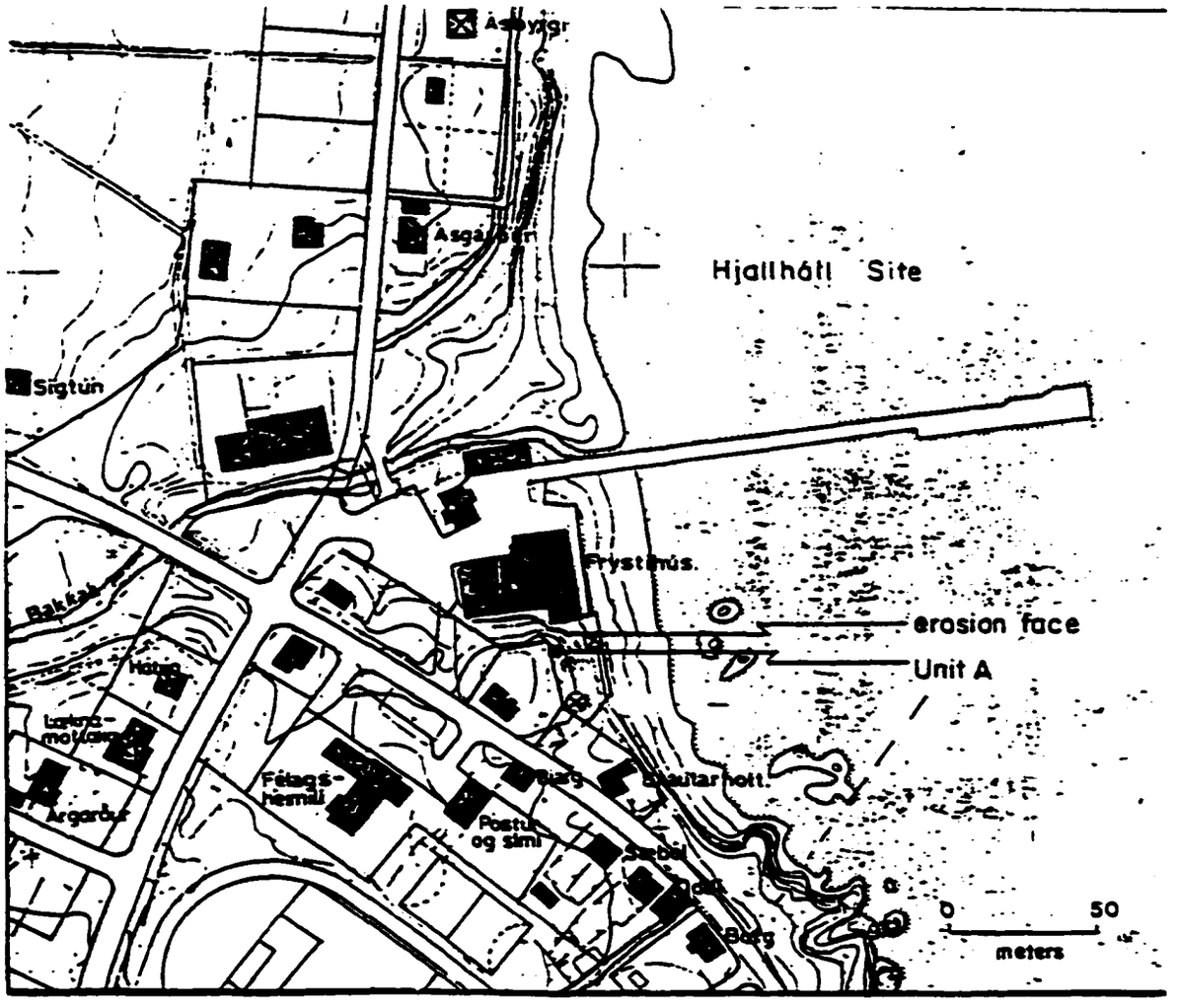

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Figure 5.22 - The profile of the western erosion face at the Hjallholl site.

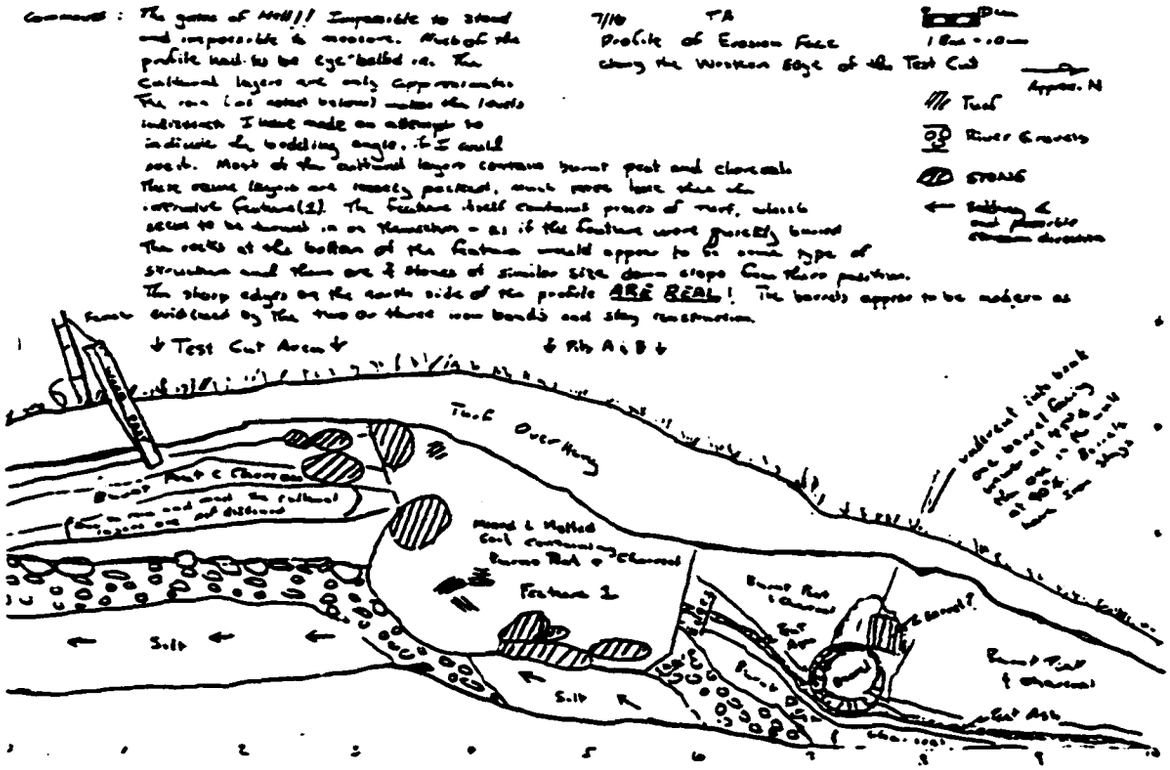

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Figure 5.23 - The site plan for the Hjallholl site showing the locations of the corings, Test Cut #1 and of the western erosion face.

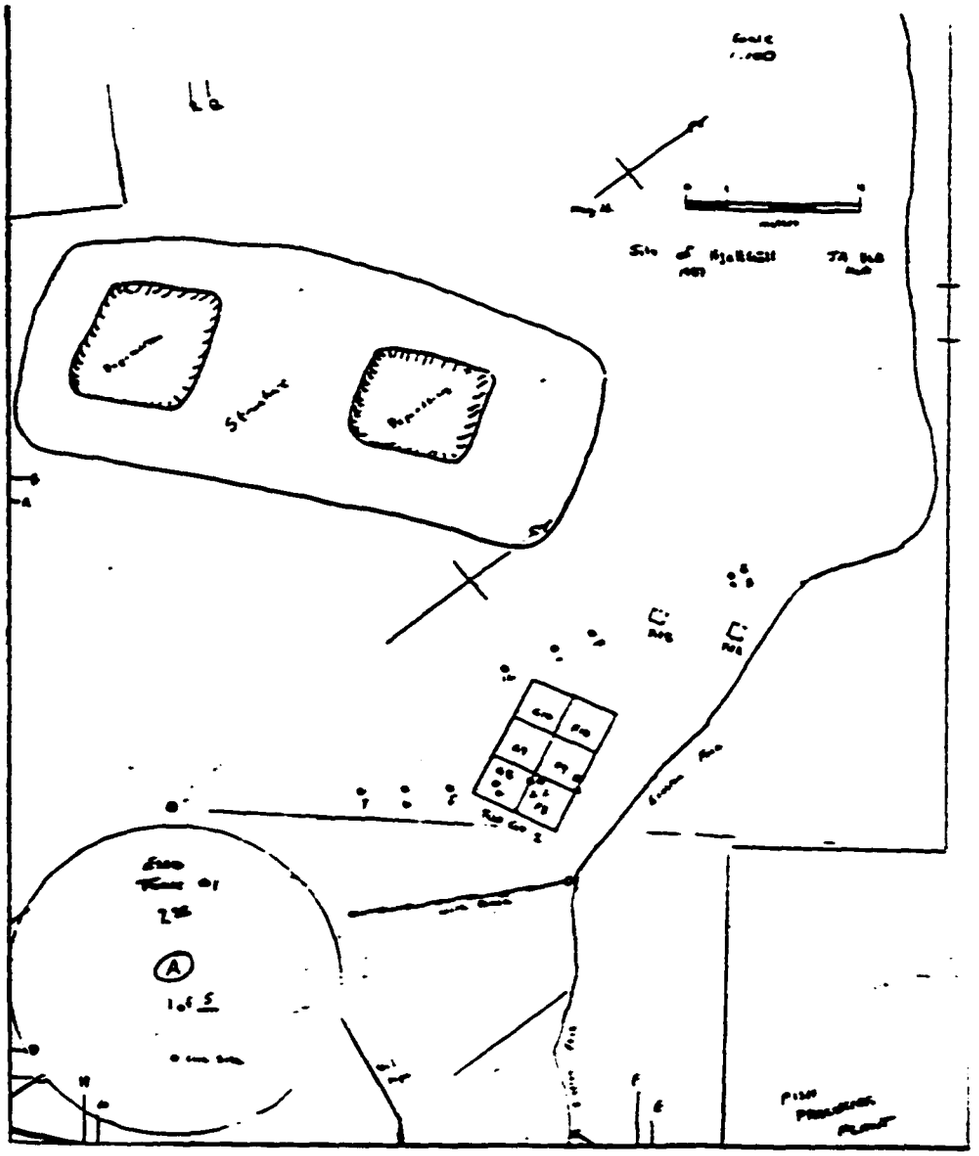

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Figure 5.24 - The profile of the southern wall of Test Cut #1 at the Hjallholl site.

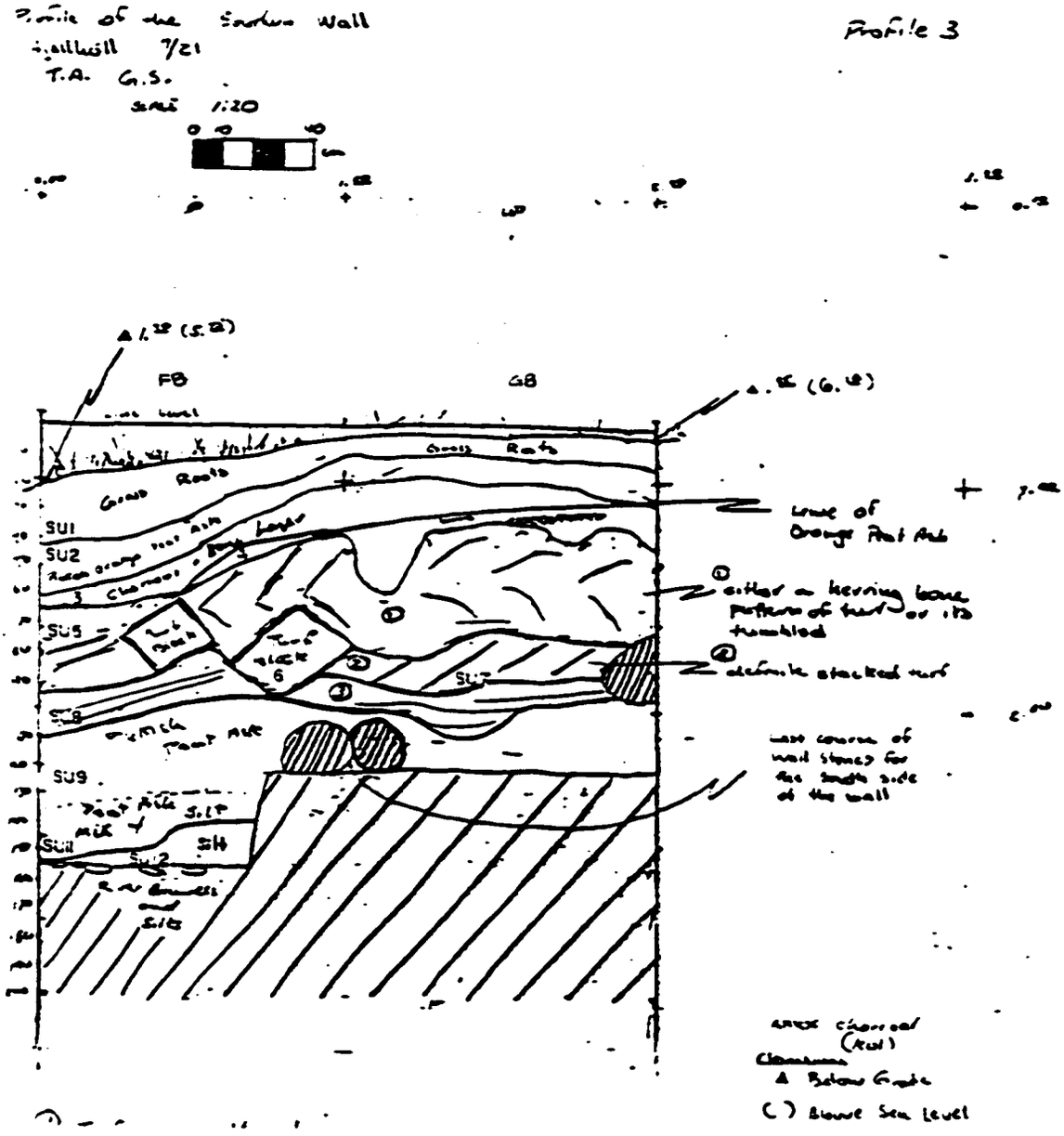

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Figure 5.25 - Plan view of Test Cut #1 at the Hjallholl site, showing Stratigraphic Unit (SU) 1, Analytic Unit (AU) 1. The "X" symbol indicates charcoal, the ">" symbol indicates burnt peat ash and the irregular hatch-marked objects indicate structural stones.

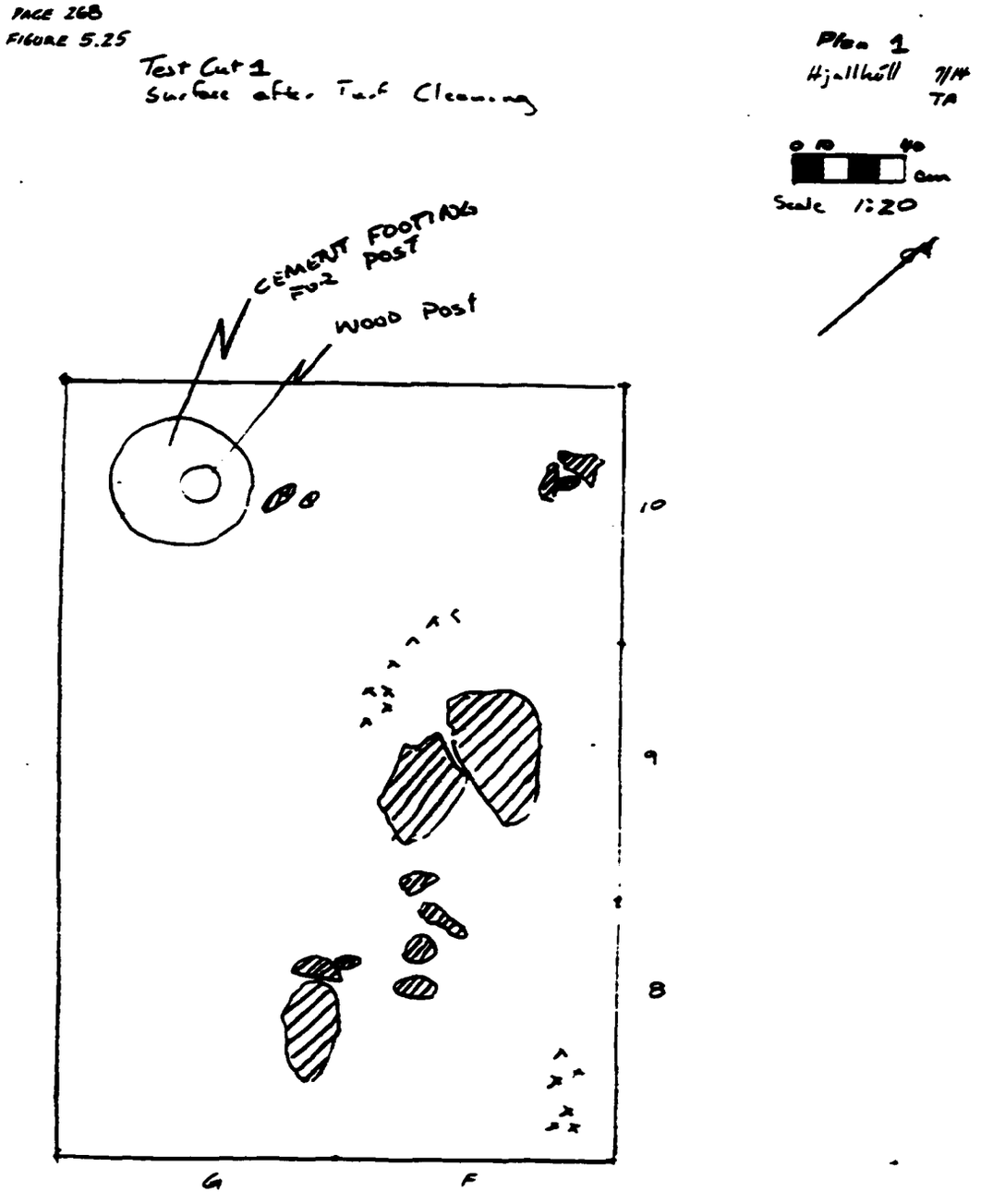

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Figure 5.26 - Plan view of Test Cut #1 at the Hajllholl site showing SU 1-2, AU 1. The large "X" with a superscript number indicates an artifact position.

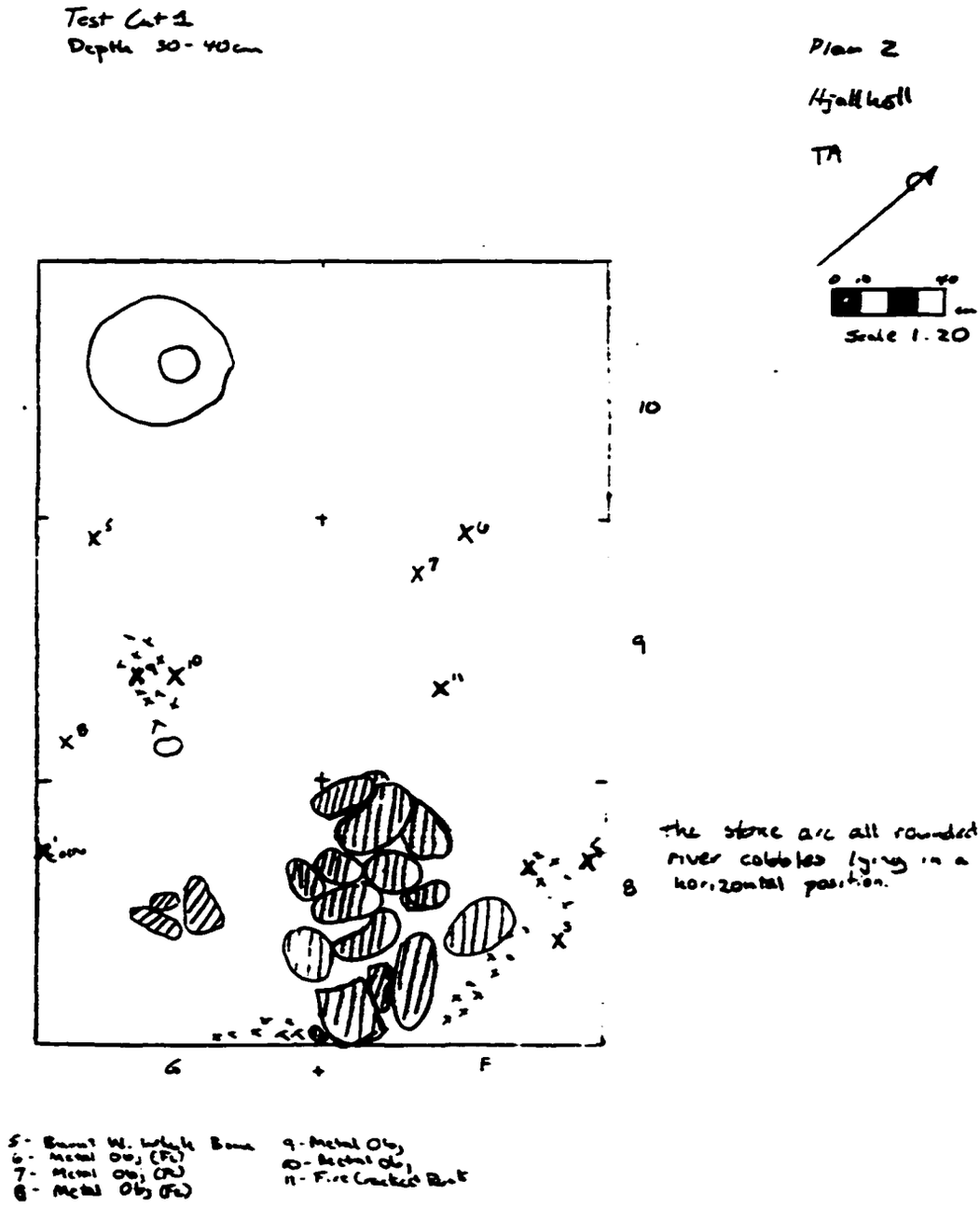

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Figure 5.27 - Plan view of Test Cut #1 at the Hjallholl site showing SU 2, AU 1.

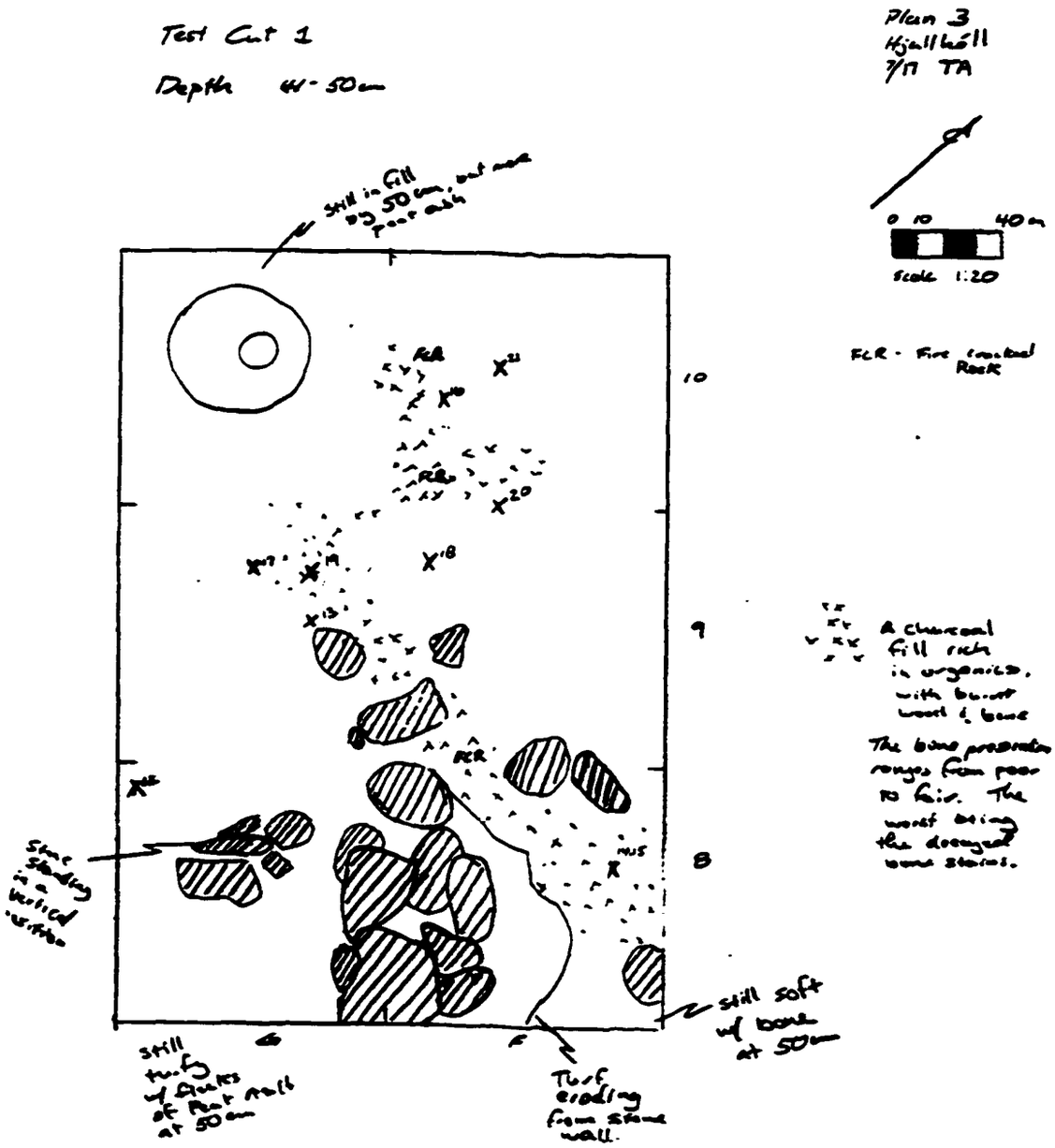

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Figure 5.28 - Plan view of Test Cut # 1 at the Hjallholl site showing SU 2-3, AU 1.

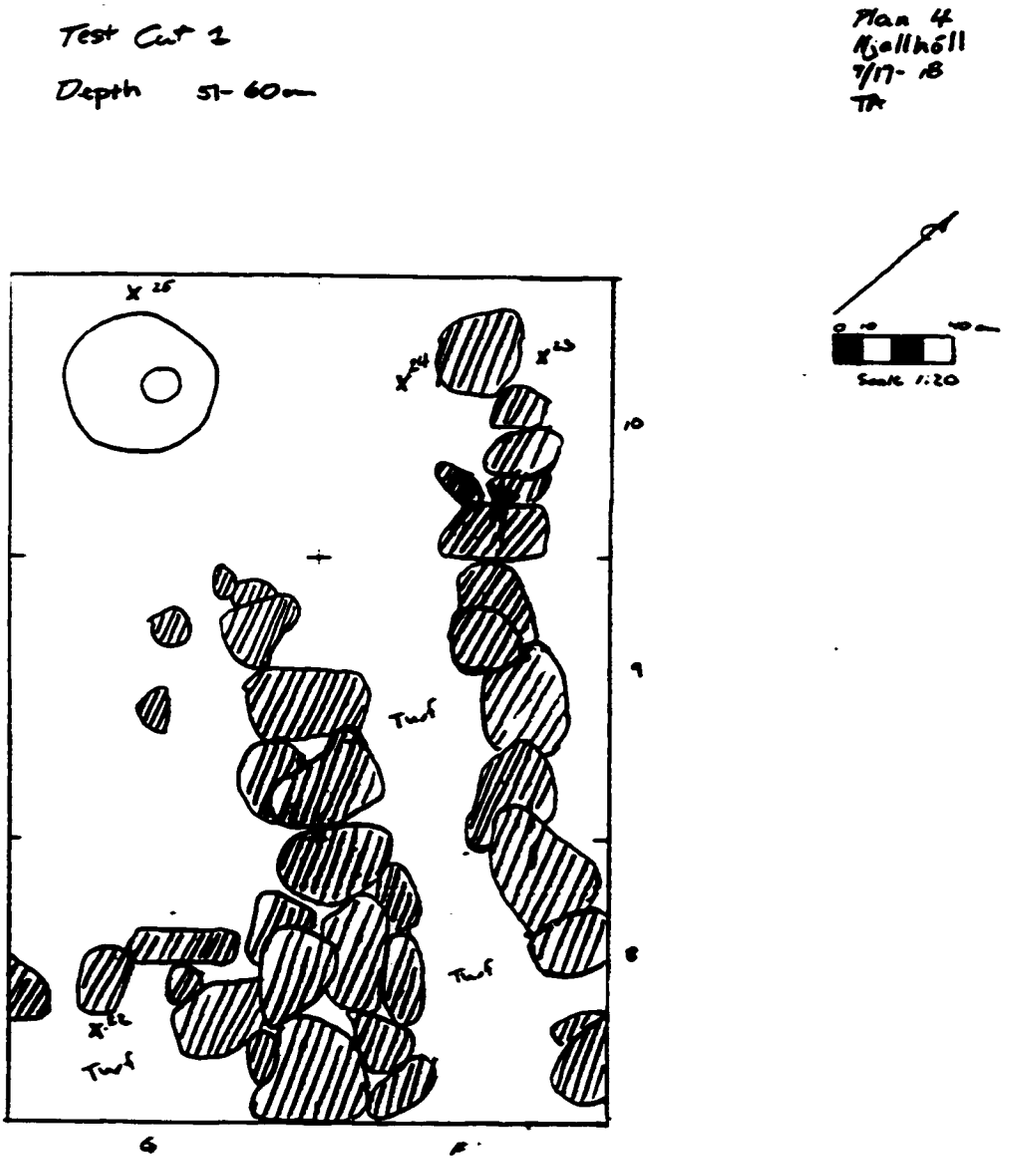

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Figure 5.29 - Plan view of Test Cut #1 at the Hjallholl site showing SU 3-5, AU 1-2. The net or line sinker is located near the grid co-ordinate G8 on the left (south) side of the test cut.

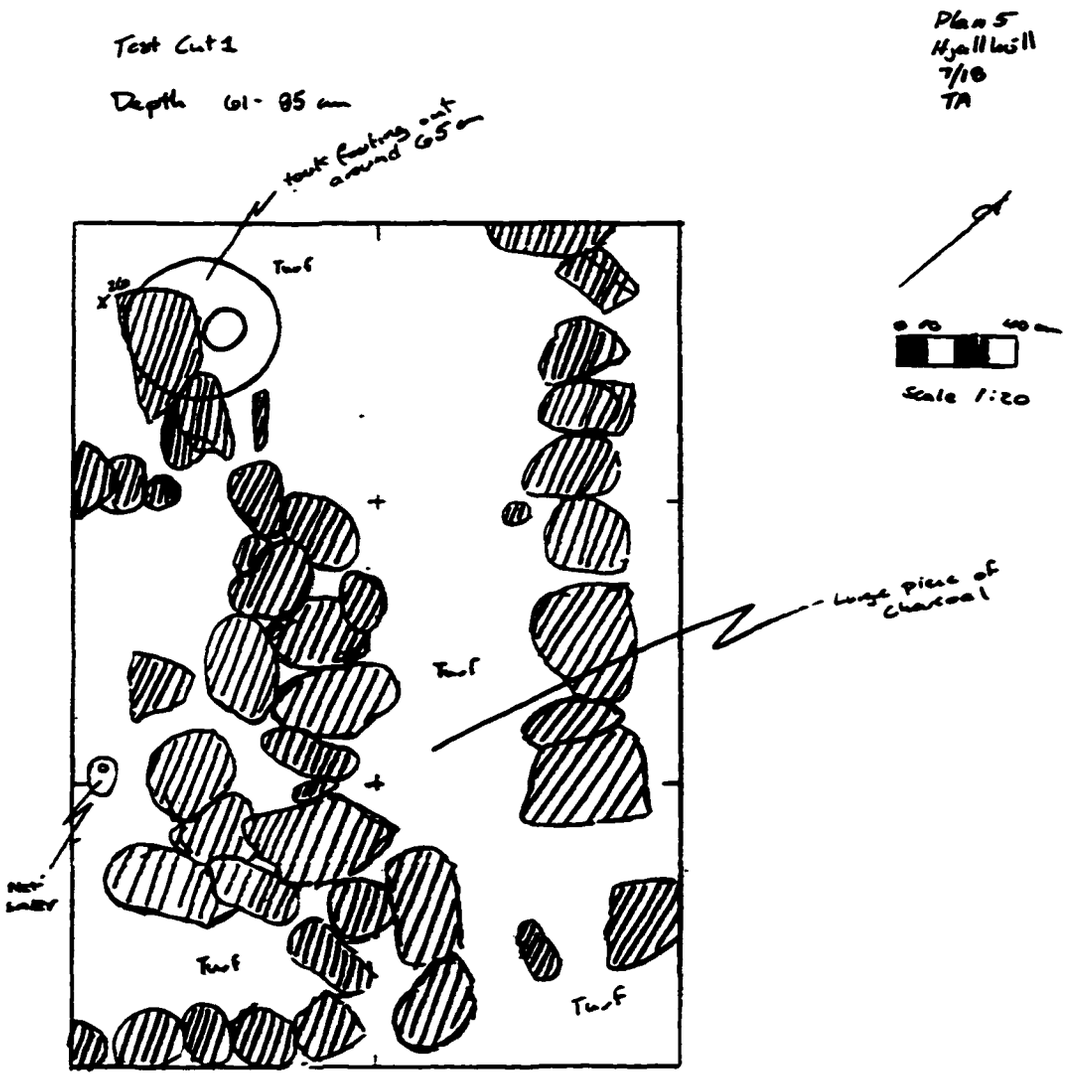

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Figure 5.30 - Plan view of Test Cut # 1 at the Hjallholl site showing SU 6-8, AU 2.

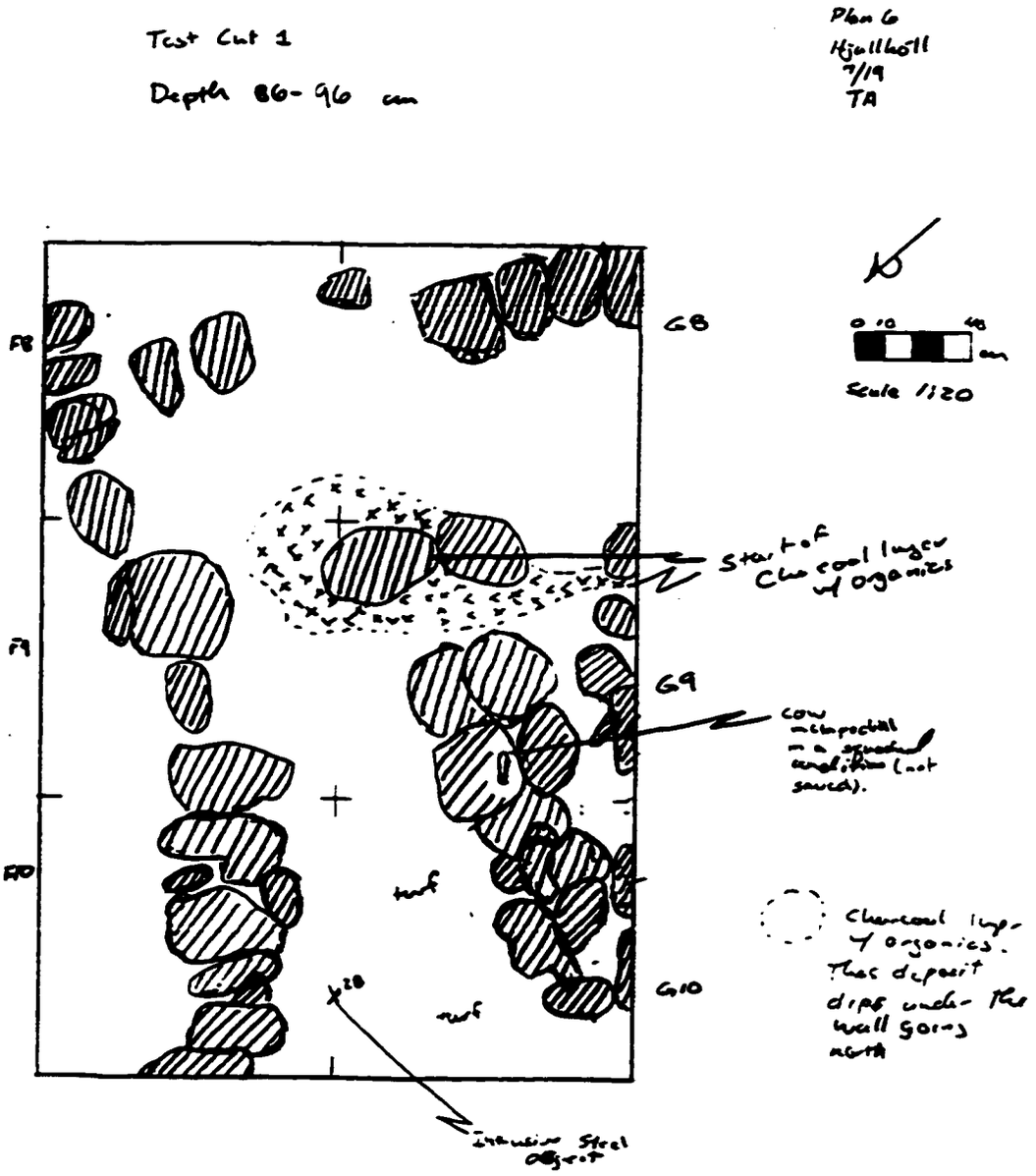

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Figure 5.31 - Plan view of Test Cut # 1 at the Hjallholl site showing SU 8-10, AU 2-3.

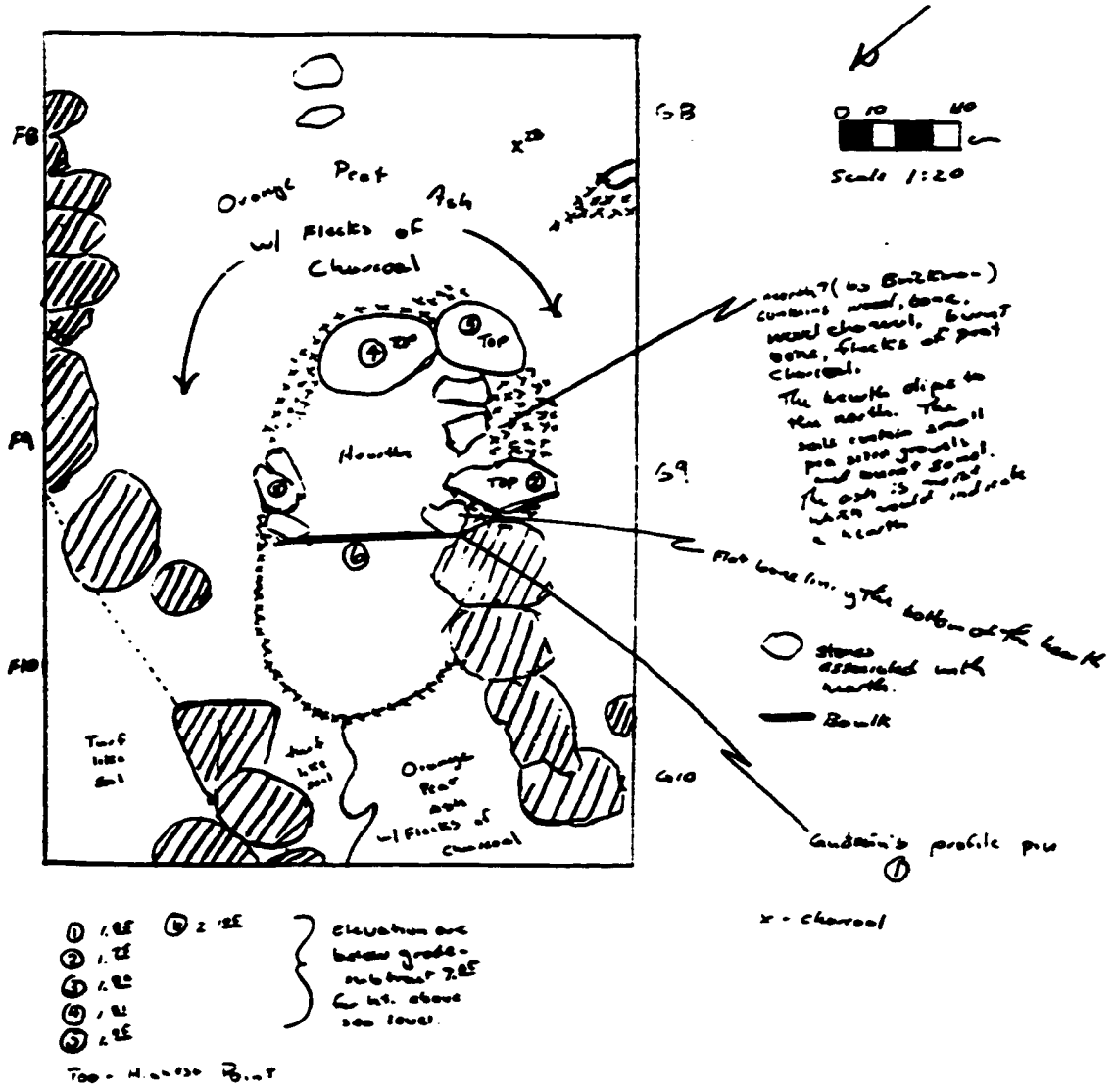

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Figure 5.32 - Plan view of Test Cut # 1 at the Hjallholl site showing SU 9-10, AU 3.

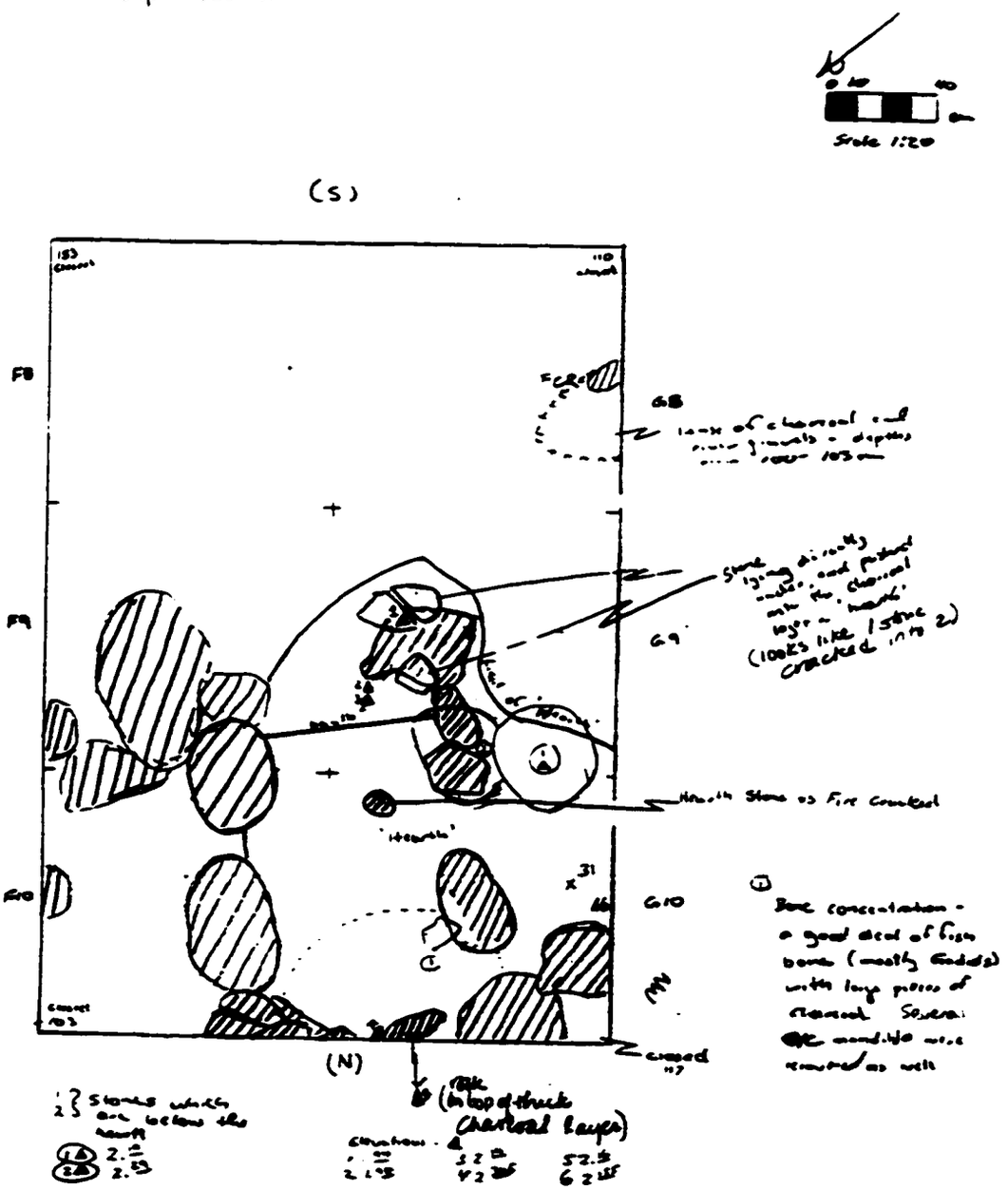

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Figure 5.33 - Site plan of the Hofstadir site located in the Myvatnssveit, Surdur-Thingeysysla. The "long fire" hearth is the central feature hatch-marked feature (illustration is from Bruun and Jonsson 1909).

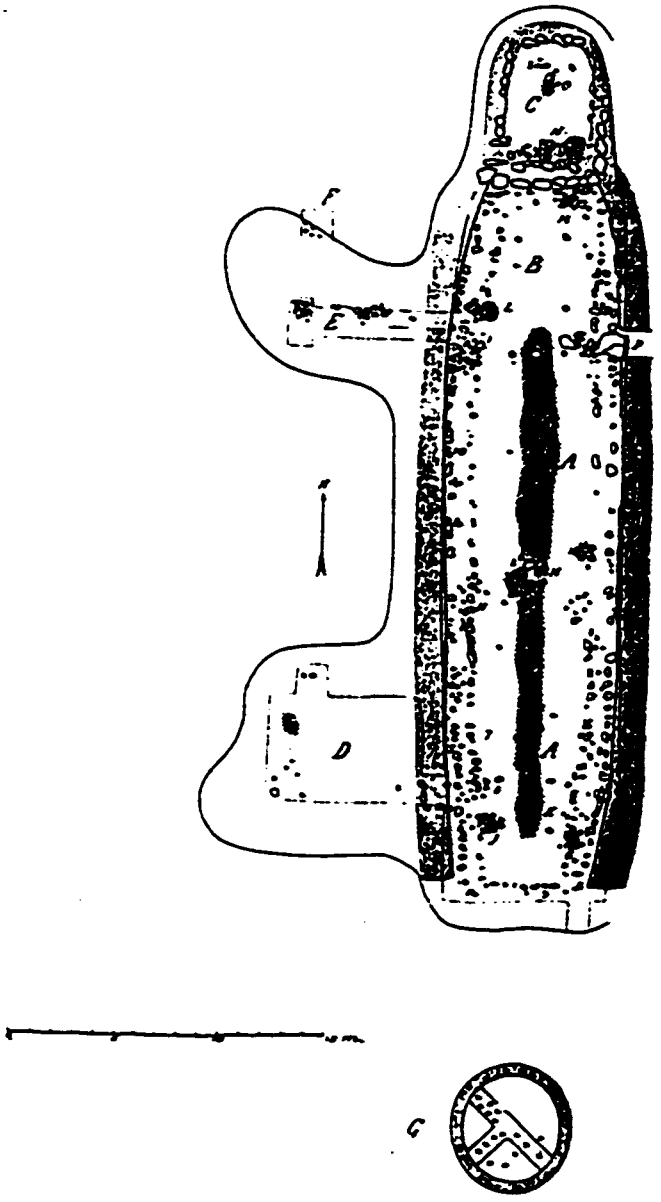

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Figure 5.34 - Pace and compass site plan of the turf ruins at Bakki, Bogarfjord-eystri, Bogarfjardarhreppur, Nordur-Mulasysla.

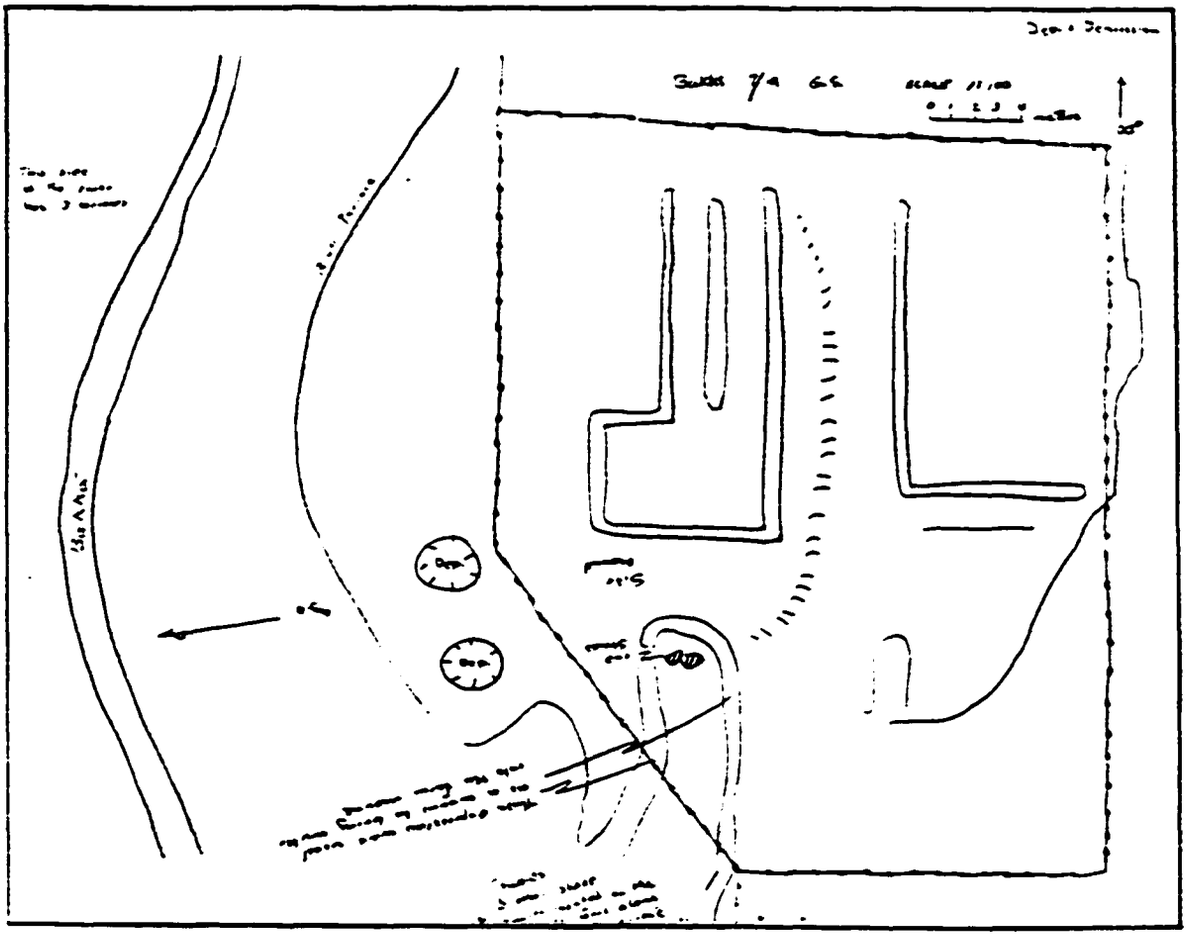

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Figure 5.35 - Pace and compass site plan of the turf ruins at Os, Bogarfjord-eystri, Bogarfjardarhreppur, Nordur-Mulasysla.

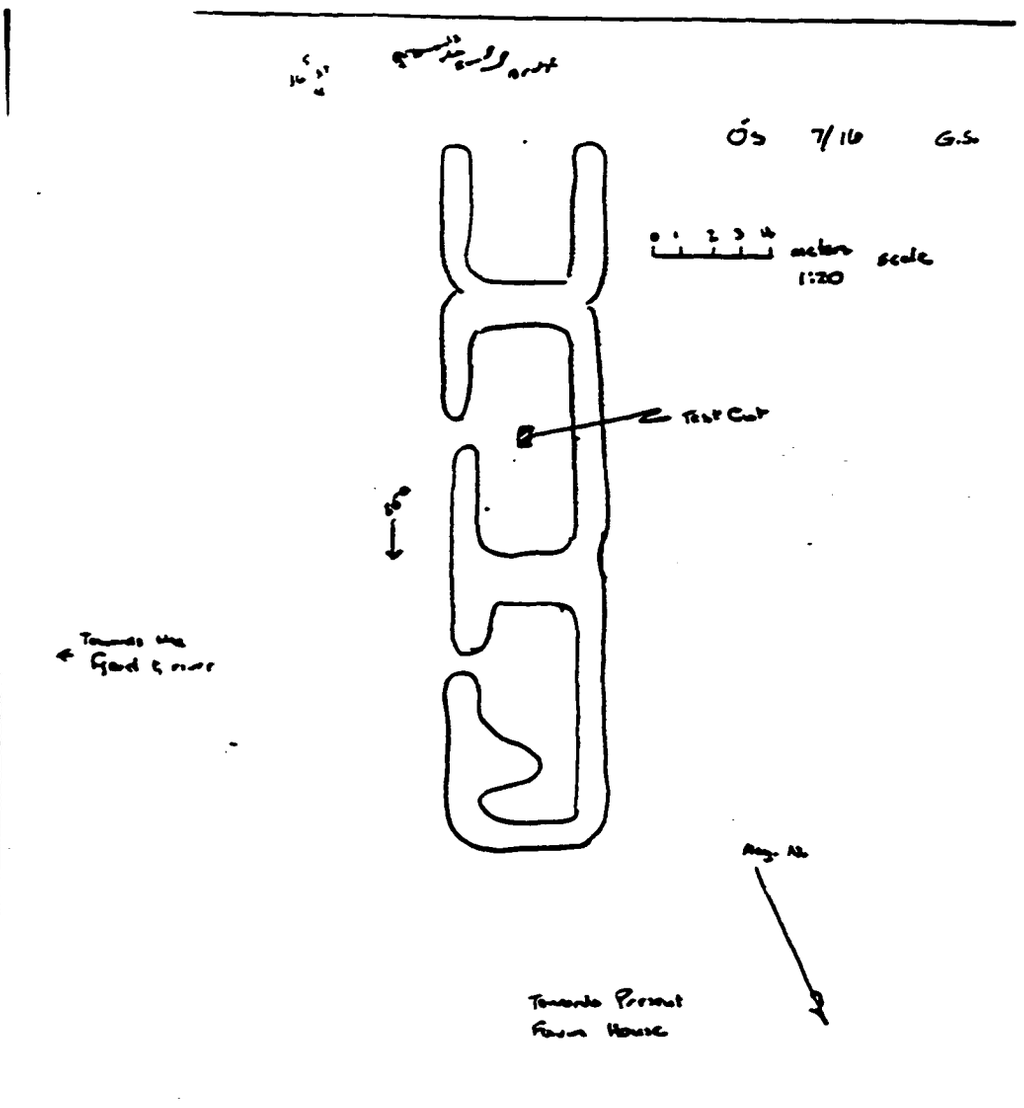

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Figure 5.36 - The relative percentage of the major taxa recovered from Test Cut # 1 at the Hjallholl site.

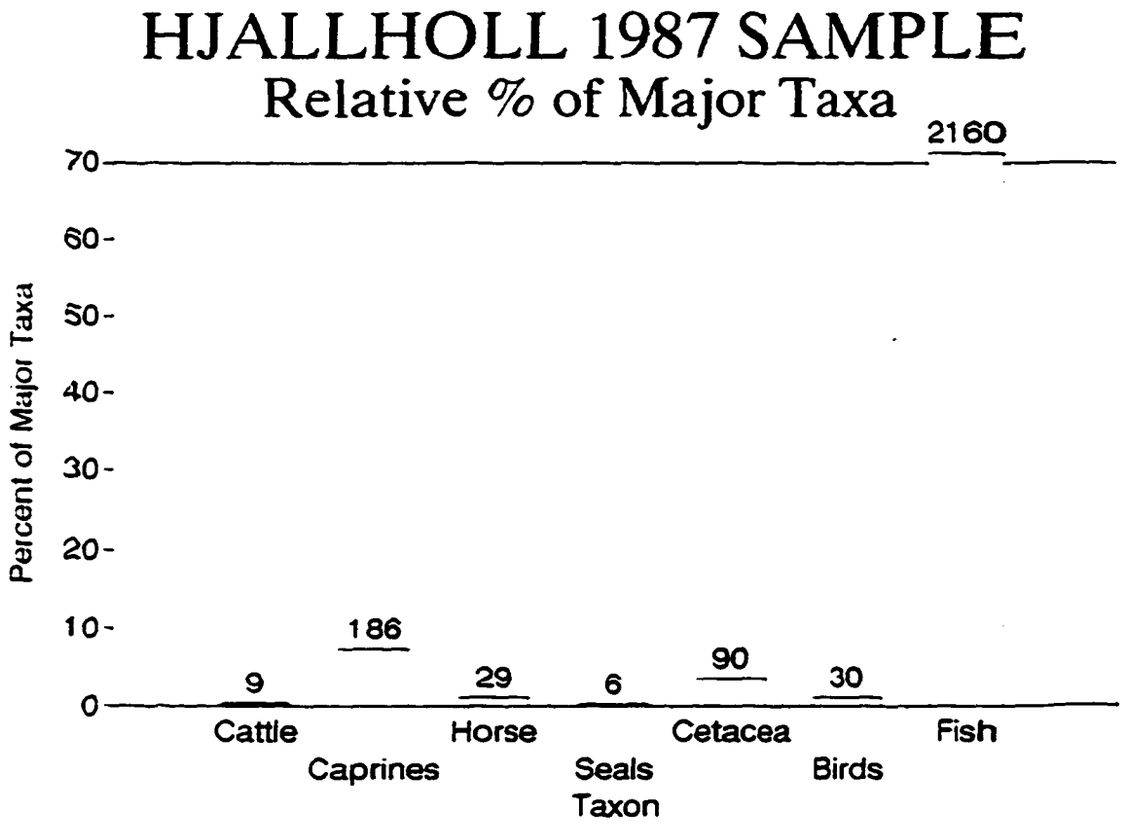

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Figure 5.37 - The relative percentage of the domestic mammals recovered from Test Cut # 1 at the Hjallholl site.

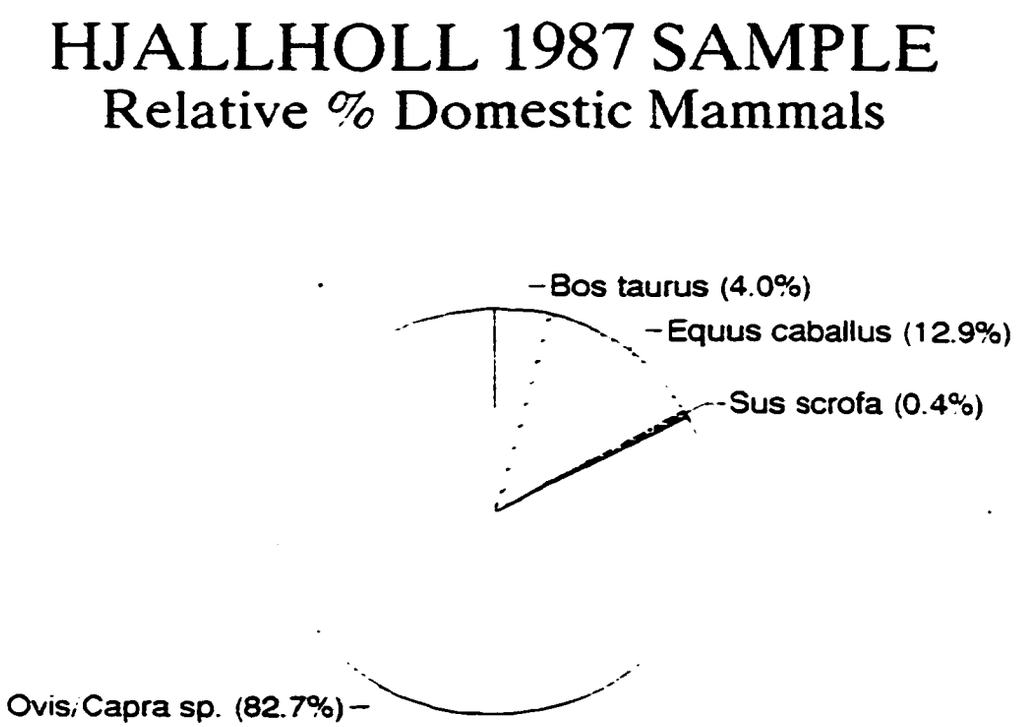

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Figure 5.38 - The relative percentage of the mammals recovered from Test Cut #1 at the Hjallholl site.

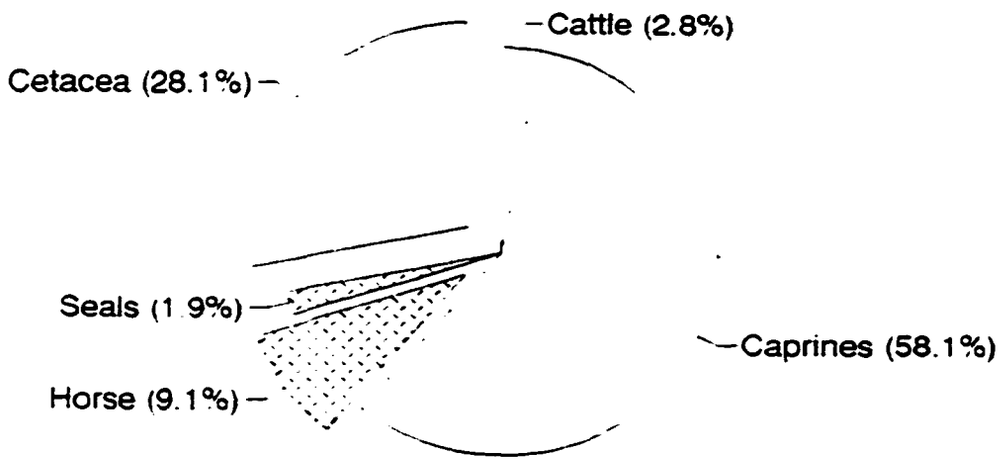

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Figure 5.39 - The relative percentage of the major taxa recovered from Test Cut #1, AU 1, tentatively dated between AD. 1100-1400, at the Hjallholl site.

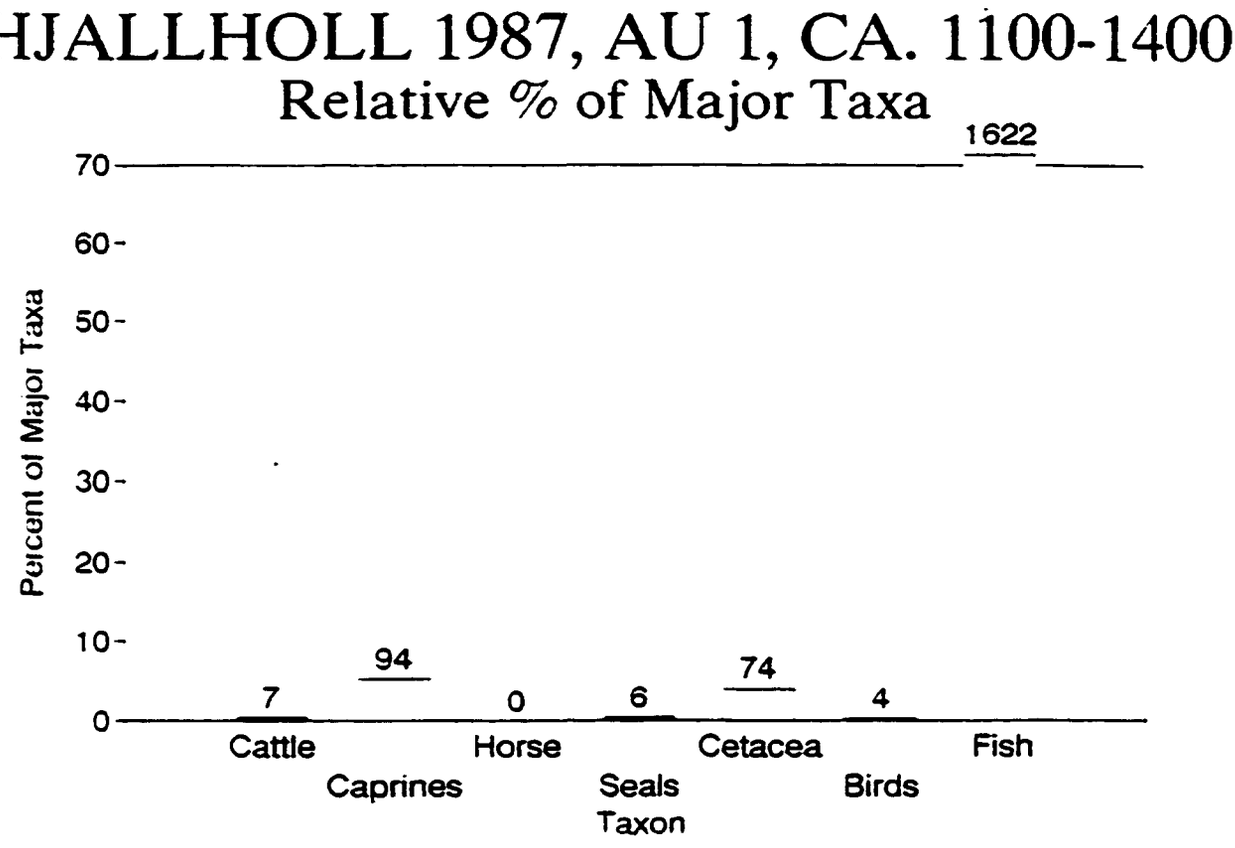

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Figure 5.40 - The relative percentage of the domestic mammals from Test Cut # 1, AU 1, tentatively dated between AD. 1100-1400, at the Hjallholl site.

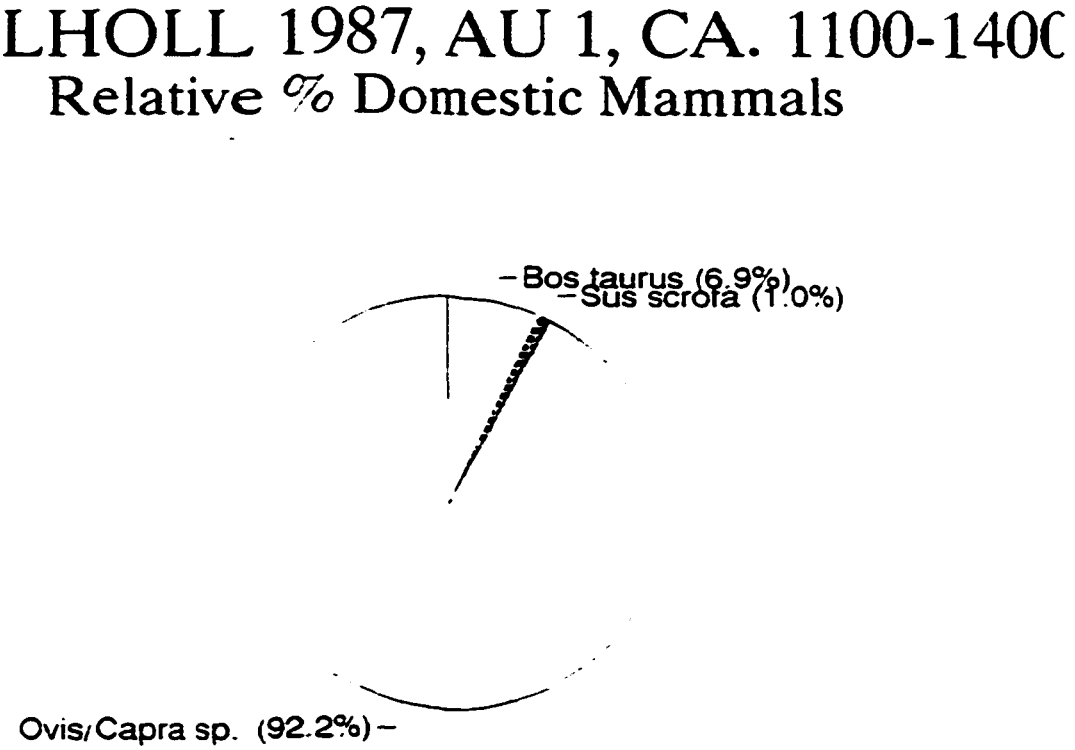

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Figure 5.41 - The relative percentage of mammals recovered from Test Cut # 1, AU 1, tentatively dated between AD. 1100-1400, at the Hjallholl site.

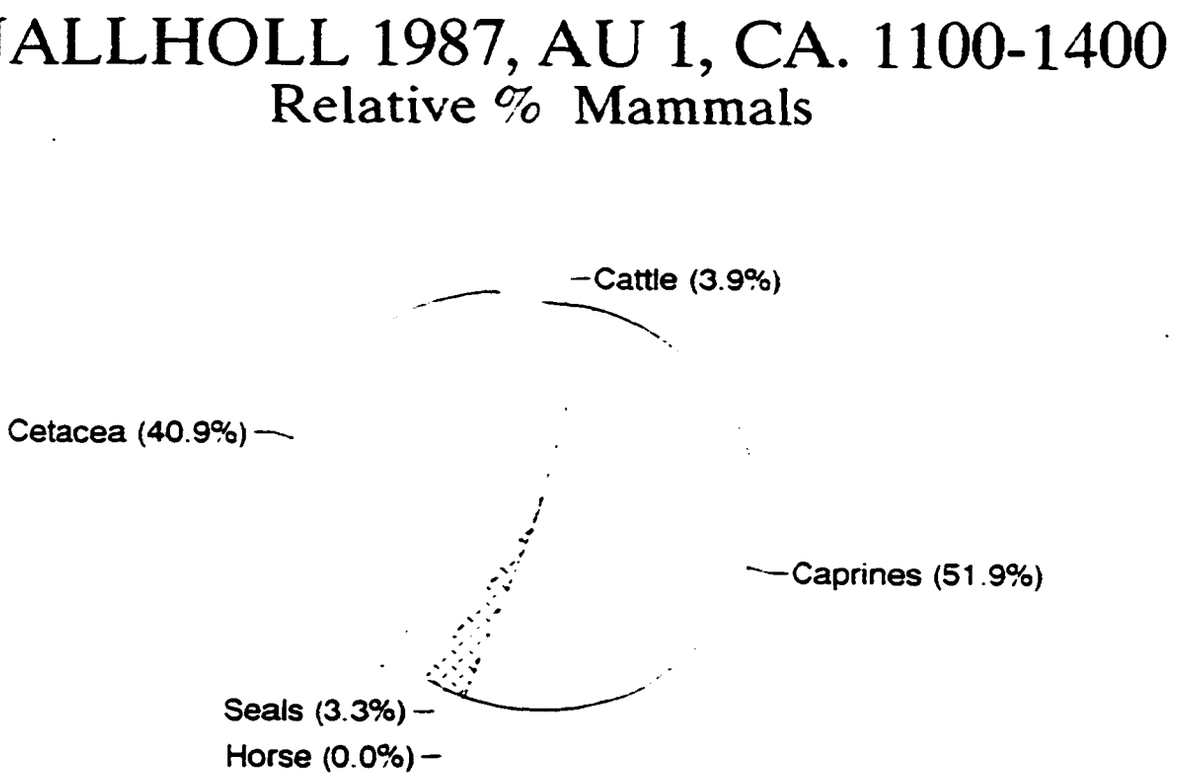

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Figure 5.42 - The relative percentage of the major taxa recovered from Test Cut #1, AU 2, at the Hjallholl site.

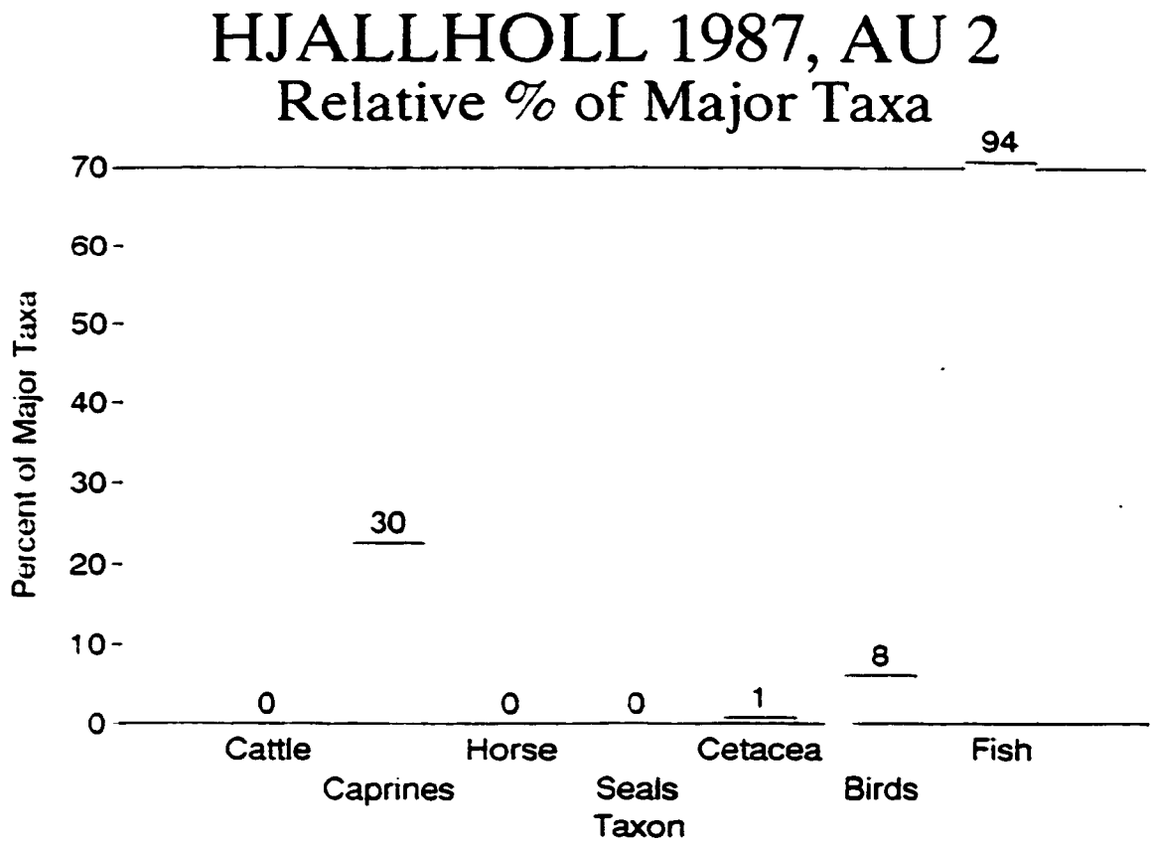

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Figure 5.43 - The relative percentage of the domestic mammals recovered from Test Cut #1, AU 2, at the Hjallholl site.

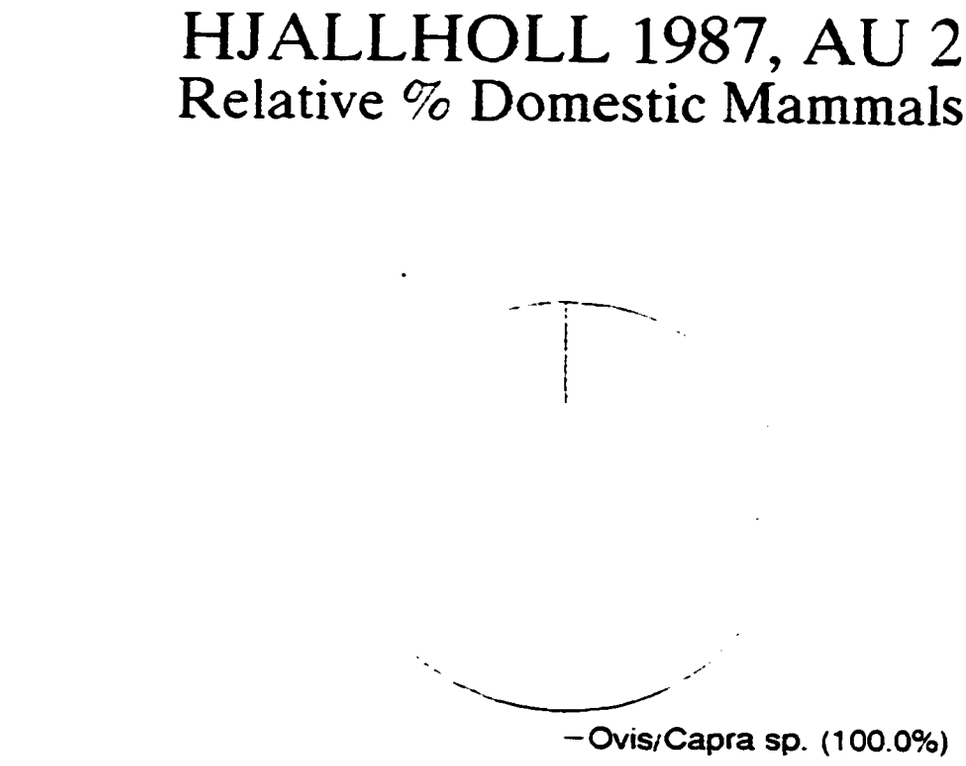

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Figure 5.44 - The relative percentage of the mammals recovered from Test Cut # 1, AU 2, at the Hjallholl site.

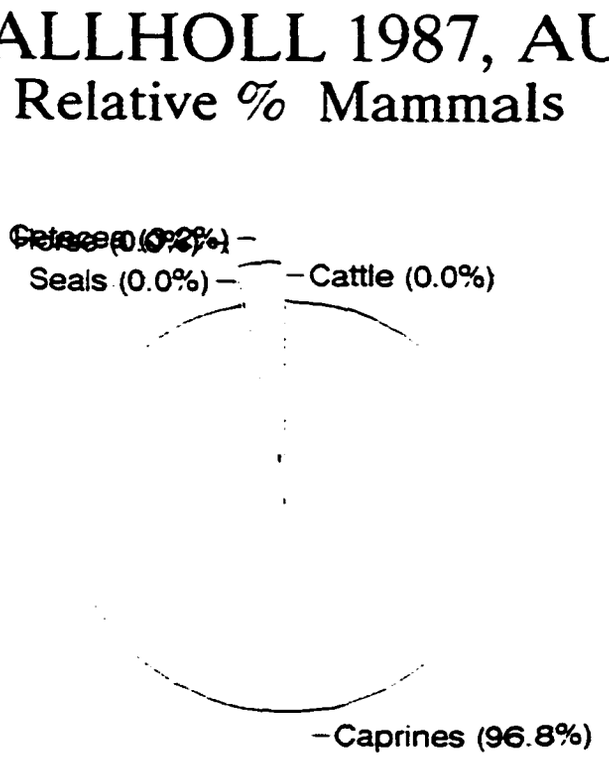

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Figure 5.45 - The relative percentage of the major taxa recovered from Test Cut #1, AU 3, at the Hjallholl site.

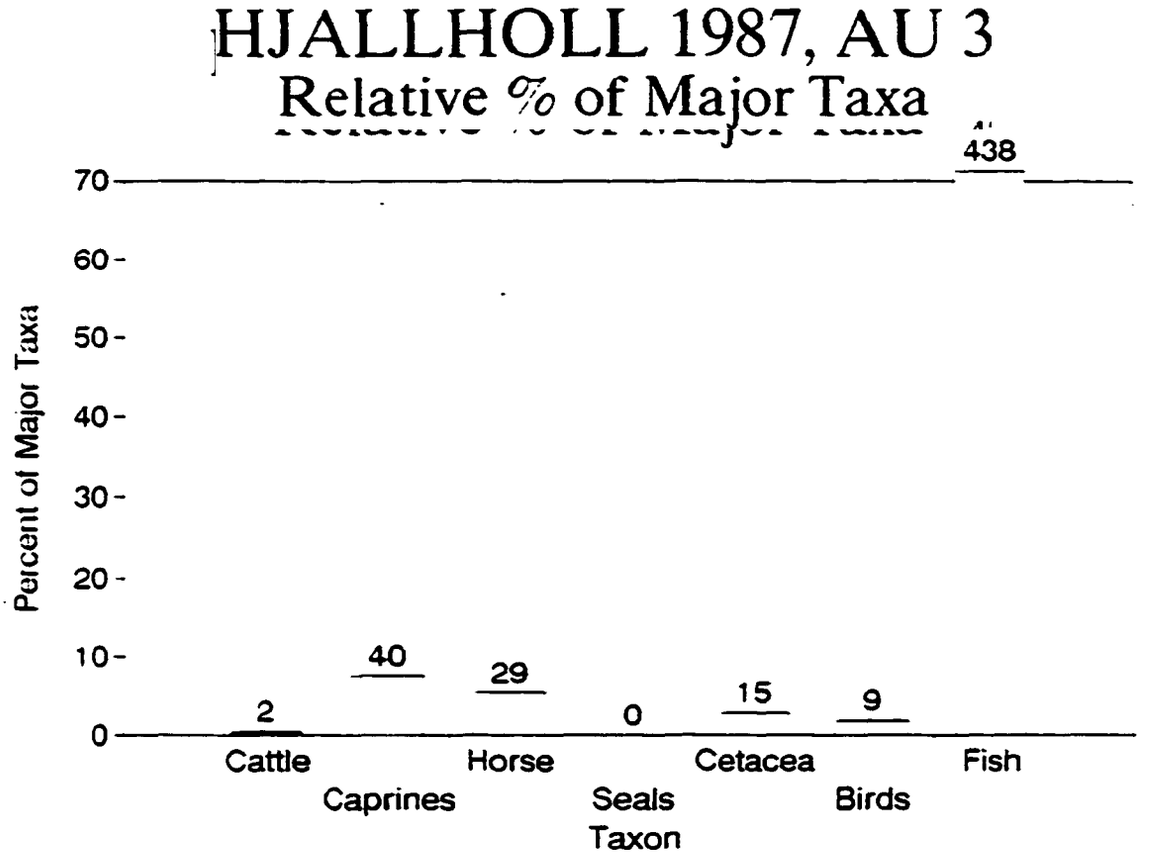

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Figure 5.46 - The relative percentage of the domestic mammals recovered from Test Cut # 1, AU 3, at the Hjallholl site.

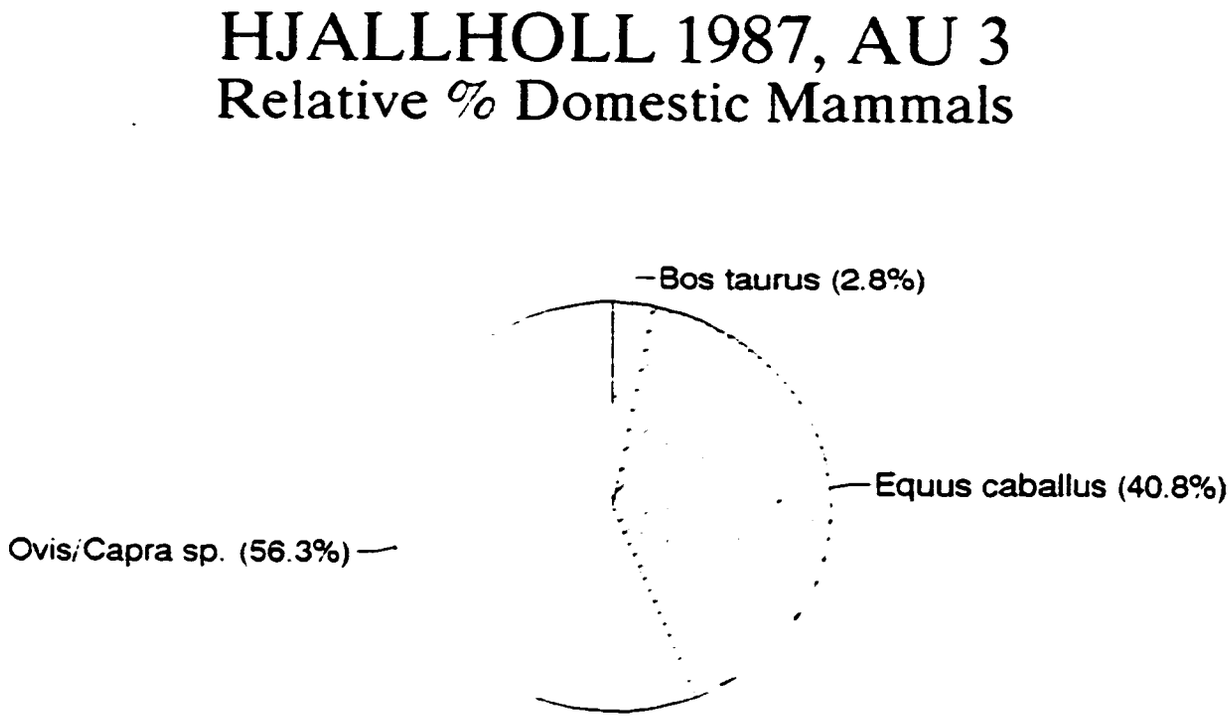

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Figure 5.47 - The relative percentage of mammals recovered from Test Cut #1, AU 3, at the Hjallholl site.

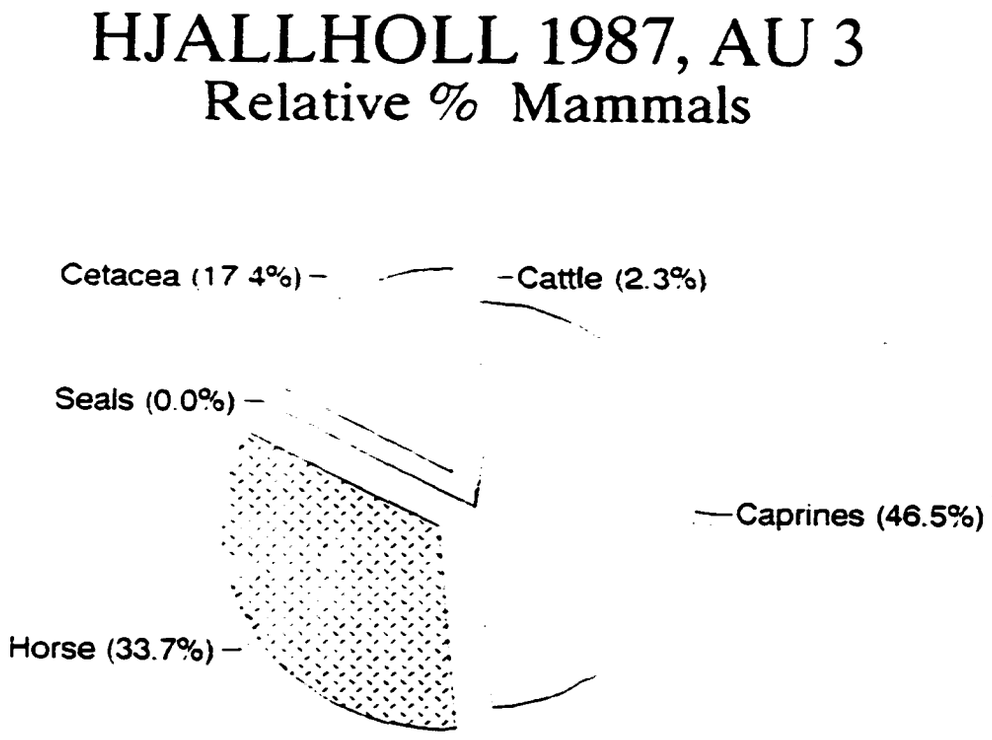

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Figure 5.48 - The ratio data for the Test Cut #1 archaeofauna from the Hjallholl site.

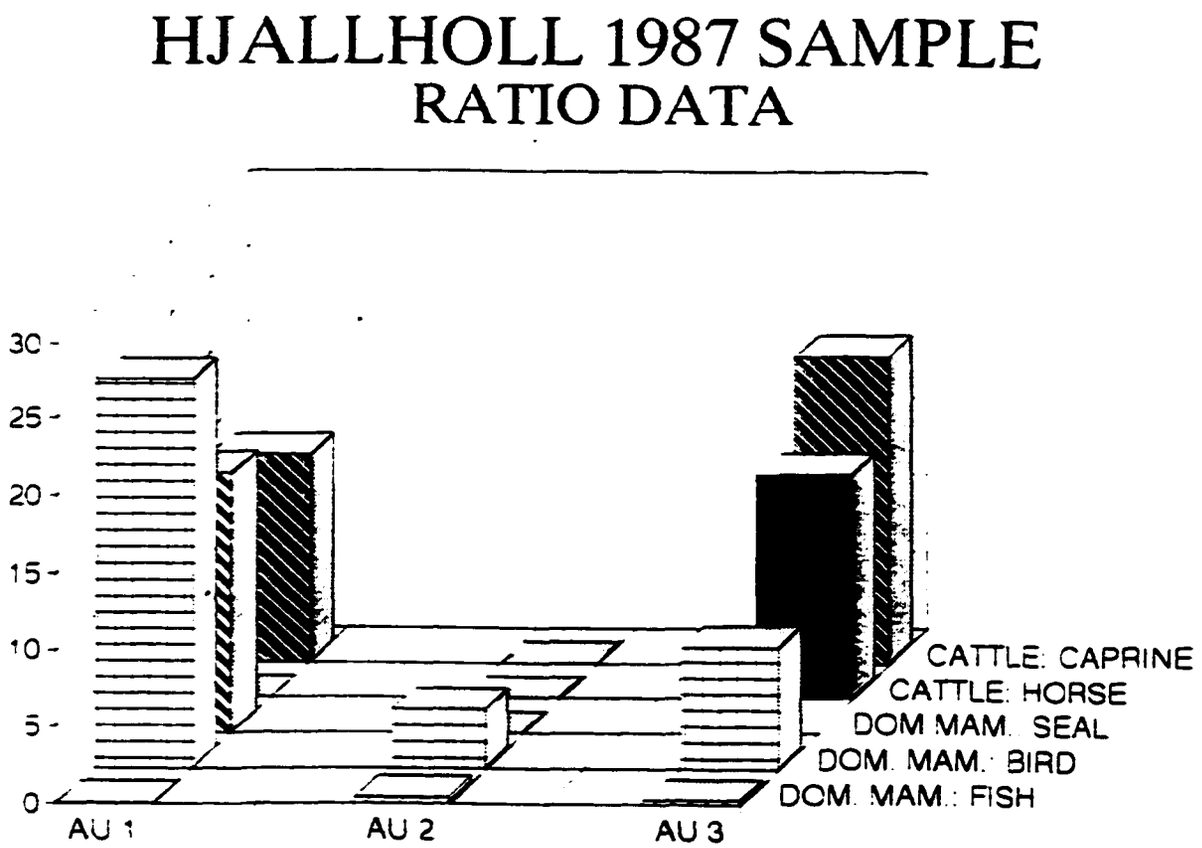

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Figure 5.49 - A comparison of the relative percentage of the major taxa recovered from Test Cut #1 at the Hjallholl site. The breakdown is by Analytic Unit.

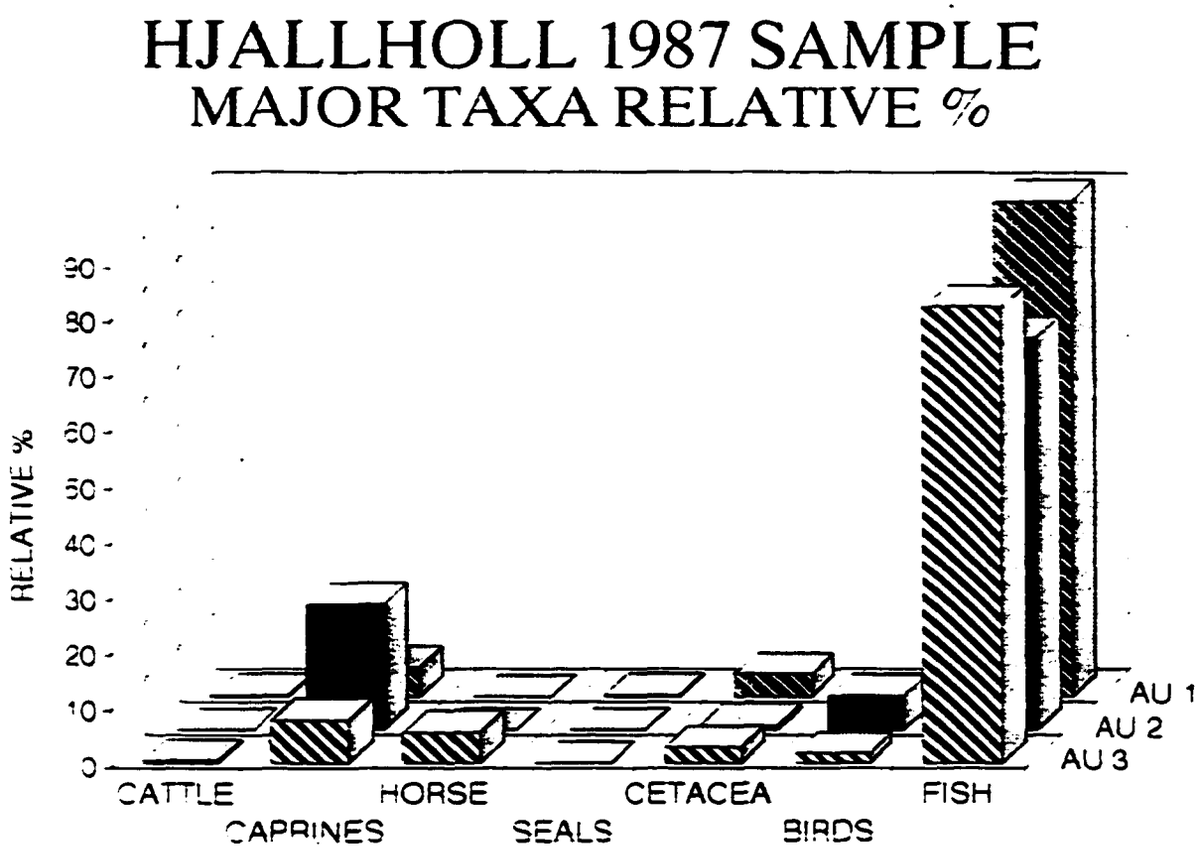

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Figure 5.50 - A comparison of the relative percentage of mammals recovered from Test Cut #1 at the Hjallholl site. The Breakdown is by Analytic Unit.

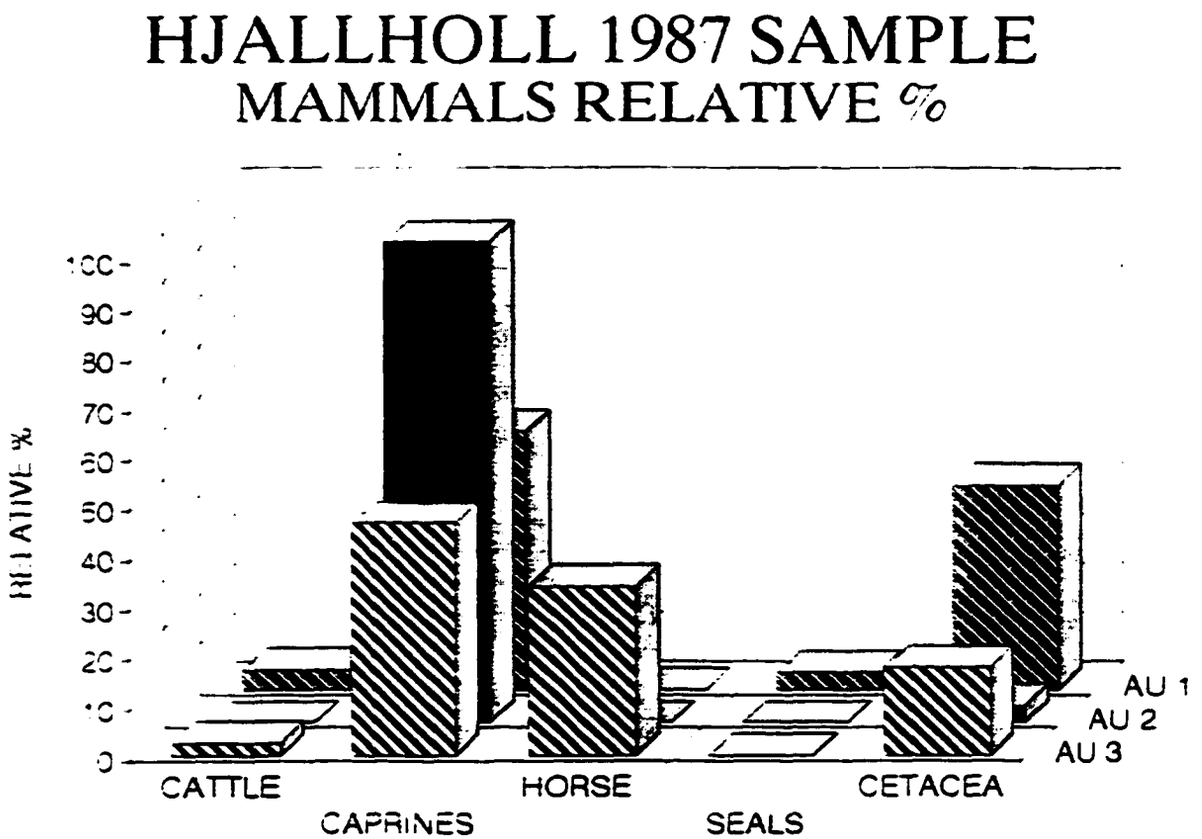

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Figure 5.51 - The general Breidafjord area; the island of Flatey is located along the northern part of the fjord.

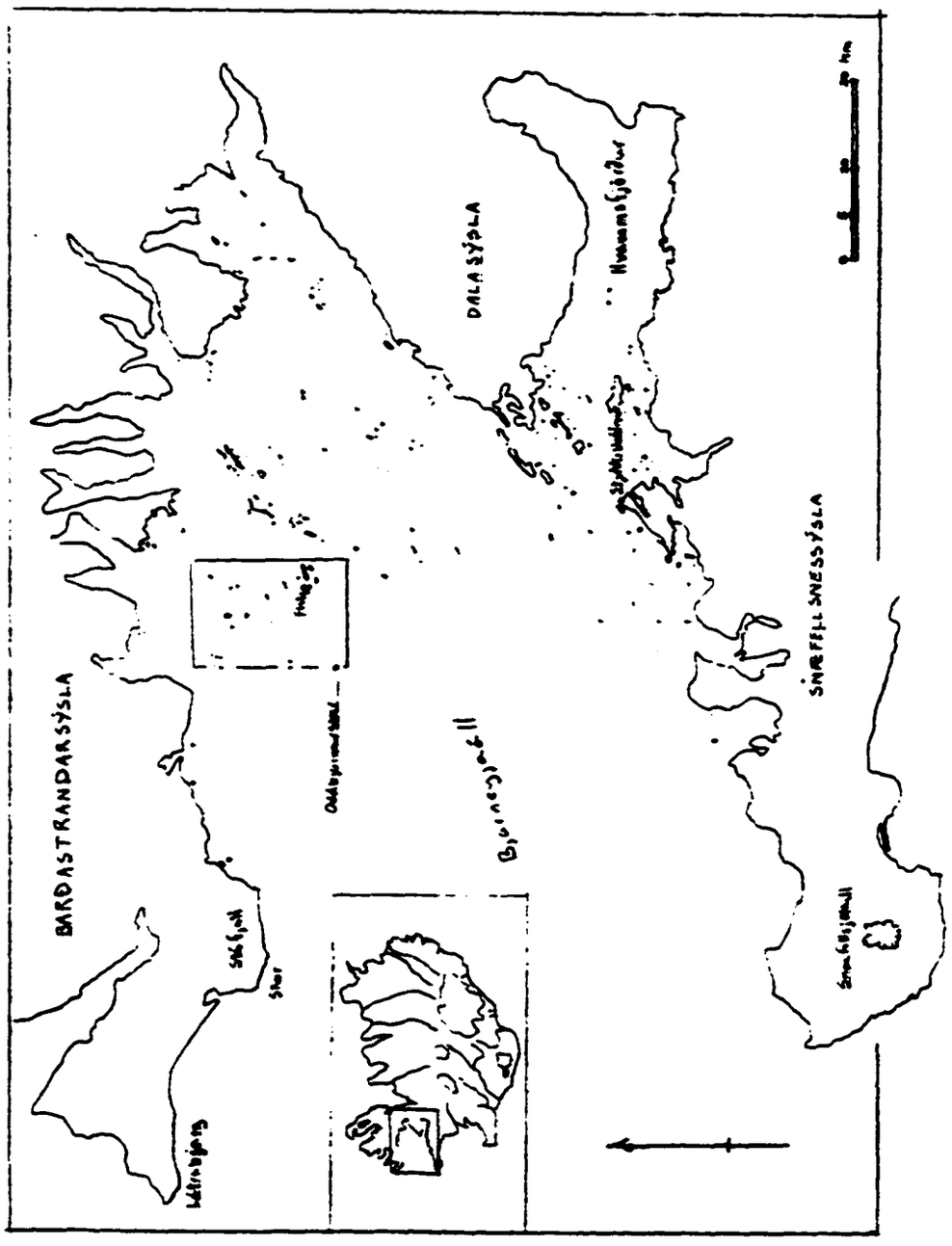

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Figure 5.52 - The general Flatey area with its associated island groups.

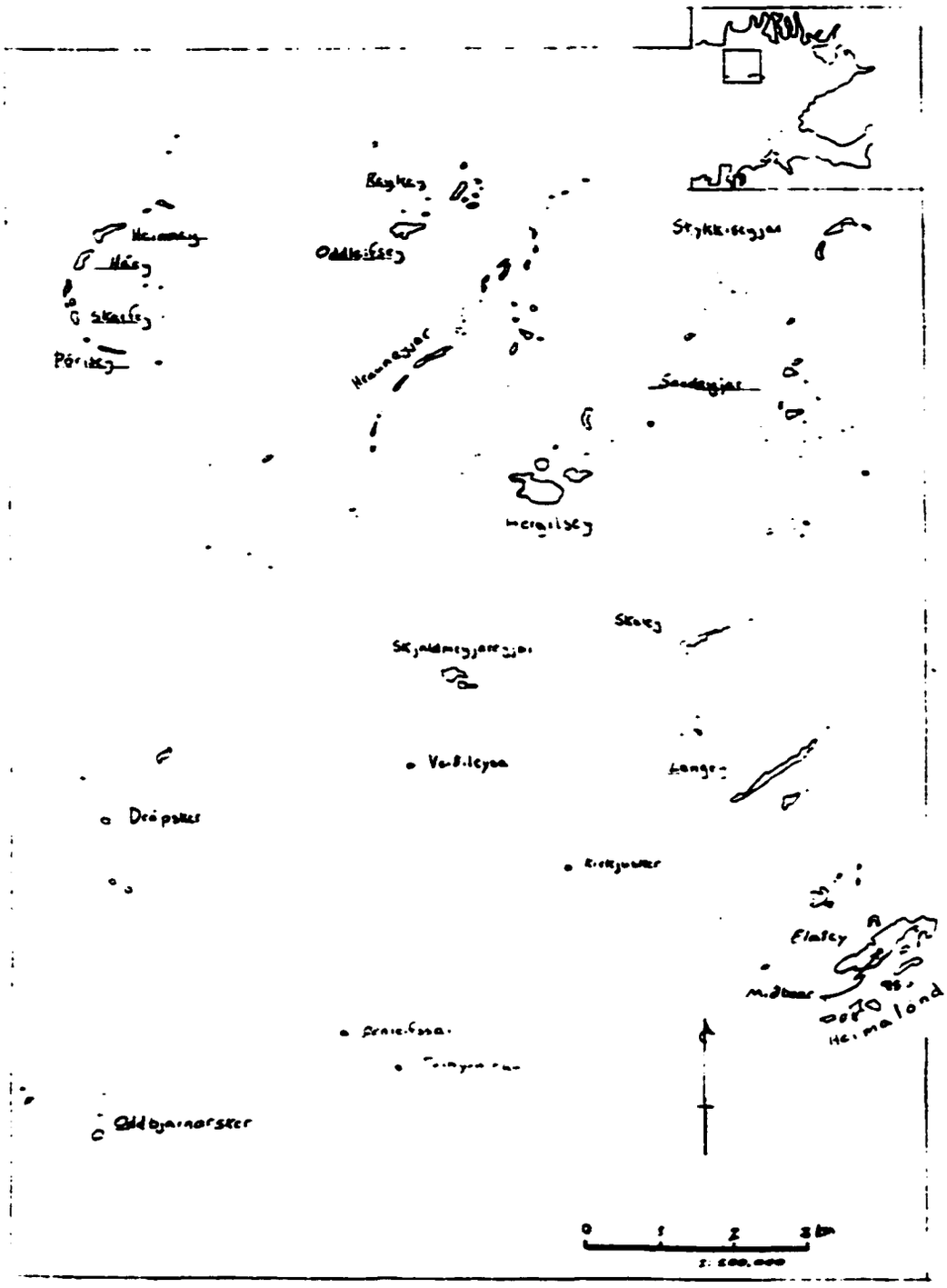

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Figure 5.53 - The Flatey island group (the island of Flatey is the largest in this group) Flateyhreppur, Austur-Bardastrandarsysla. The site of Midbaer (4505-1) is located between the Elf Rocks (4505-2) and the Klauster (Cloister).

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Figure 5.54 - A detail of the Samuel Eggertsson map done in 1906. The Midbaer turf ruin is located along the southern portion of the island (along the F grid co-ordinate).

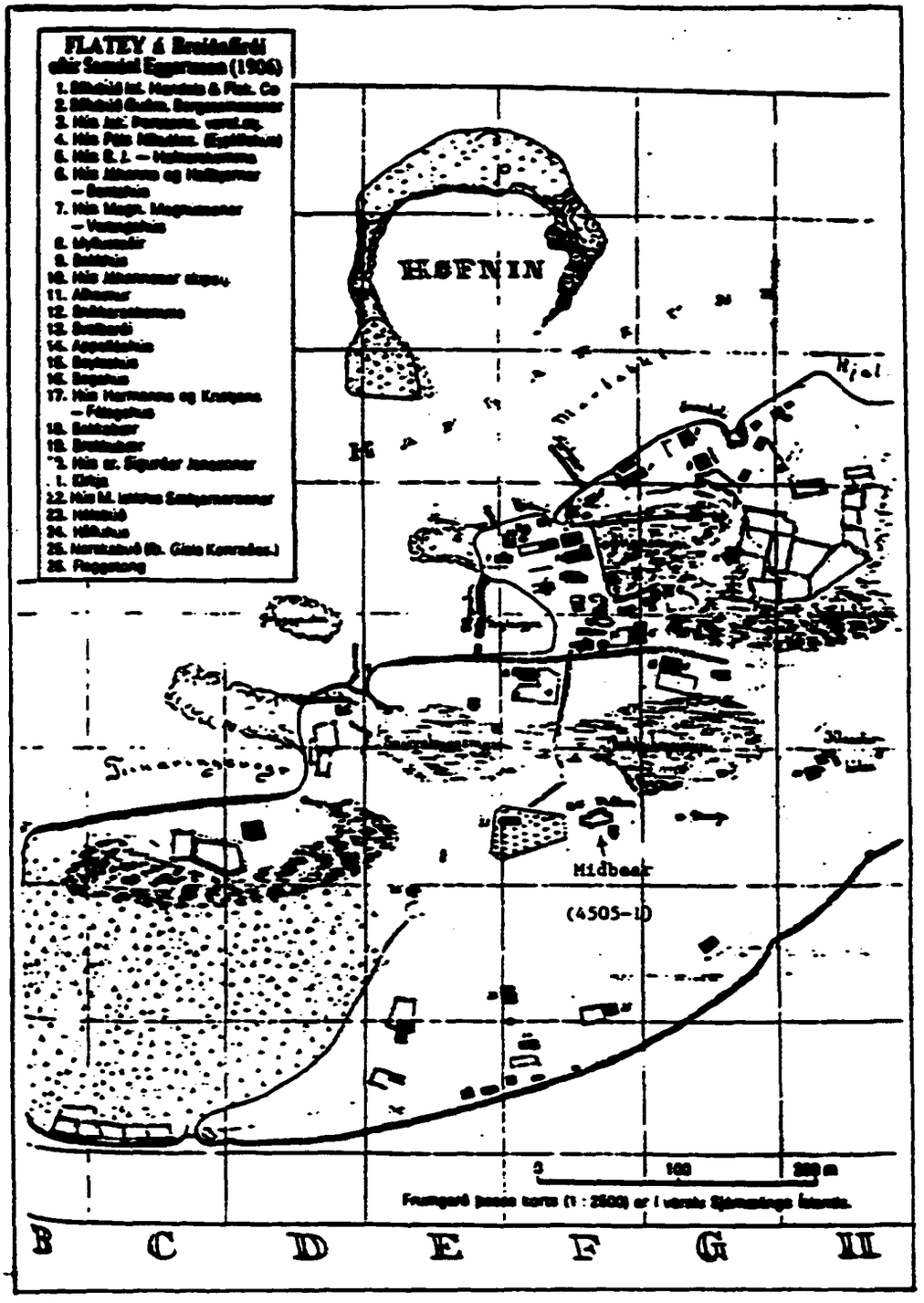

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Figure 5.55 - A Kaolin Pipe Bowl recovered from the surface of the Midbaer site.

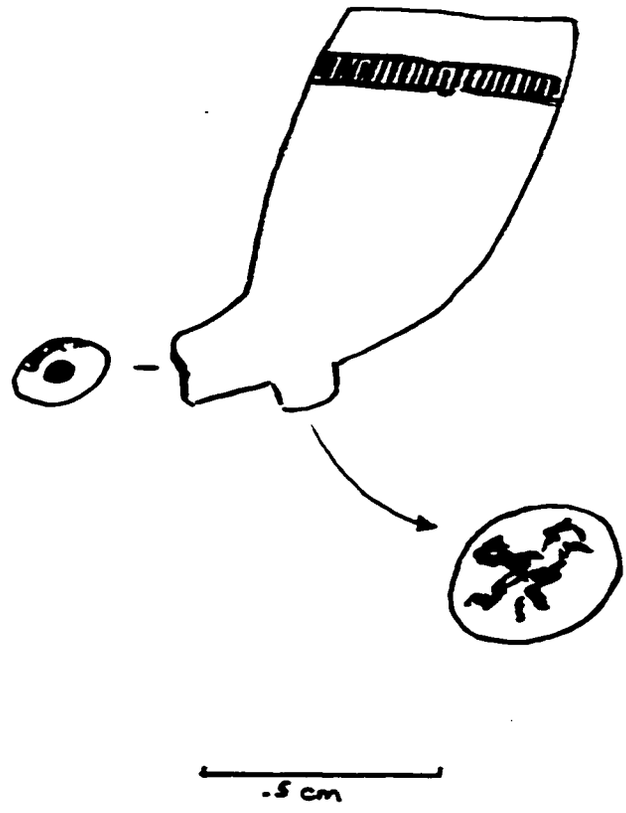

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Figure 5.56 - Pace and compass site plan of the Midbaer site (4505-1).

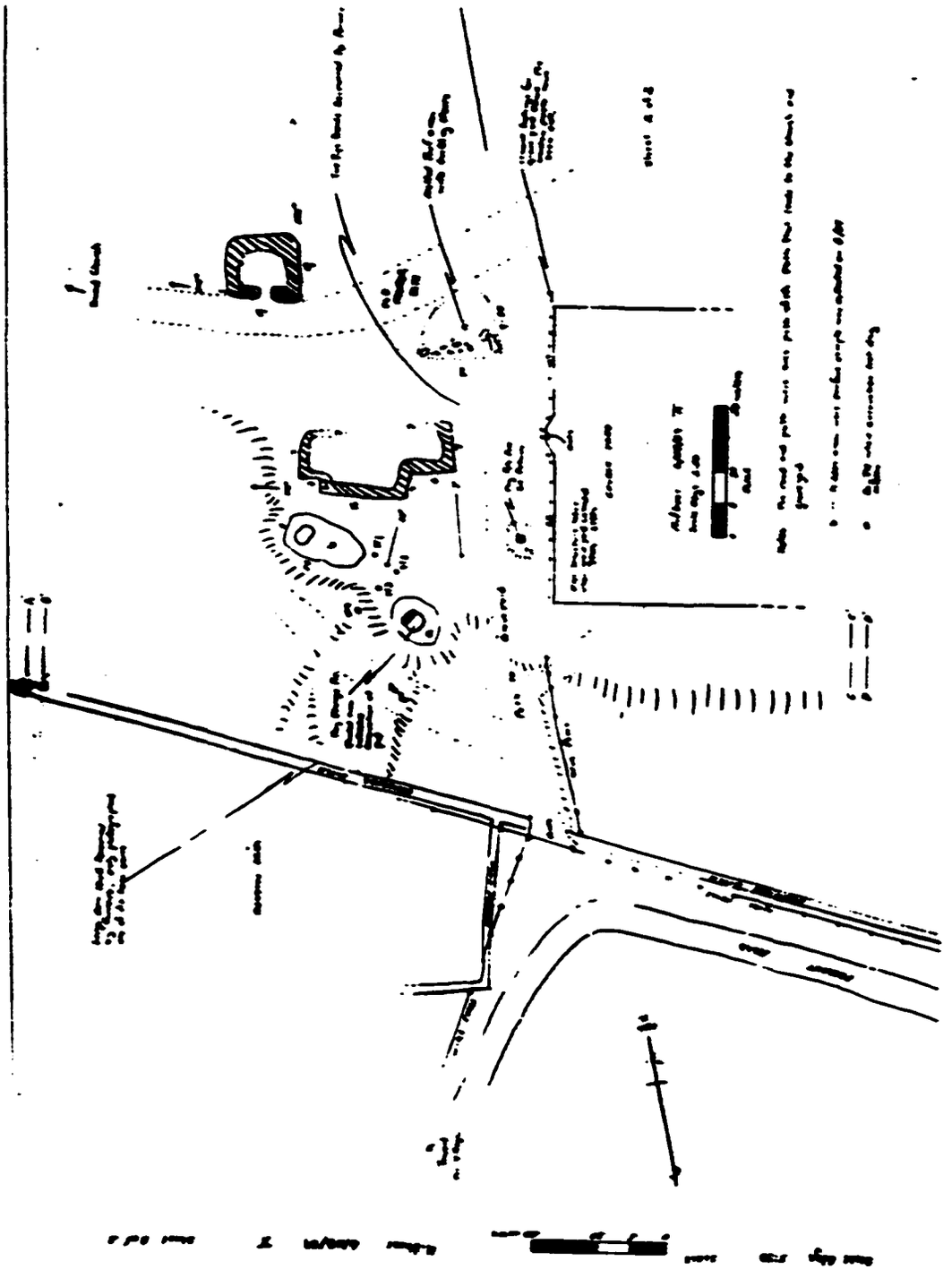

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Figure 5.57 - The south profile of the 1920's Hay Pit and the Midbaer Column sample.

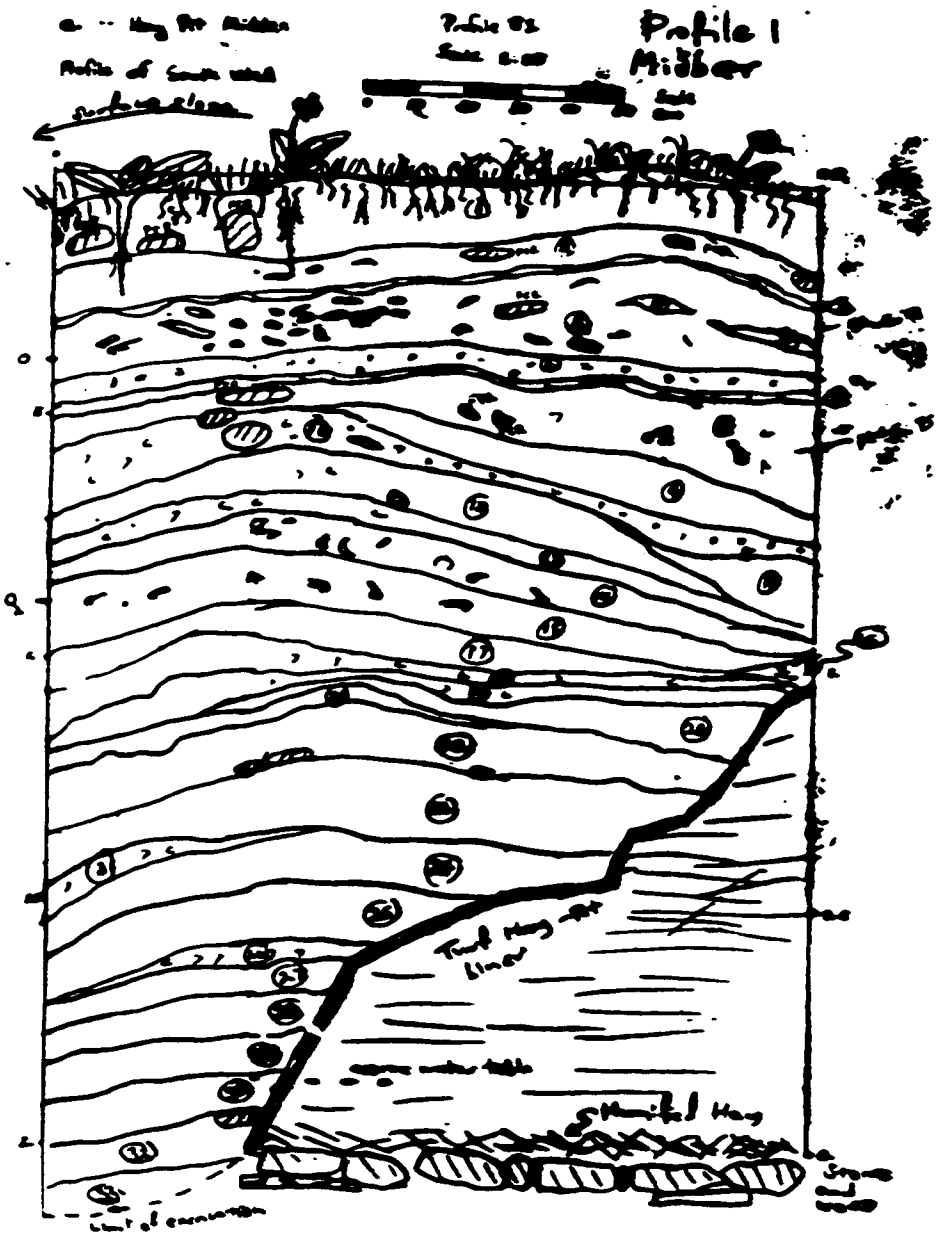

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Figure 5.58 - Pace and compass map of Site 4505-2, an "Elf Rock Alignment" located to the west of the Midbaer site on the island of Flatey.

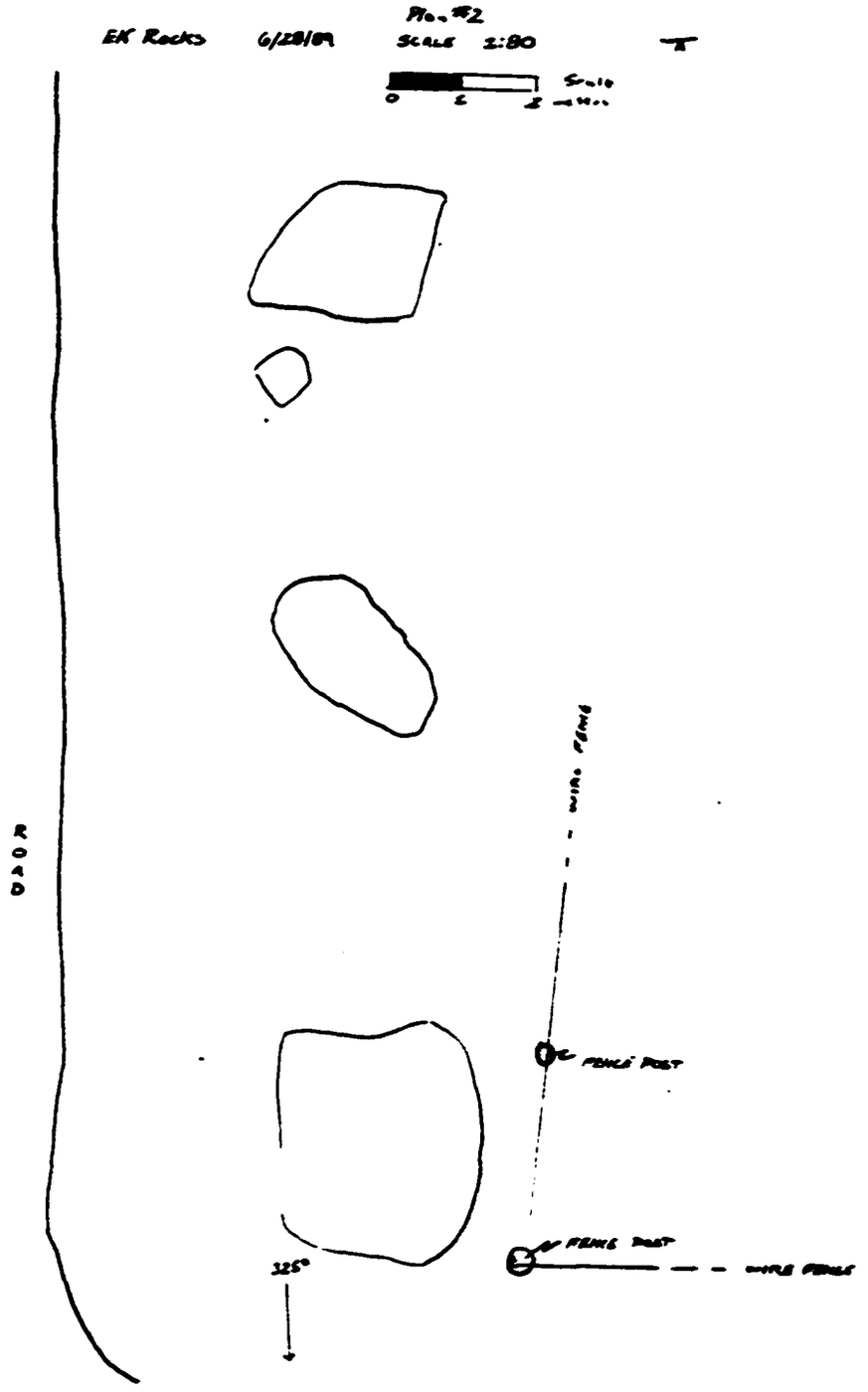

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Figure 5.59 - The reconstructed Atlantic Cod lengths based upon the recovered archaeofauna from the Midbaer site.

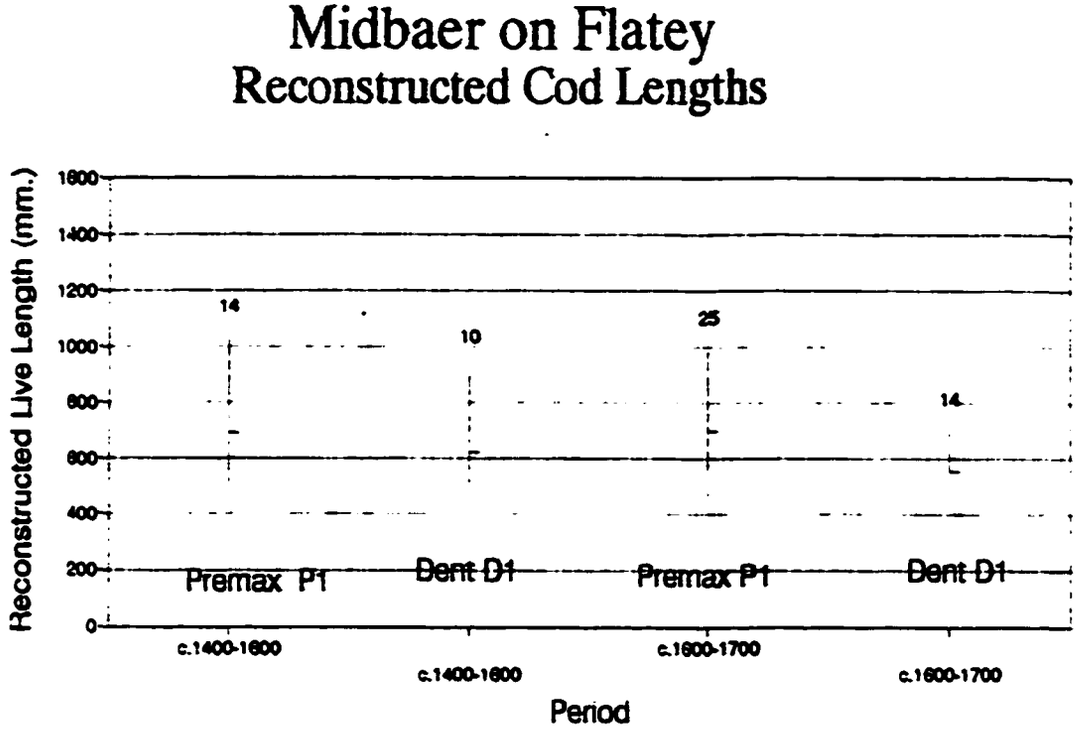

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Figure 5.60 - The relative percentage of the major taxa recovered from the Midbaer site.

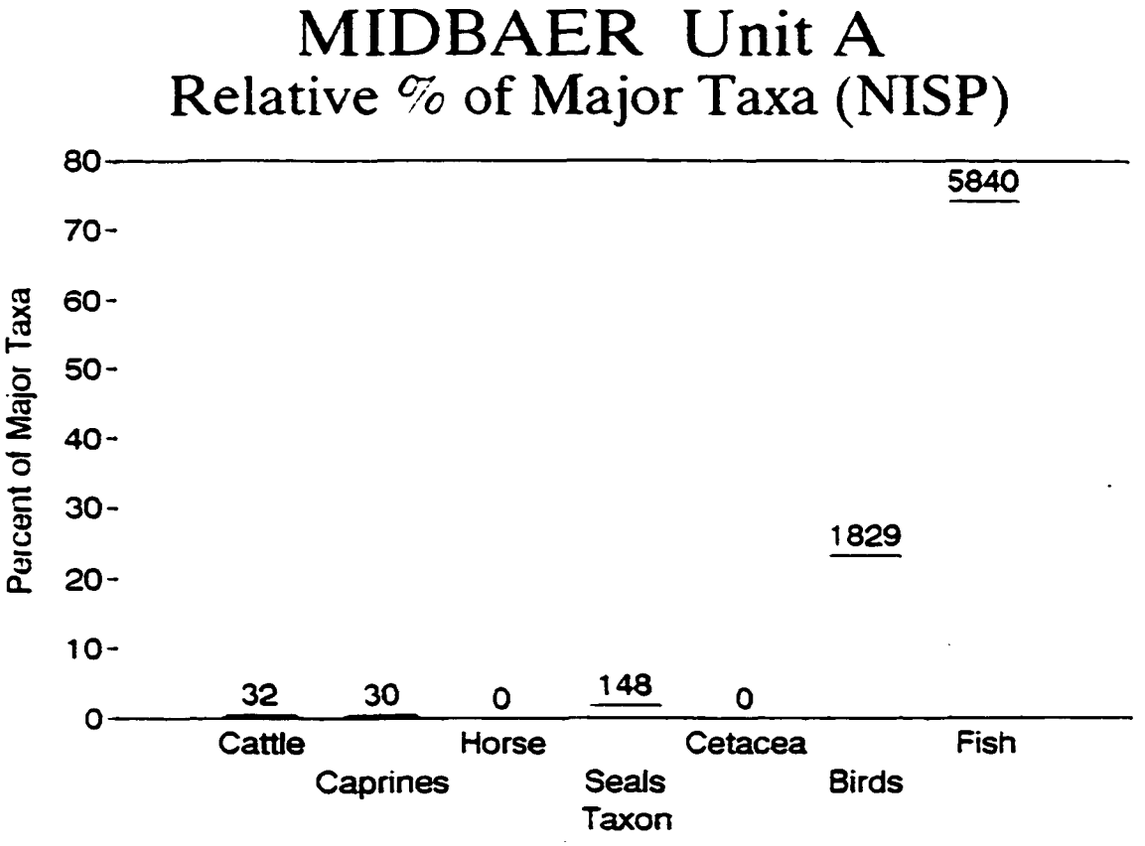

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Figure 5.61 - The relative percentage of the domestic mammals recovered from the Midbaer site.

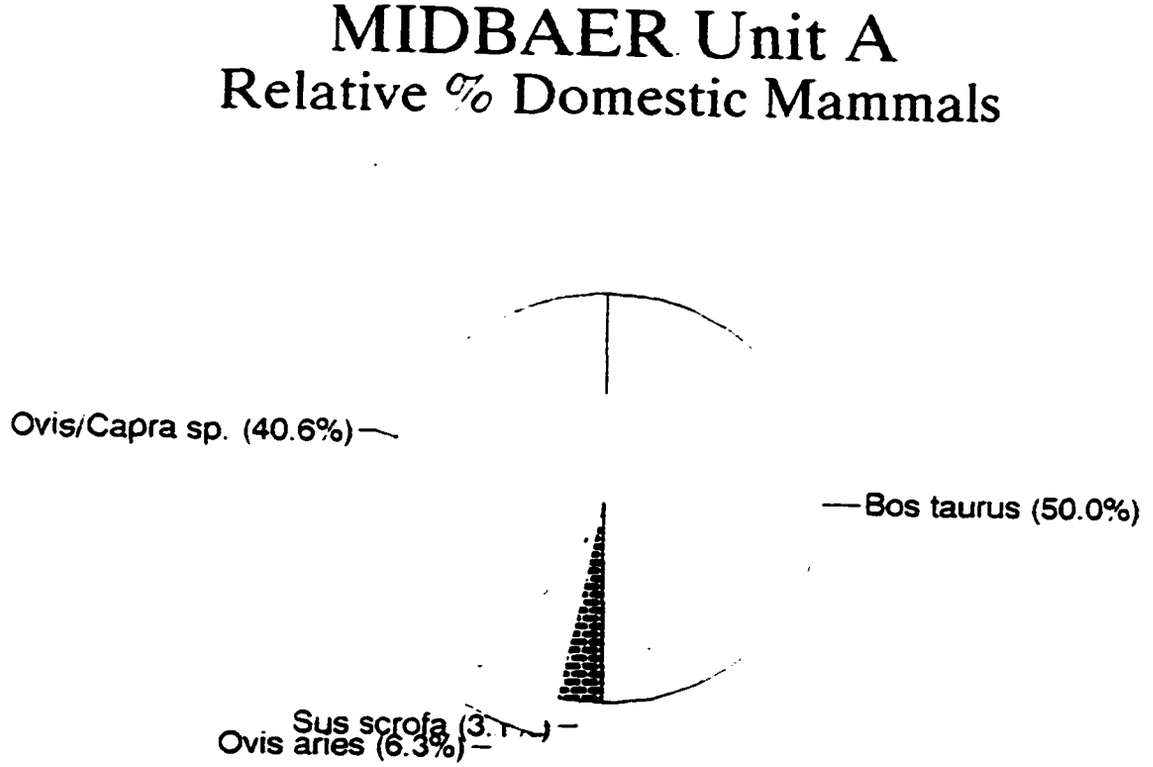

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Figure 5.62 - The relative percentage of mammals recovered from the Midbaer site.

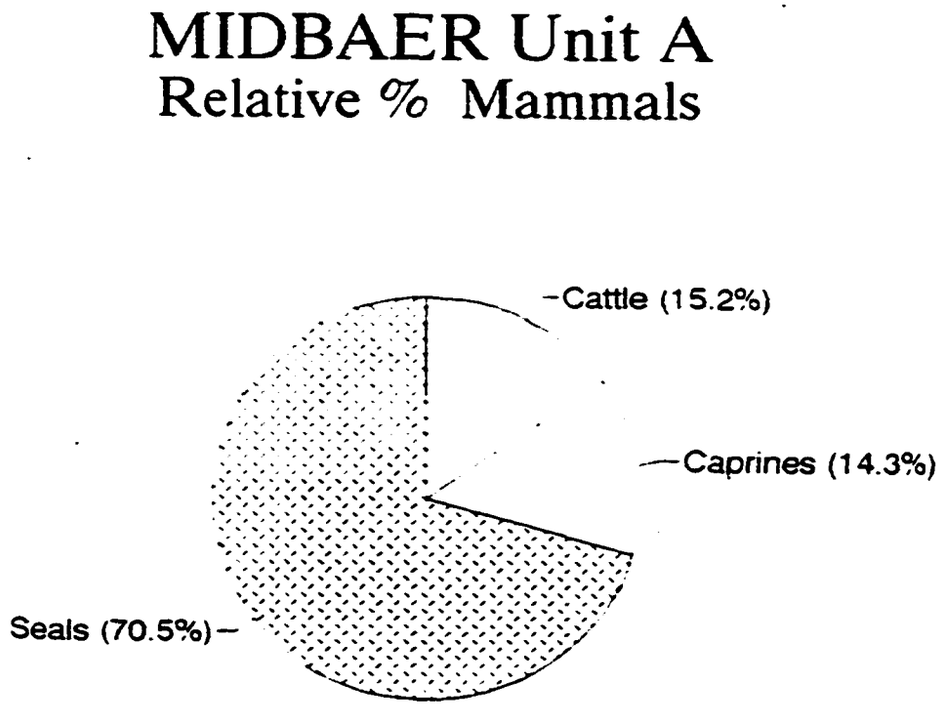

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Figure 5.63 - The relative percentage of the major taxa recovered from AU 1, dated between AD. 1250-1400, at the Midbaer site.

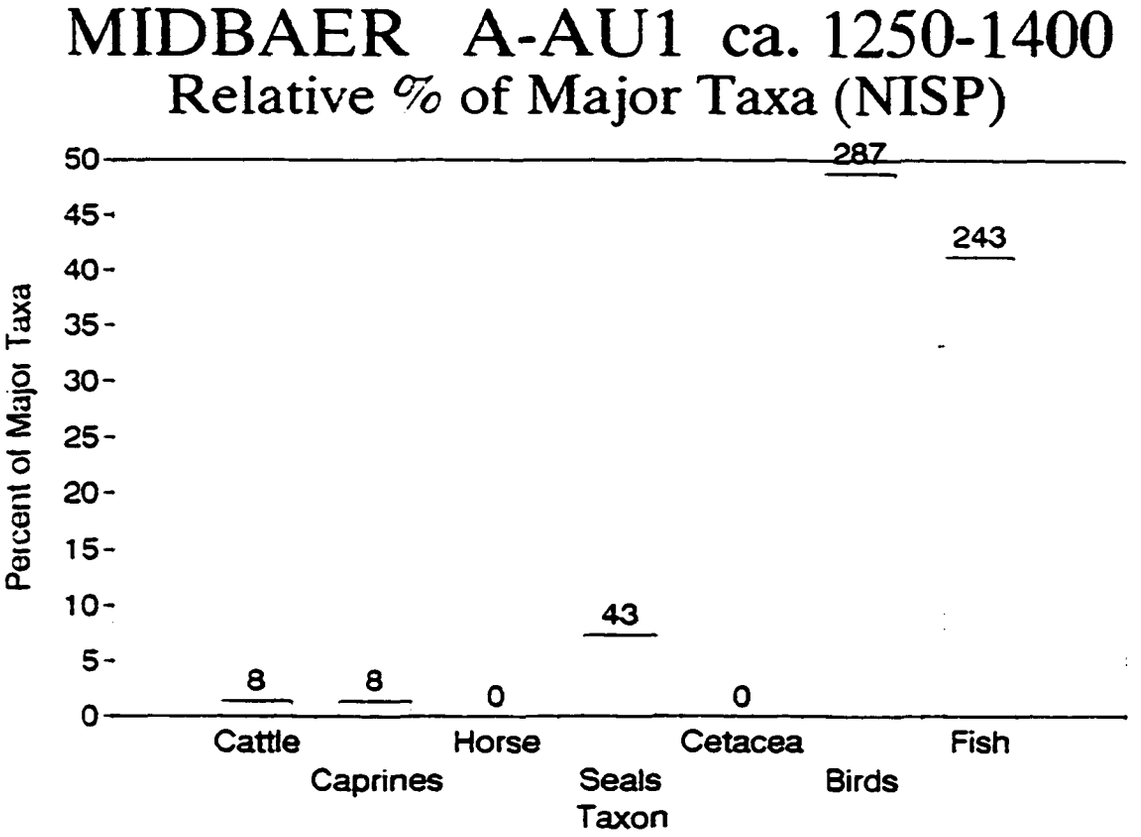

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Figure 5.64 - The relative percentage of the domestic mammals recovered from AU 1, dated between AD. 1250-1400, at the Midbaer site.

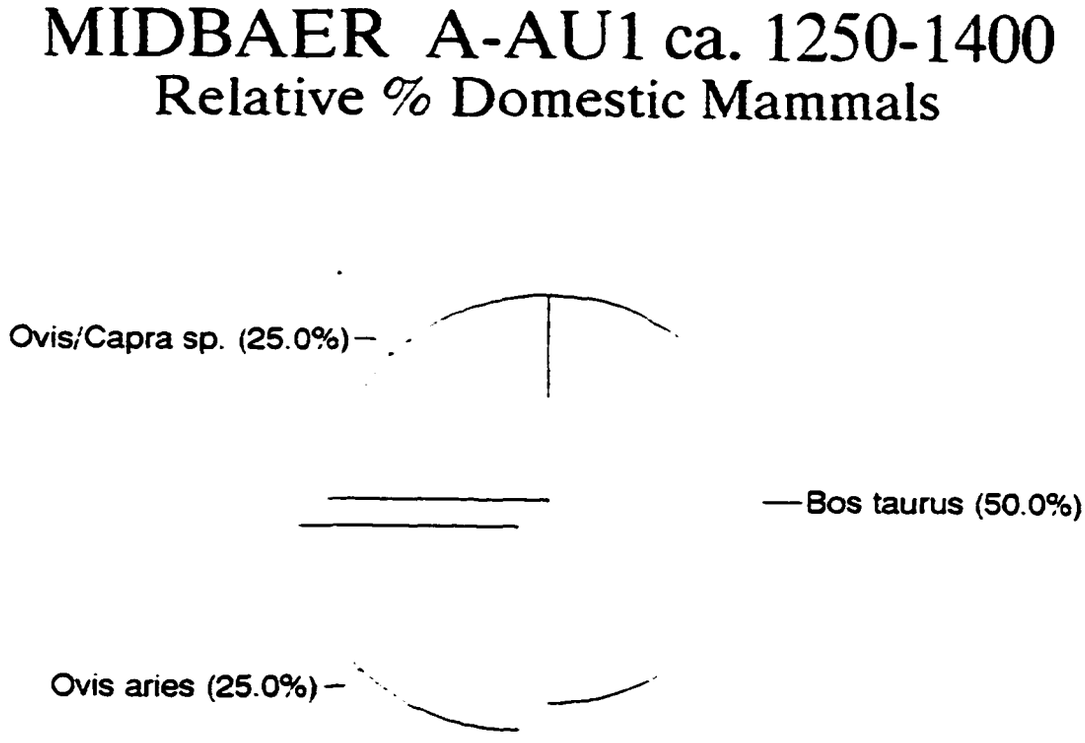

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Figure 5.65 - The relative percentage of the mammals recovered from AU 1, dated between AD. 1250-1400, at the Midbaer site.

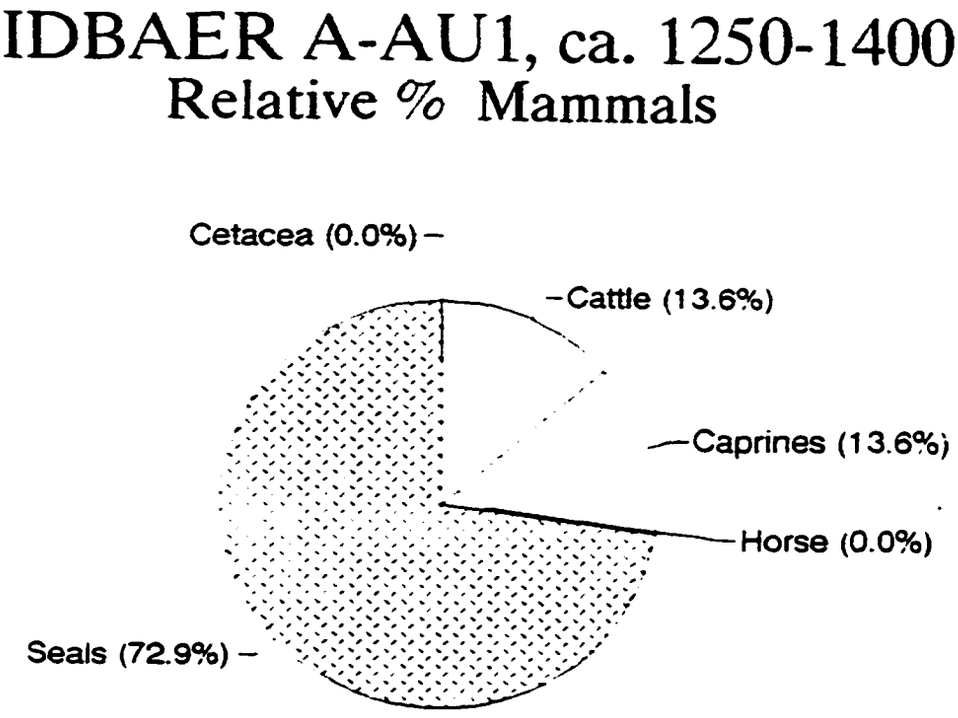

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Figure 5.66 - The relative percentage of the major taxa recovered from AU 2, dated between AD. 1400-1600, at the Midbaer site.

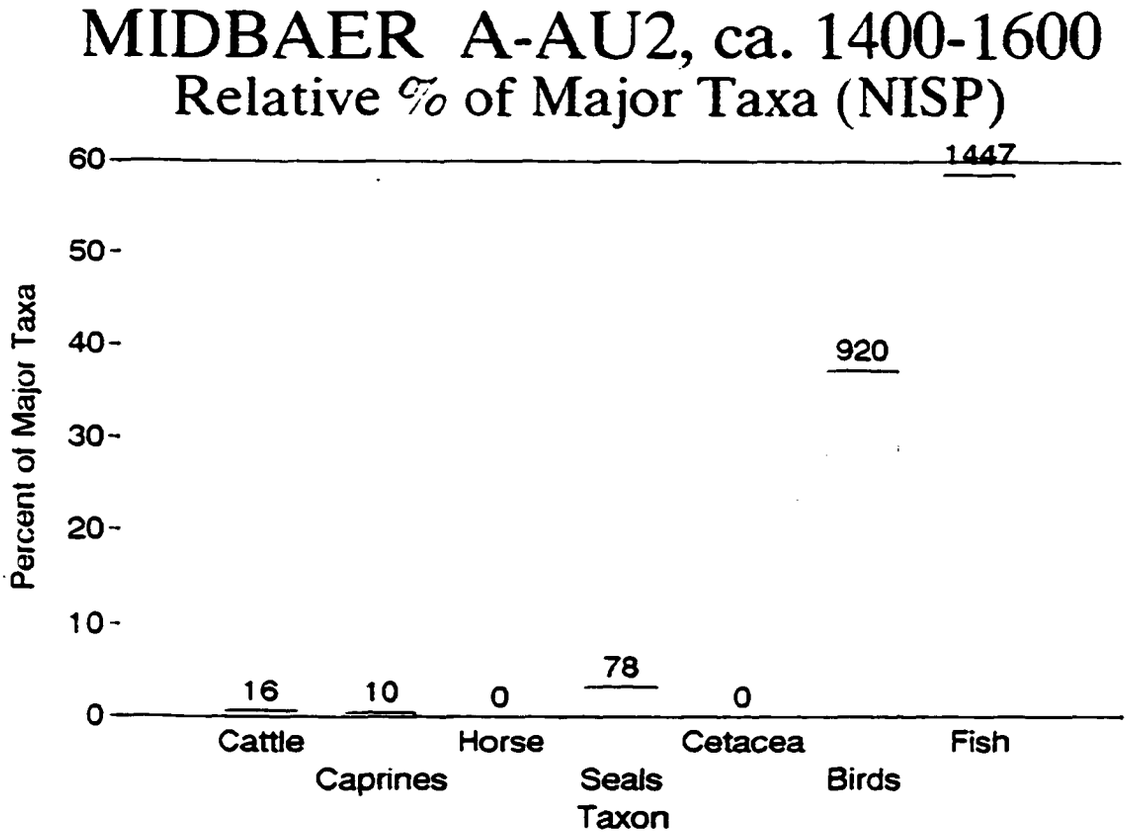

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Figure 5.67 - The relative percentage of the domestic mammals recovered from AU 2, dated between AD. 1400-1600, at the Midbaer site.

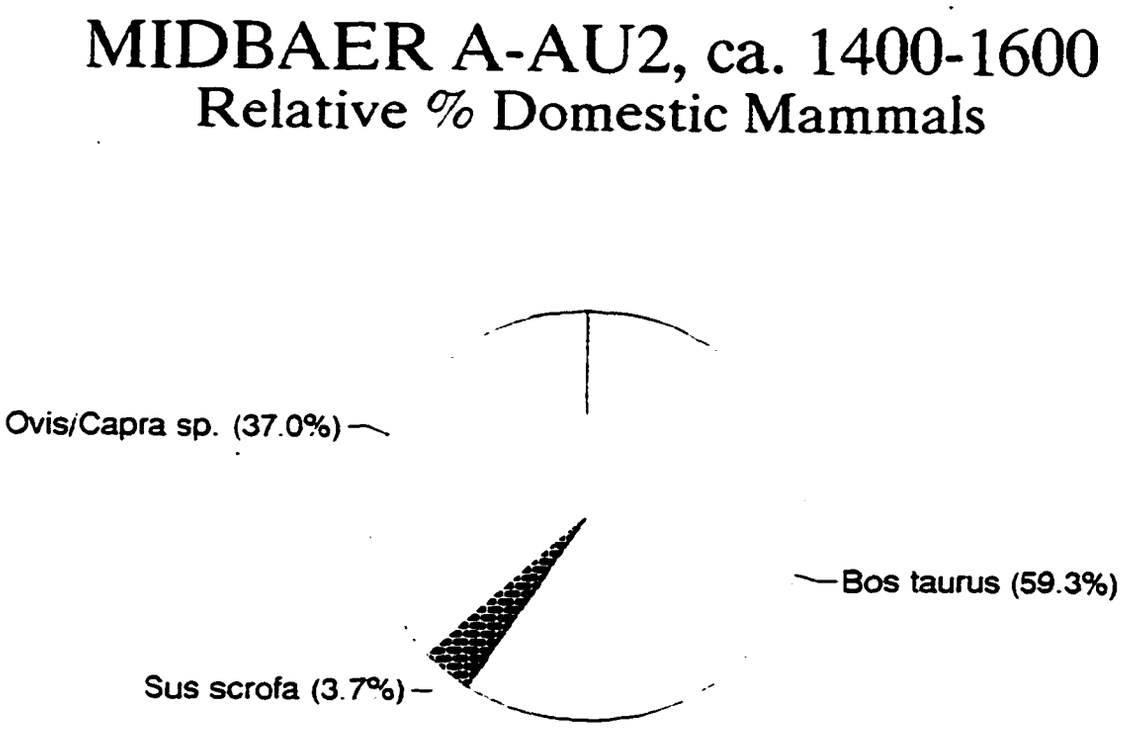

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Figure 5.68 - The relative percentage of the mammals recovered from AU 2, dated between AD. 1400 -1600, at the Midbaer site.

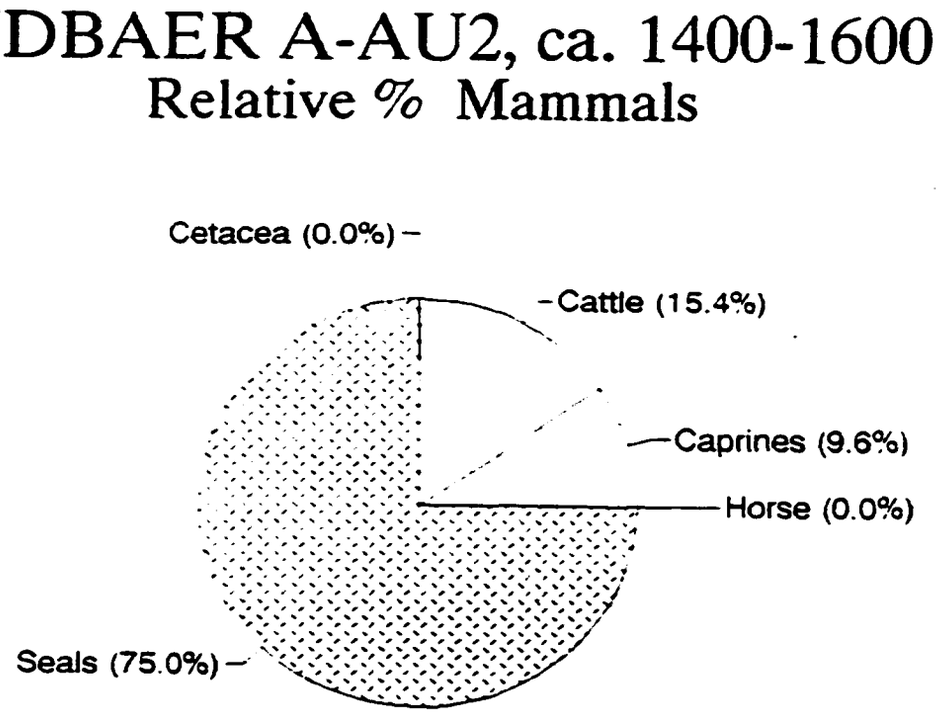

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Figure 5.69 - The relative percentage of the major taxa recovered from AU 3, dated between AD. 1600-1700, at the Midbaer site.

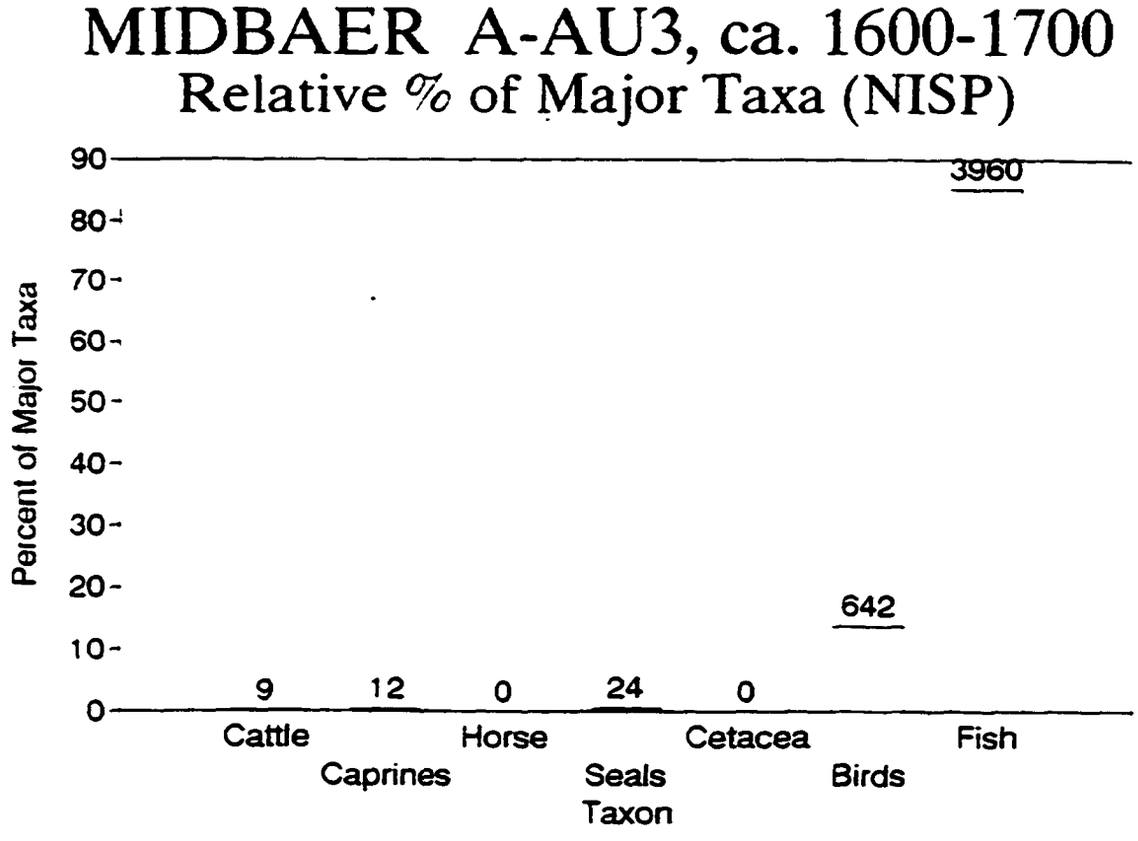

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Figure 5.70 - The relative percentage of the domestic mammals recovered from AU 3, dated between AD. 1600-1700, at the Midbaer site.

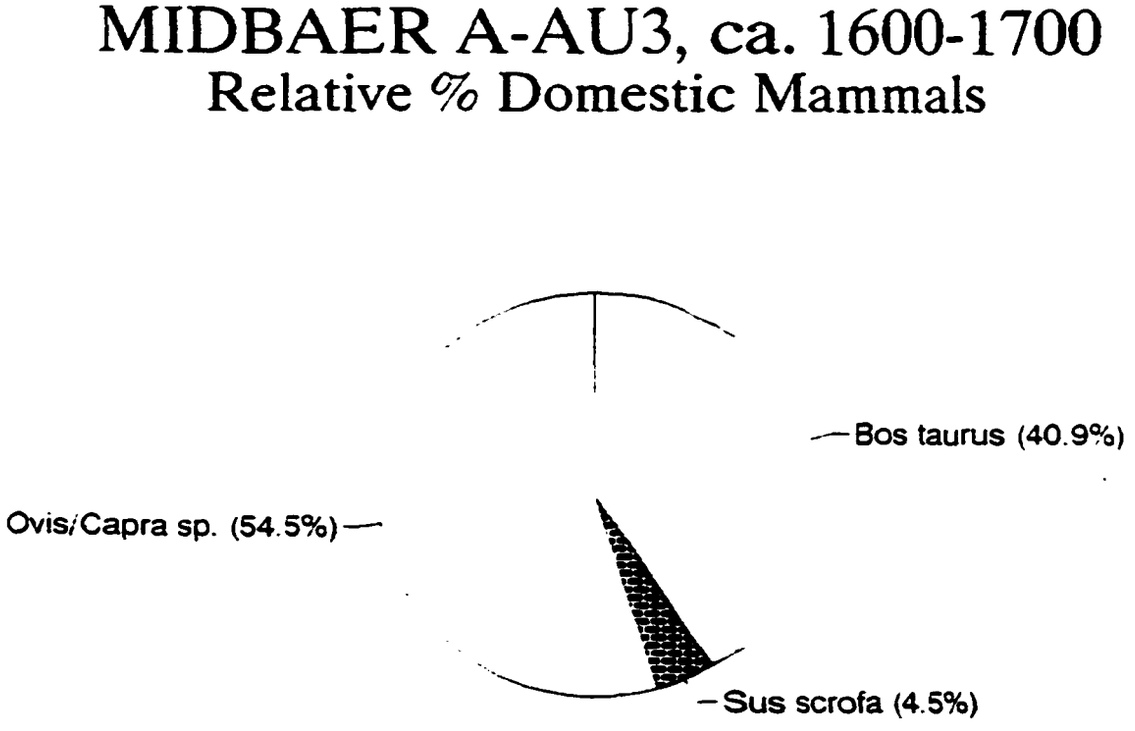

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Figure 5.71 - The relative percentage of mammals recovered from AU 3, dated between AD. 1600-1700, at the Midbaer site.

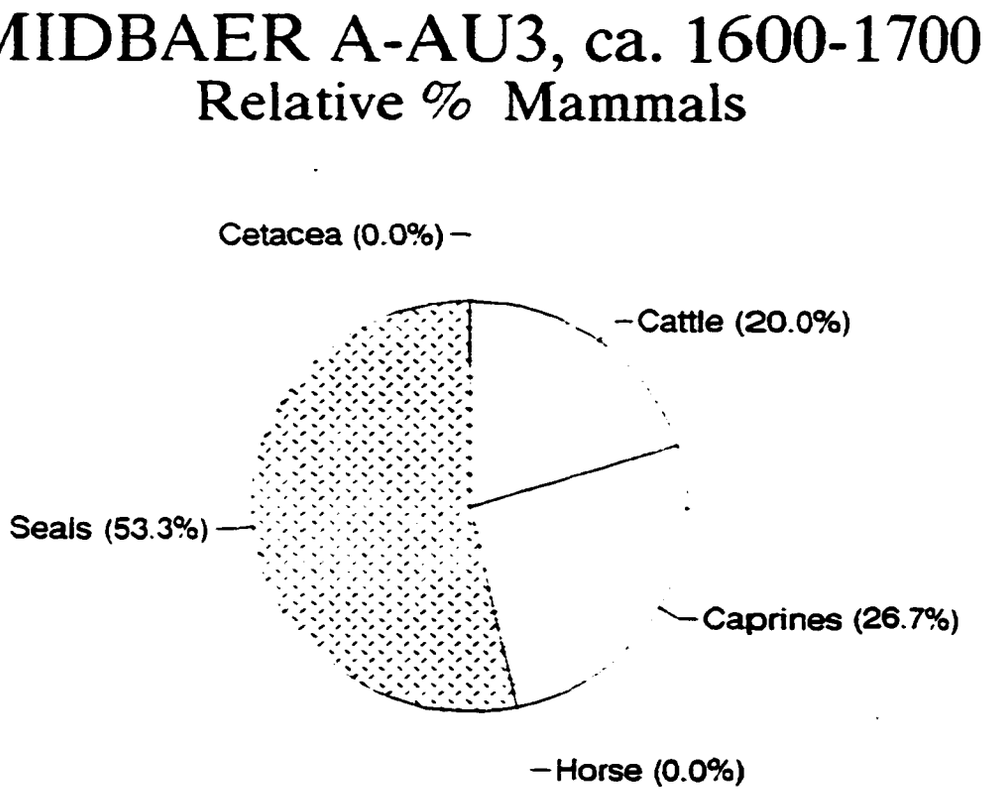

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Figure 5.72 - The relative percentage of the major taxa recovered from AU 1 and 2, dated between AD. 1250-1600, at the Midbaer site.

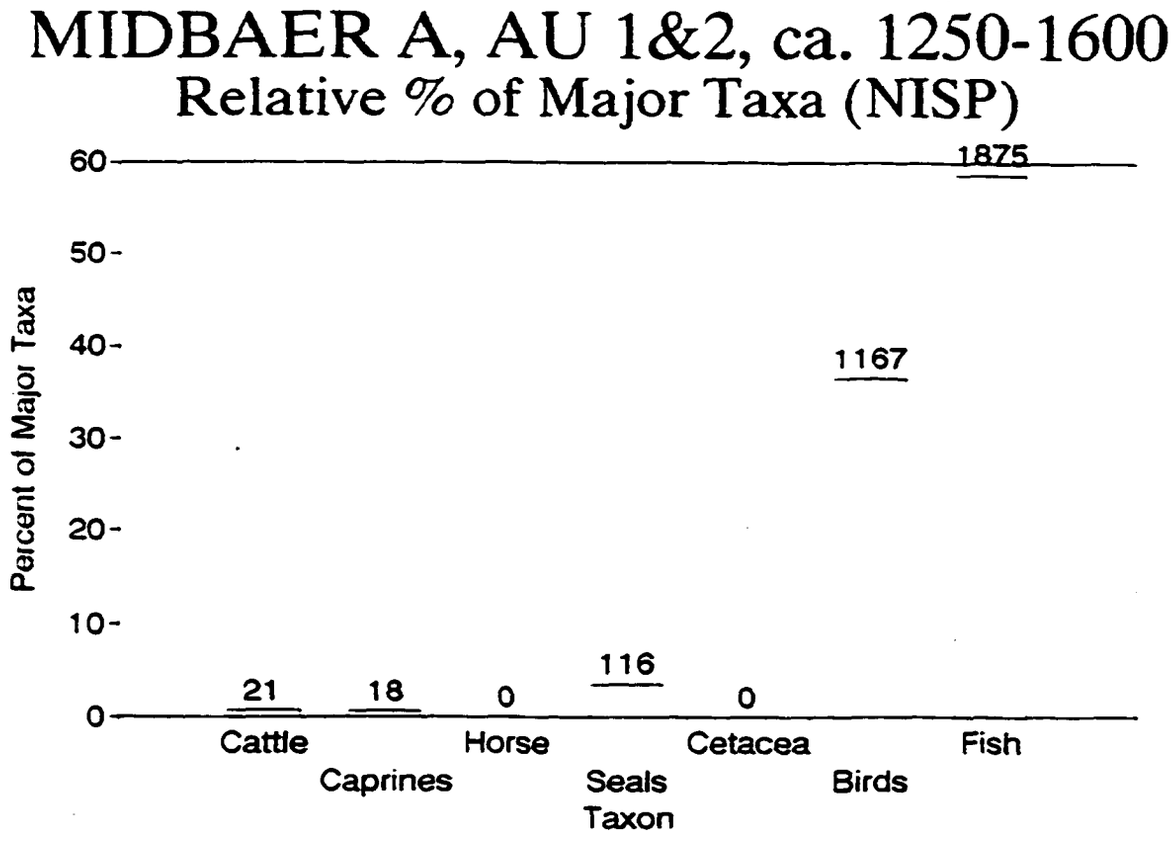

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Figure 5.73 - The relative percentage of the domestic mammals recovered from AU 1 and 2, dated between AD. 1250-1600, at the Midbaer site.

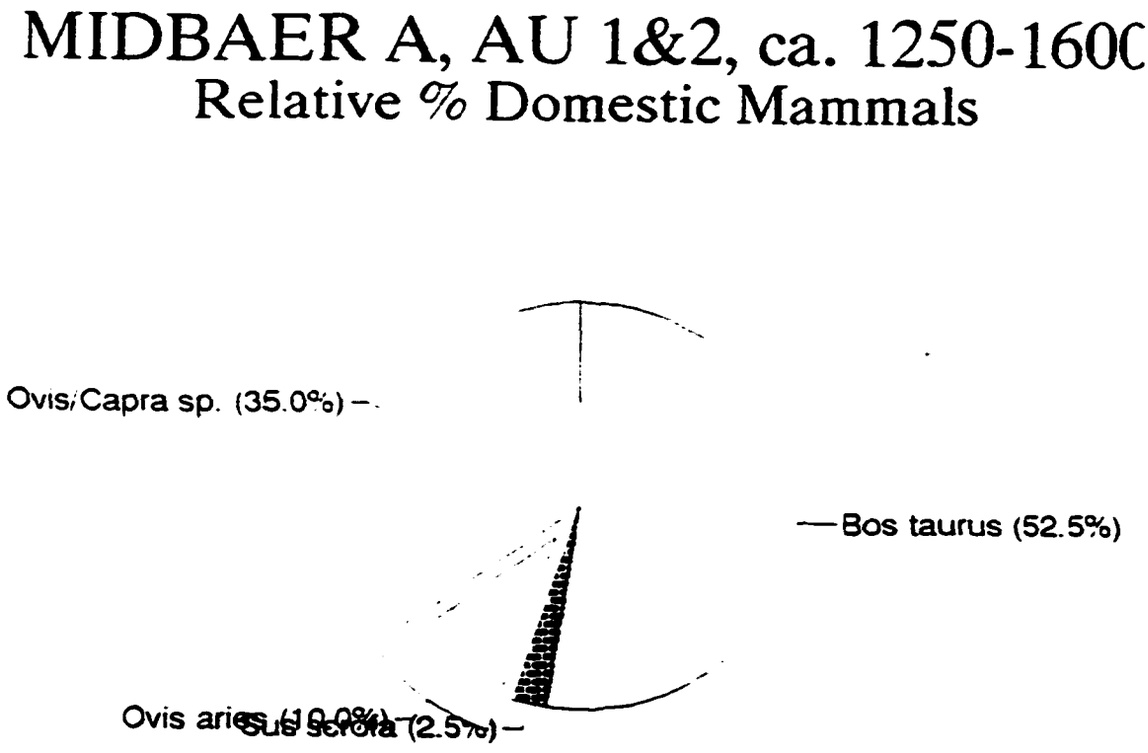

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Figure 5.74 - The relative percentage of the mammals recovered from AU 1 and 2, dated between AD. 1250-1600, at the Midbaer site.

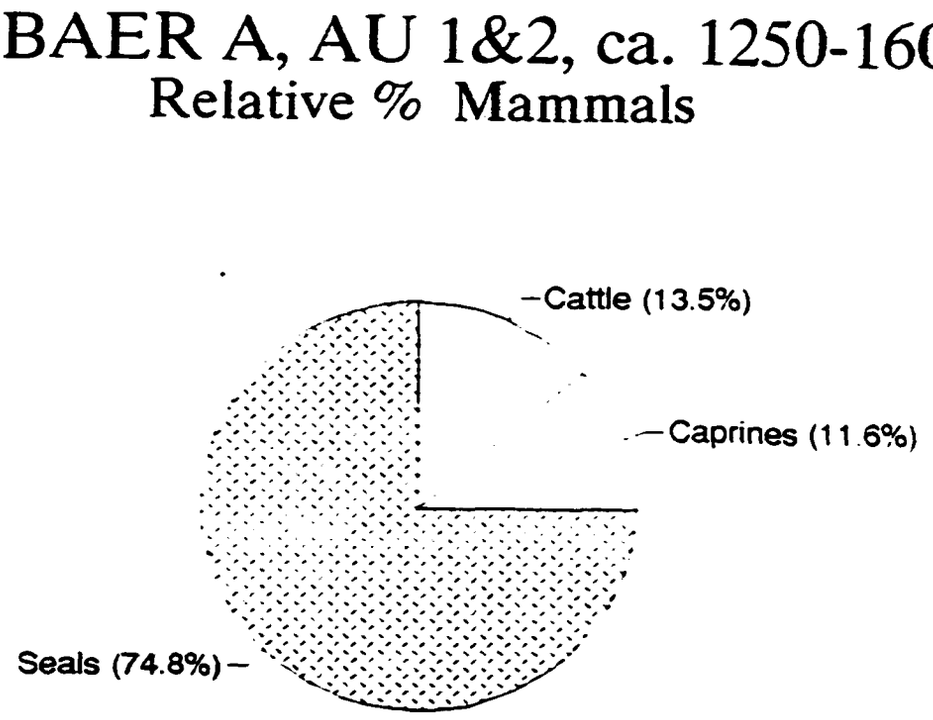

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Figure 5.75 - The relative percentage of the major mammalian taxa recovered from the Midbaer site. The three Analytic Units (AU 1-3) are graphed for sake of comparison.

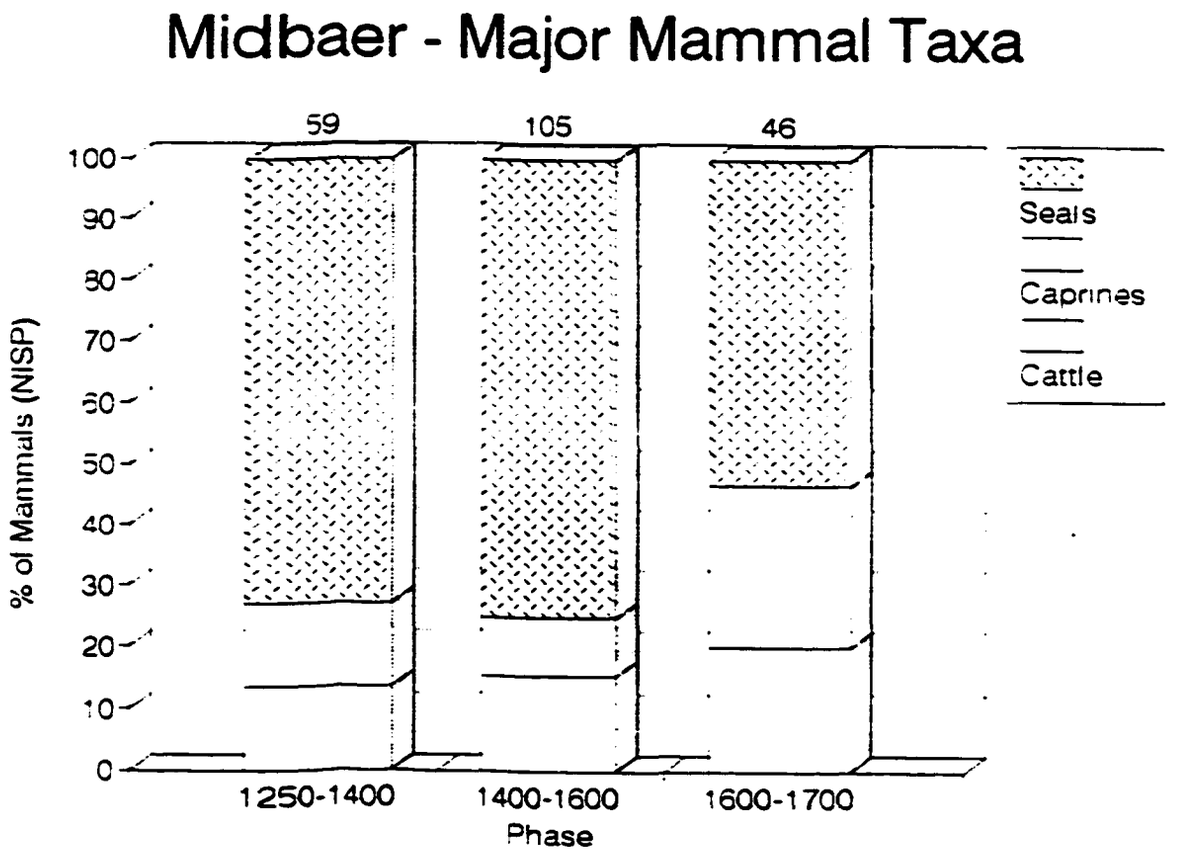

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Figure 5.76 - The relative percentage of the major taxa recovered from the Midbaer site. The three Analytic Units (AU 1-3) are graphed for sake of comparison.

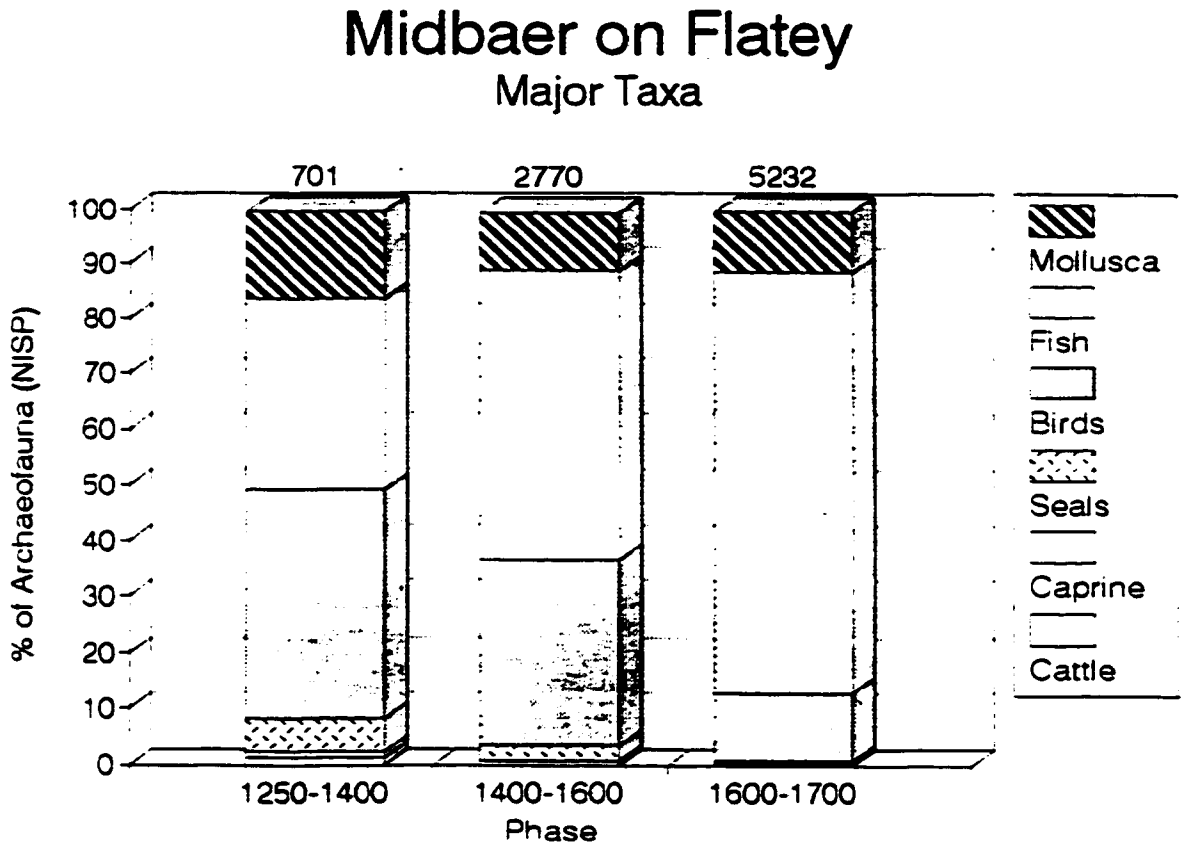

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Figure 5.77 - The neonatal percentage data for caprines, cattle and phocids (seals) recovered from the Midbaer site.

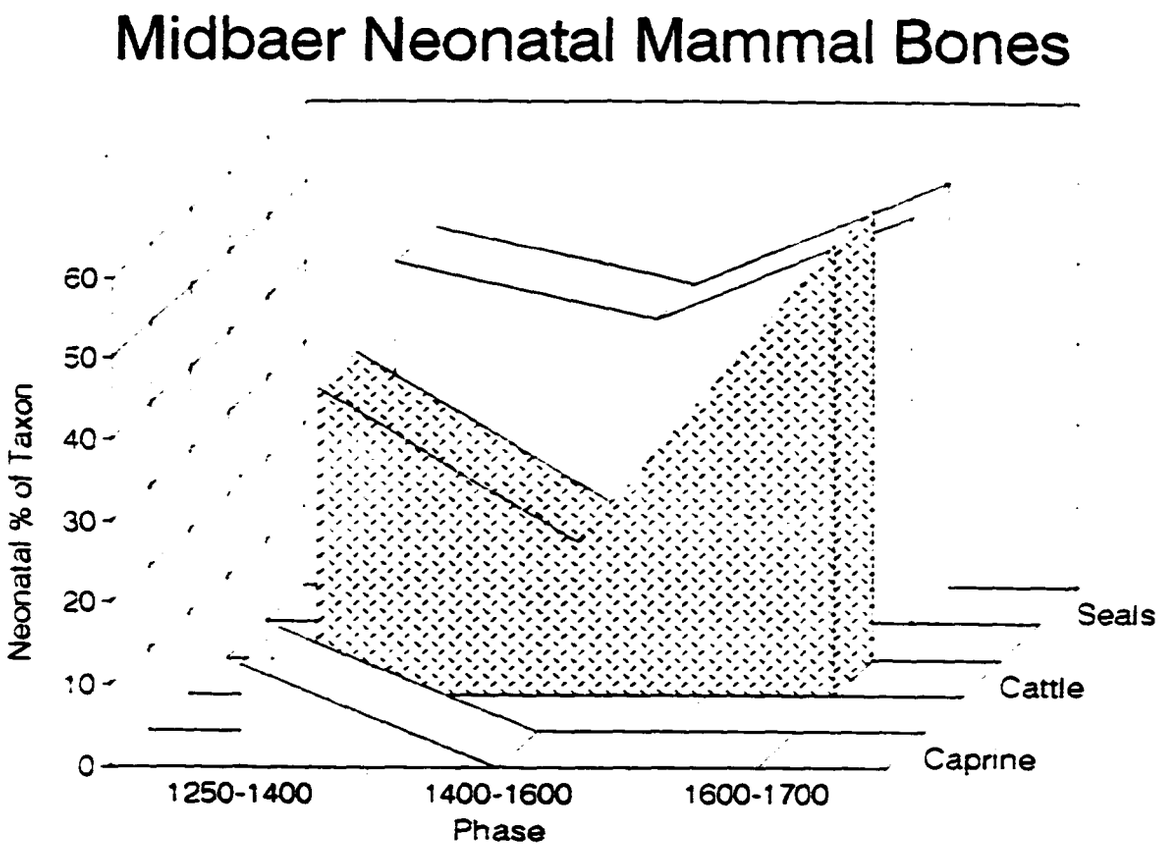

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Figure 5.78 - The location of the wreck ***Melackmeyt*** in the north harbor known as Hofnin (Yngra flak translates to the Younger (ship) wreck, Eldra flak translates to the Older (ship) wreck, Akkeri is anchor and Fallstykkki translates to cannon, the map is from Einarsson 1993b) just off the island of Flatey.

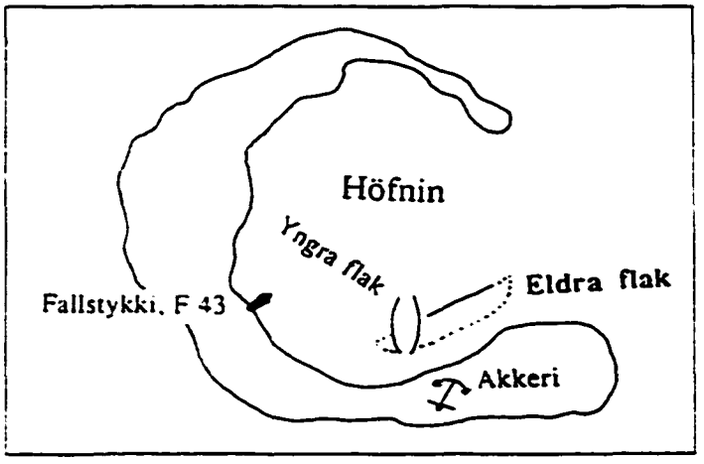

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Figure 5.79 - Plan view of the wreck of the ***Melaackmeyt*** (kannadir retir translates to turbated soil section, illustration is from Einarsson 1993b).

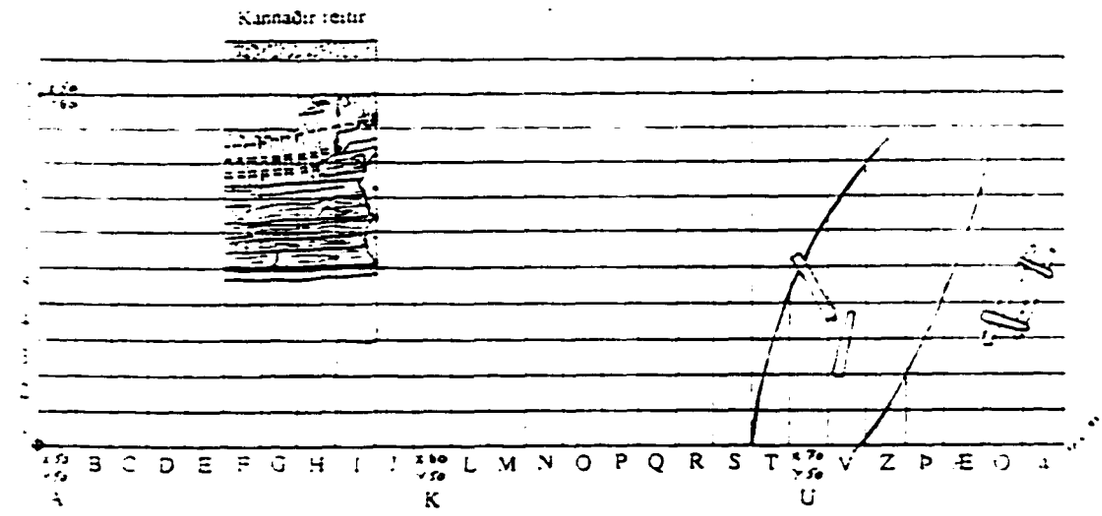

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Figure 5.80 - The location of the Nesstofa (Nes) site along the Seltjarnarnes, Kjosarsysla and in relation to the other sites mentioned in the text.

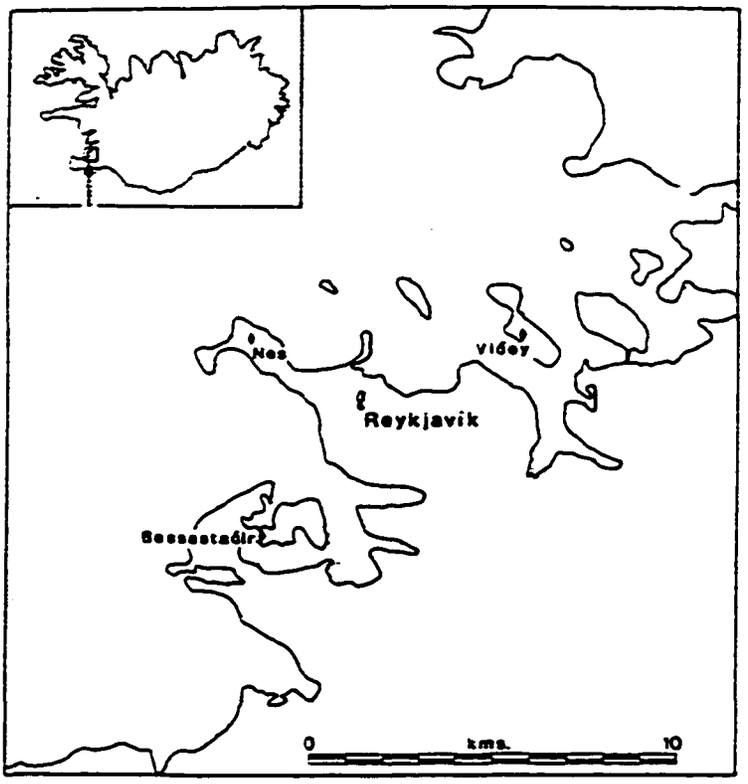

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Figure 5.81 - Site Plan of the Nesstofa (Nes) site and general surroundings (drawing from T. Amorosi 1990, P. Buckland 1990 and G. Olafsson 1979).

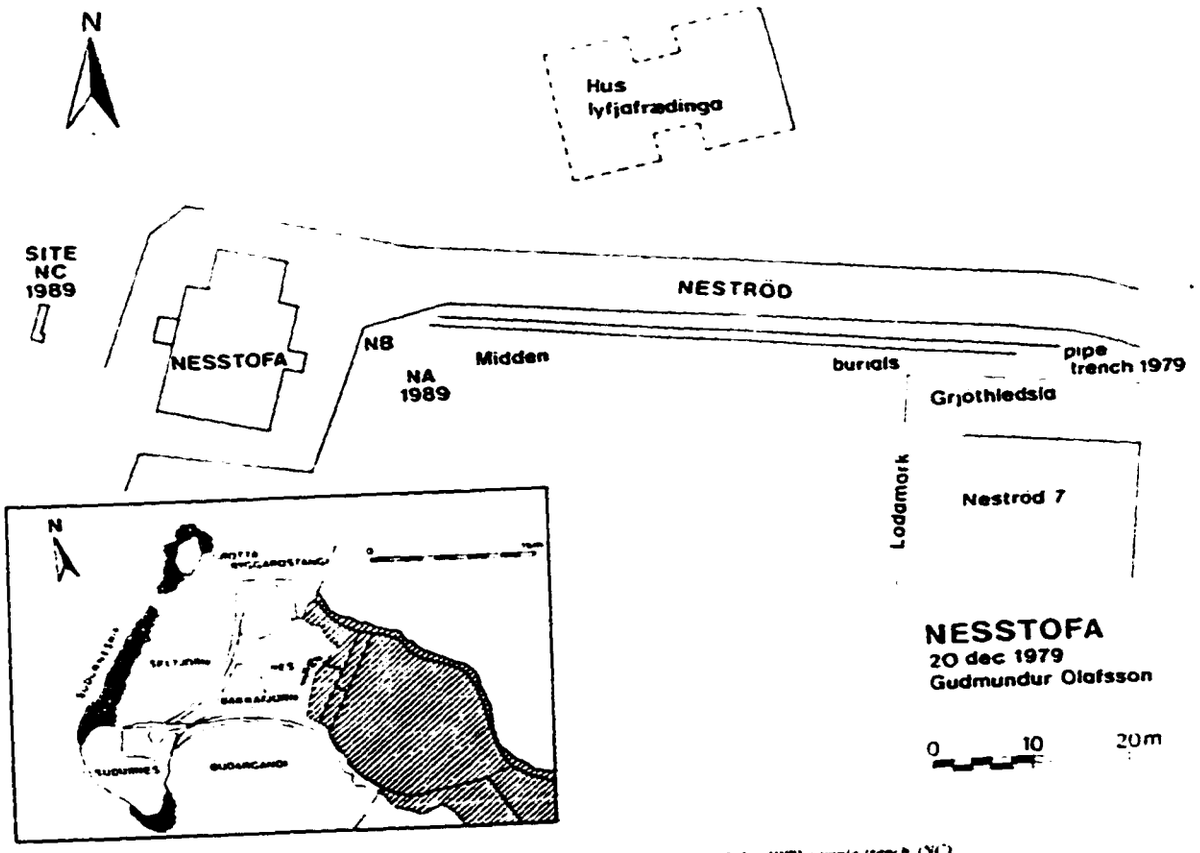

Fig. 9.2 Plan of the site at Nesstofa, showing the location of the 1989 sample trench (NC)

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Figure 5.82 - The east profile of Trench NC (drawing from T. Amorosi, T.H. McGovern and V.O. Vilhjalmson 1989).

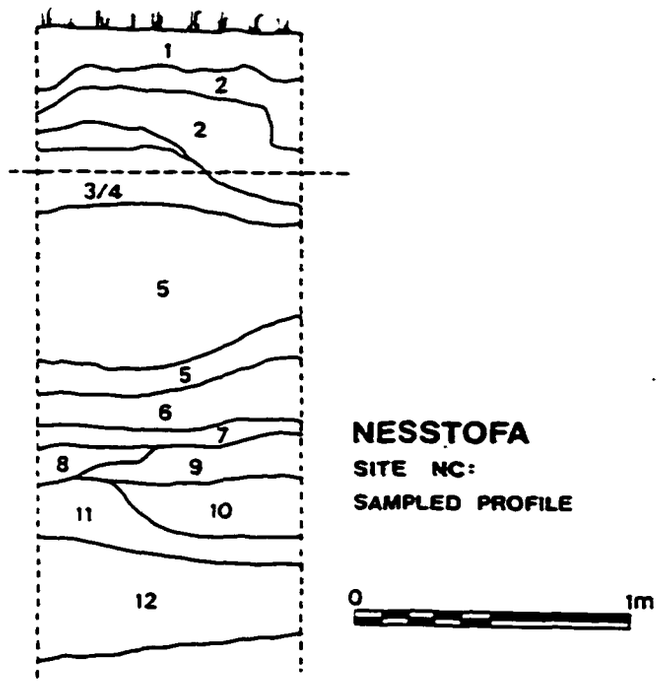

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Figure 5.83 - Sketch of the eastern side of the 1995 test trench at the Nesstofa (Nes) site. Note the sketch is not done to scale.

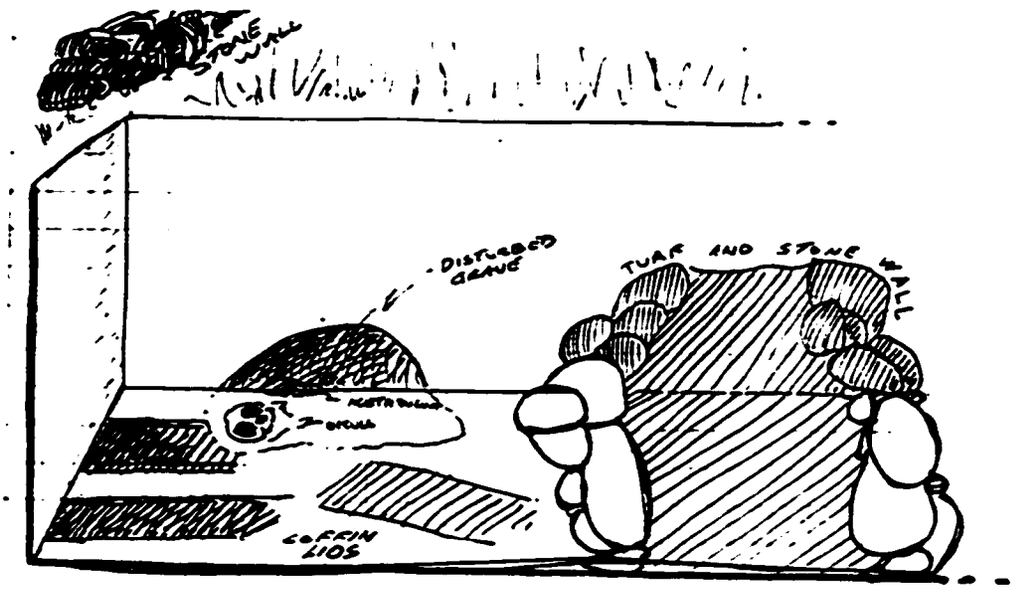

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Figure 5.84 - Sketch of the western side of the 1995 test trench at the Nesstofa (Nes) site. Note the sketch is not done to scale.

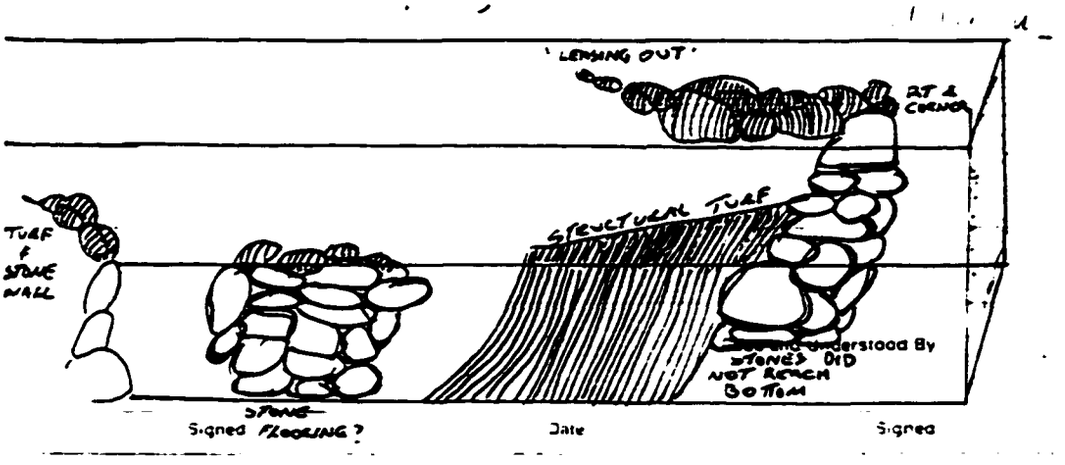

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Figure 5.85 - The relative percentage of the major taxa recovered from Stratigraphic Unit (SU) or Layer 2, NC trench at the Nesstofa site.

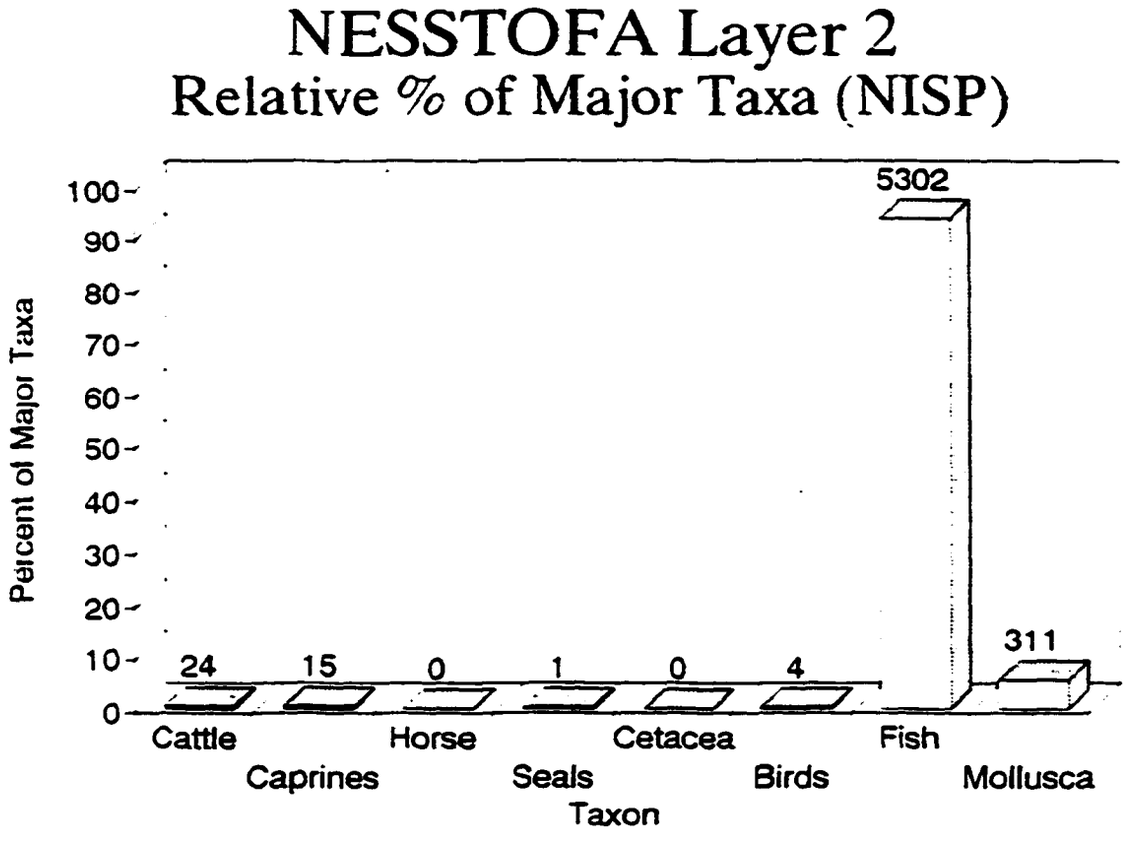

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Figure 5.86 - The relative percentage of the major taxa recovered from SU or Layer 3, NC trench at the Nesstofa site.

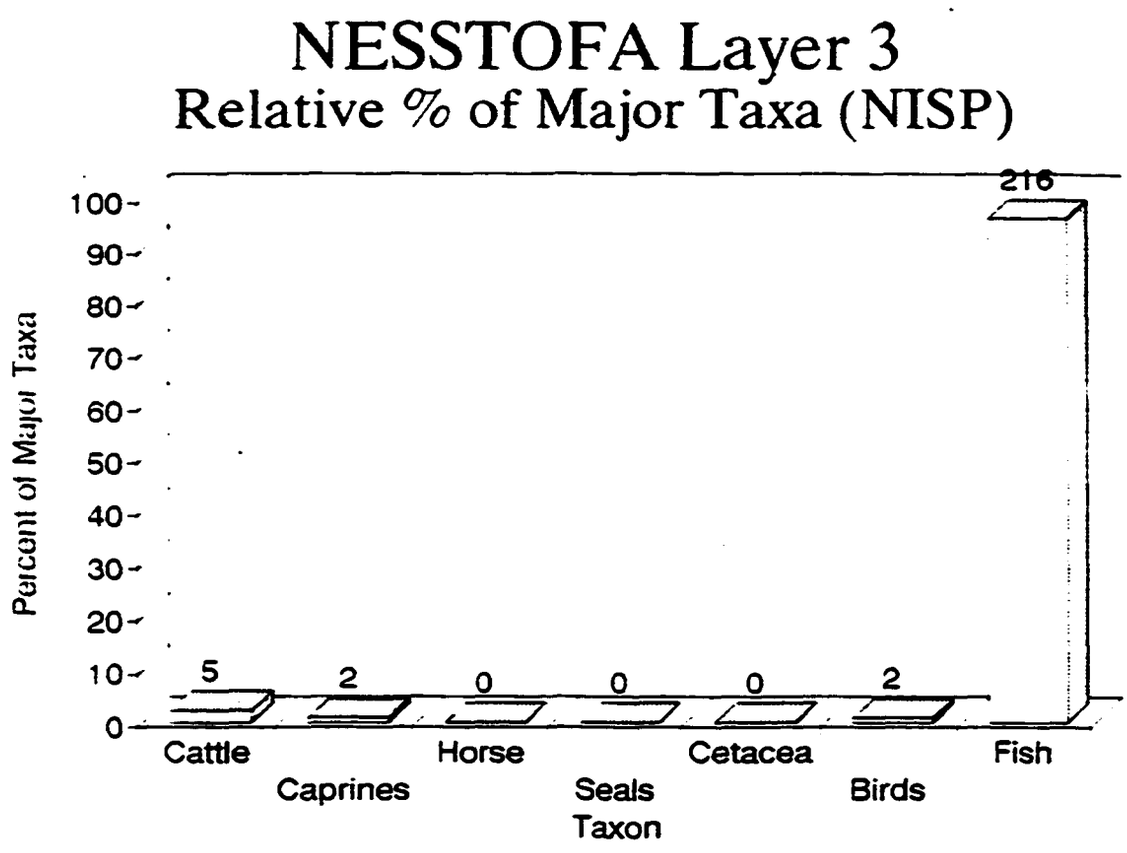

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Figure 5.87 - The relative percentage of the major taxa recovered from SU or Layer 5, NC trench at the Nesstofa site.

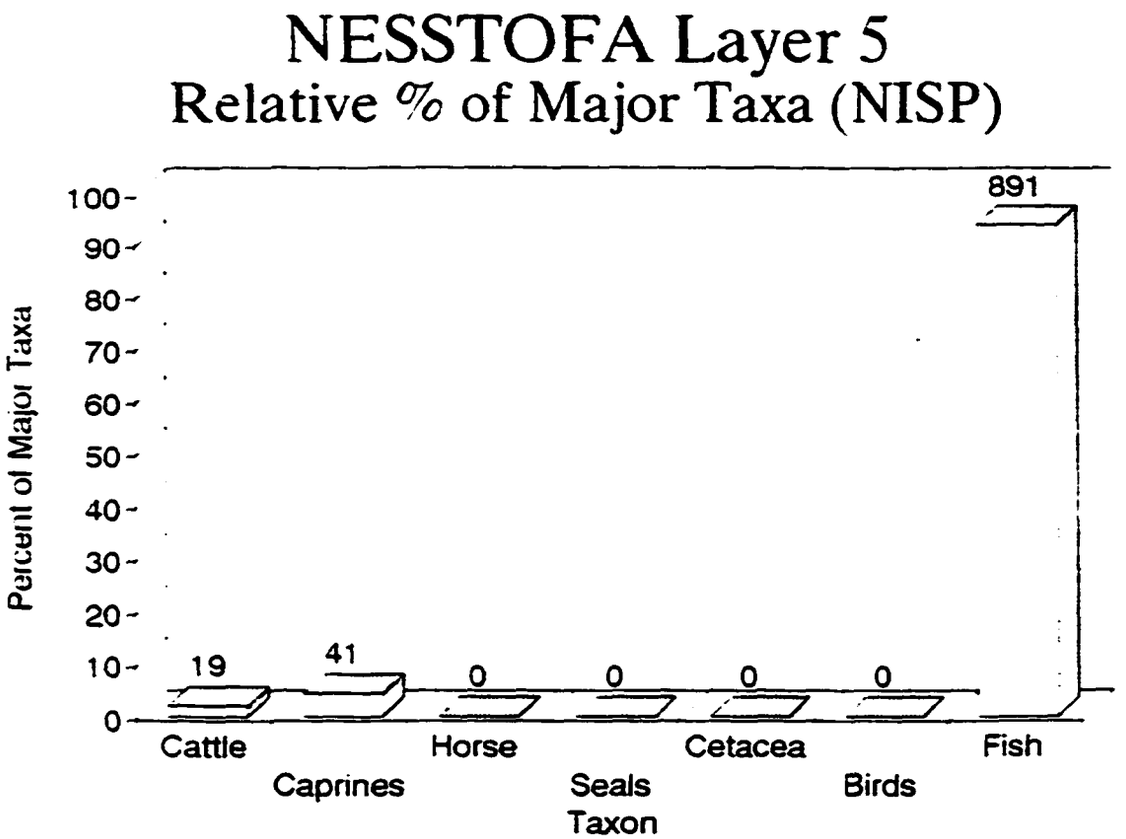

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Figure 5.88 - The relative percentage of the major taxa recovered from SU or Layer 6, NC trench at the Nesstofa site.

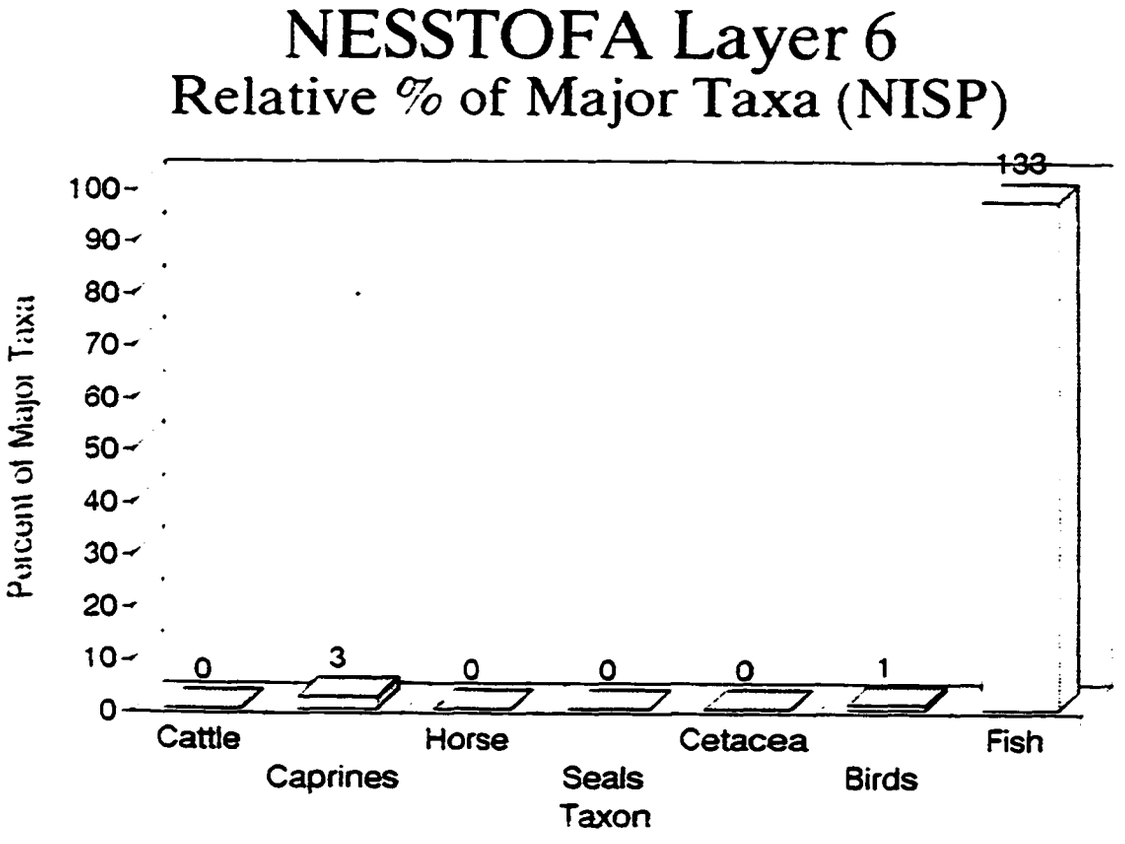

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Figure 5.89 - The relative percentage of the major taxa recovered from SU or Layer 7, NC trench at the Nesstofa site.

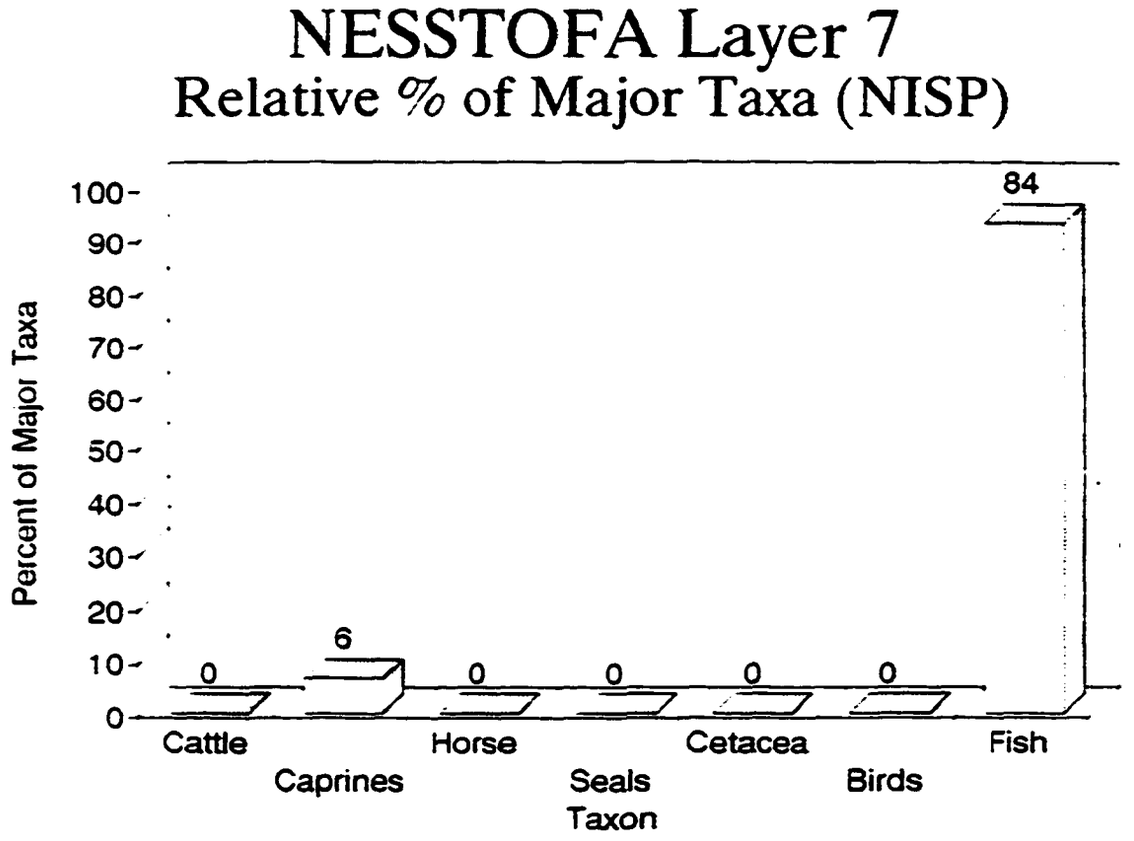

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Figure 5.90 - The relative percentage of the major taxa recovered from SU or Layer 8, NC trench at the Nesstofa site.

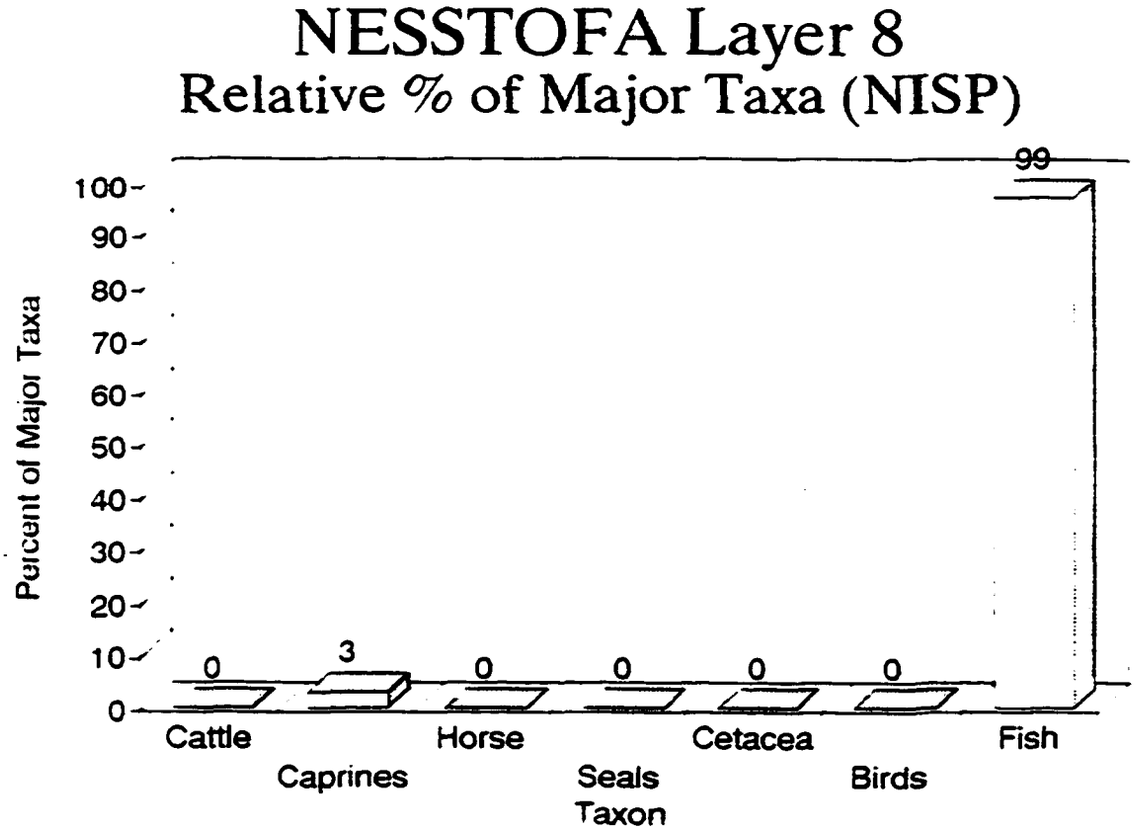

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Figure 5.91 - The relative percentage of the major taxa recovered from SU or Layer 9, NC trench at the Nesstofa site.

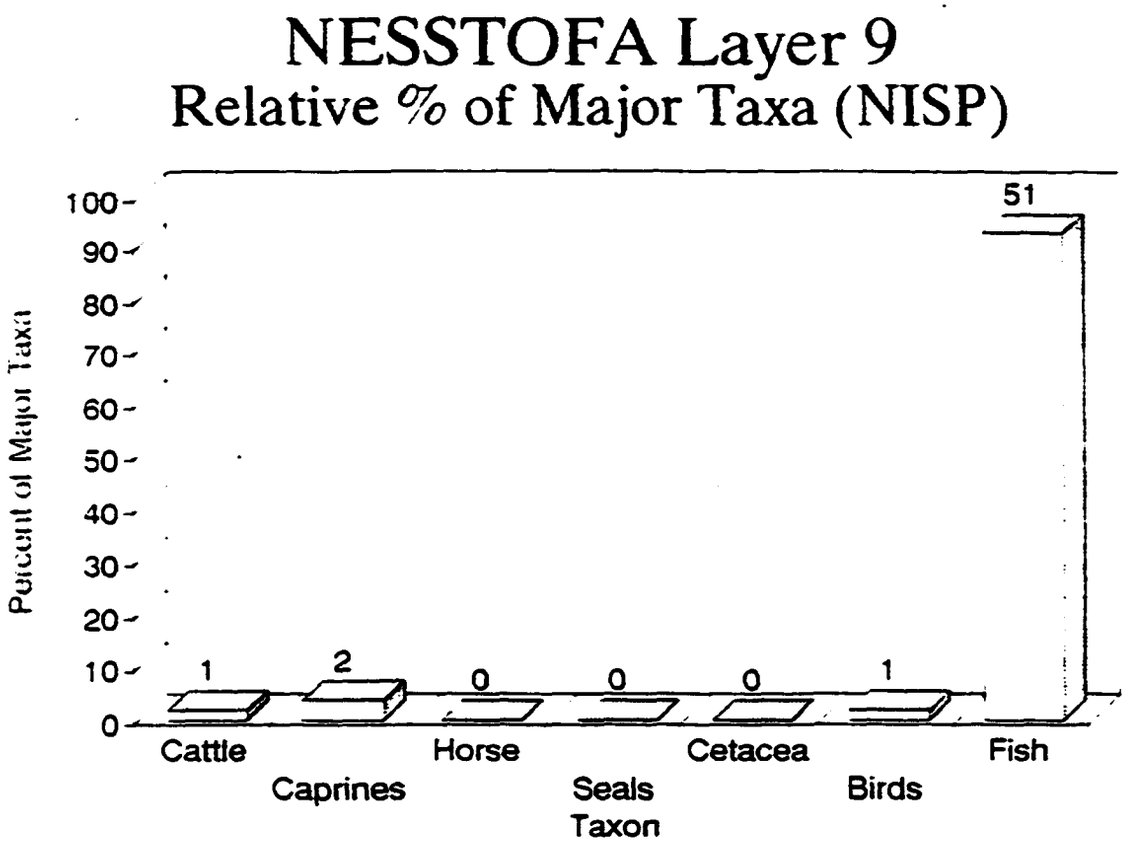

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Figure 5.92 - The relative percentage of the major taxa recovered from SU or Layer 10, NC trench at the Nesstofa site.

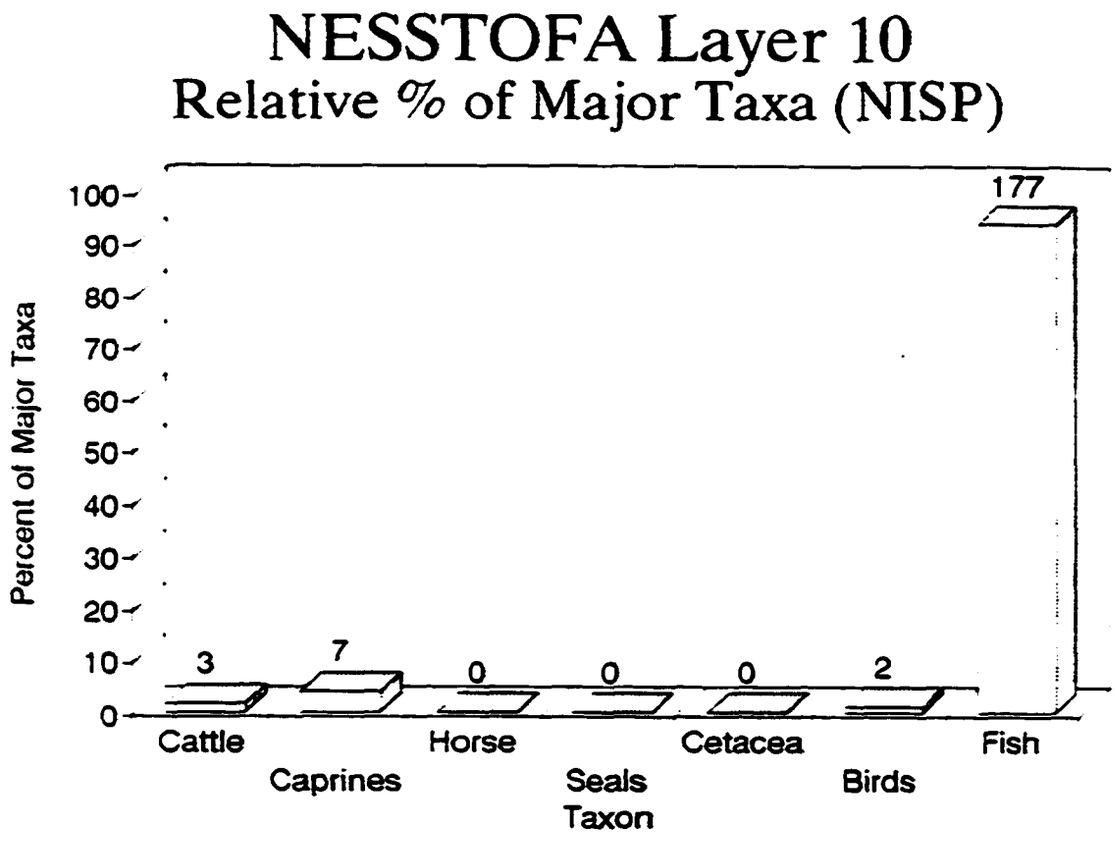

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Figure 5.93 - The relative percentage of the major taxa recovered from SU or Layer 11, NC trench at the Nesstofa site.

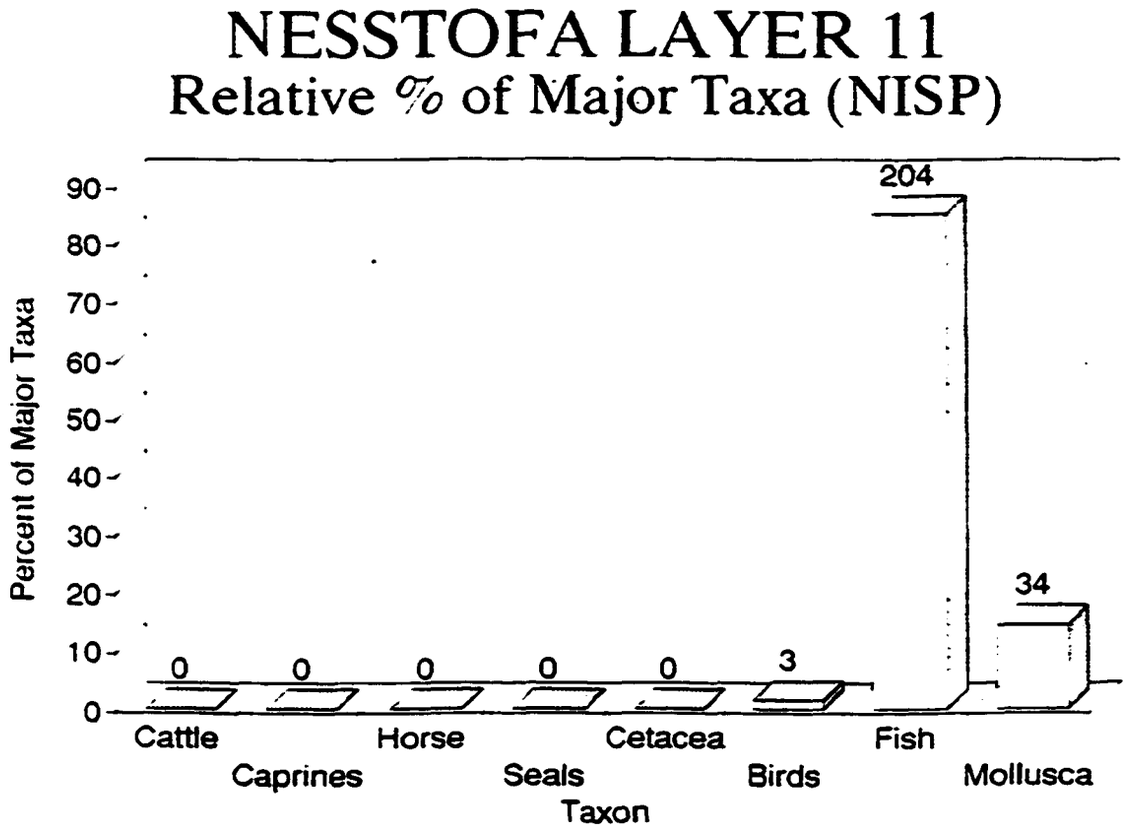

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Figure 5.94 - The relative percentage of the major taxa recovered from SU or Layer 12, NC trench at the Nesstofa site.

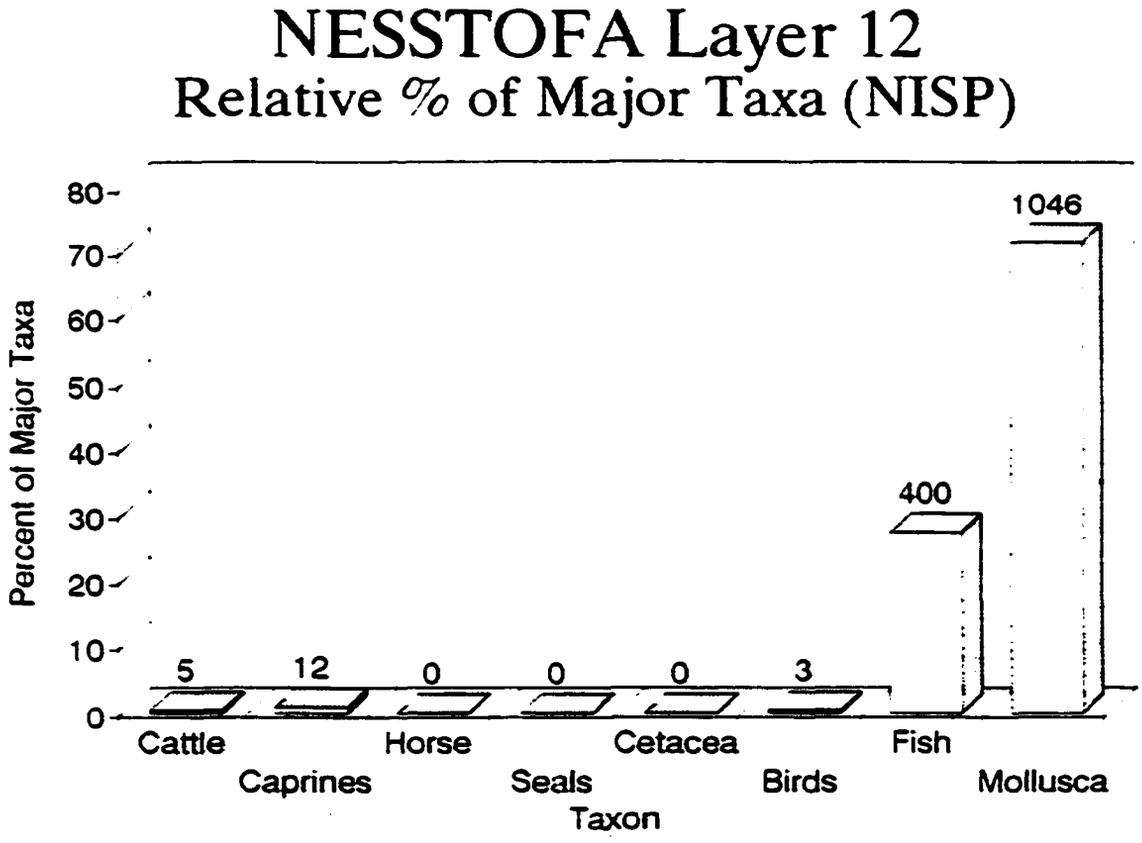

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Figure 5.95 - The relative percentage of the major taxa listed by Stratigraphic Unit or Layer recovered from the NC trench at the Nesstofa site.

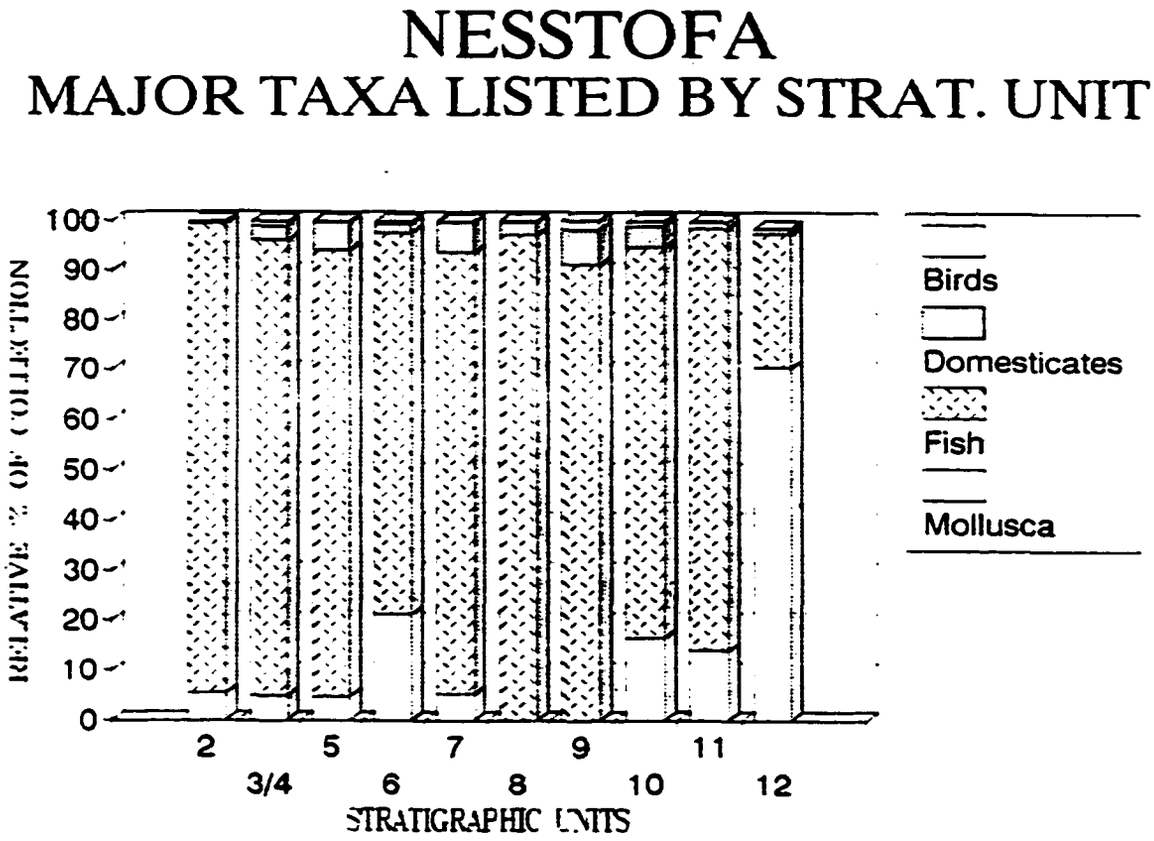

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Figure 5.96 - An Analytic Unit (AU) comparison of the relative percentage of the major taxa recovered from the NC trench at the Nesstofa site.

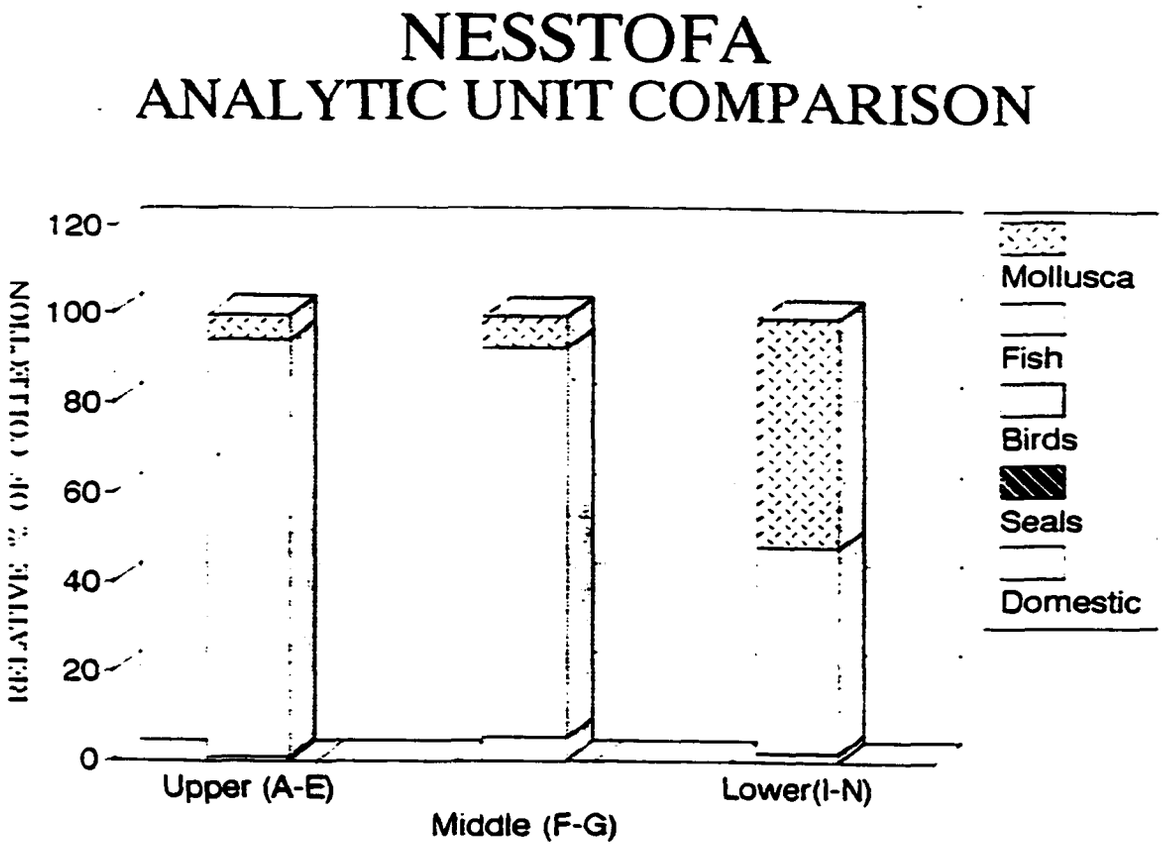

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Figure 5.97 - The location of the Akurvik (4901-1) and Gjogur(4901-7) sites in Arneshreppur, Strandasysla, northwestern Iceland. Sites number 4901-2 is a fishing booth designated as Pollvik I, 4901-3 is a hunting blind designated as Pollvik II, 4901-4 is a modern turf garden wall designated as Pollvik III. Site designation 4901-8 is the Reykjanes farmstead. Site designation 4901-14 is the Gislabali tenant farm or sel and 4901-18 is another tenant farm designated as Avikurdalur. These two tenant farms were either owned by the Reykjanes and/or Gjogur farmsteads.

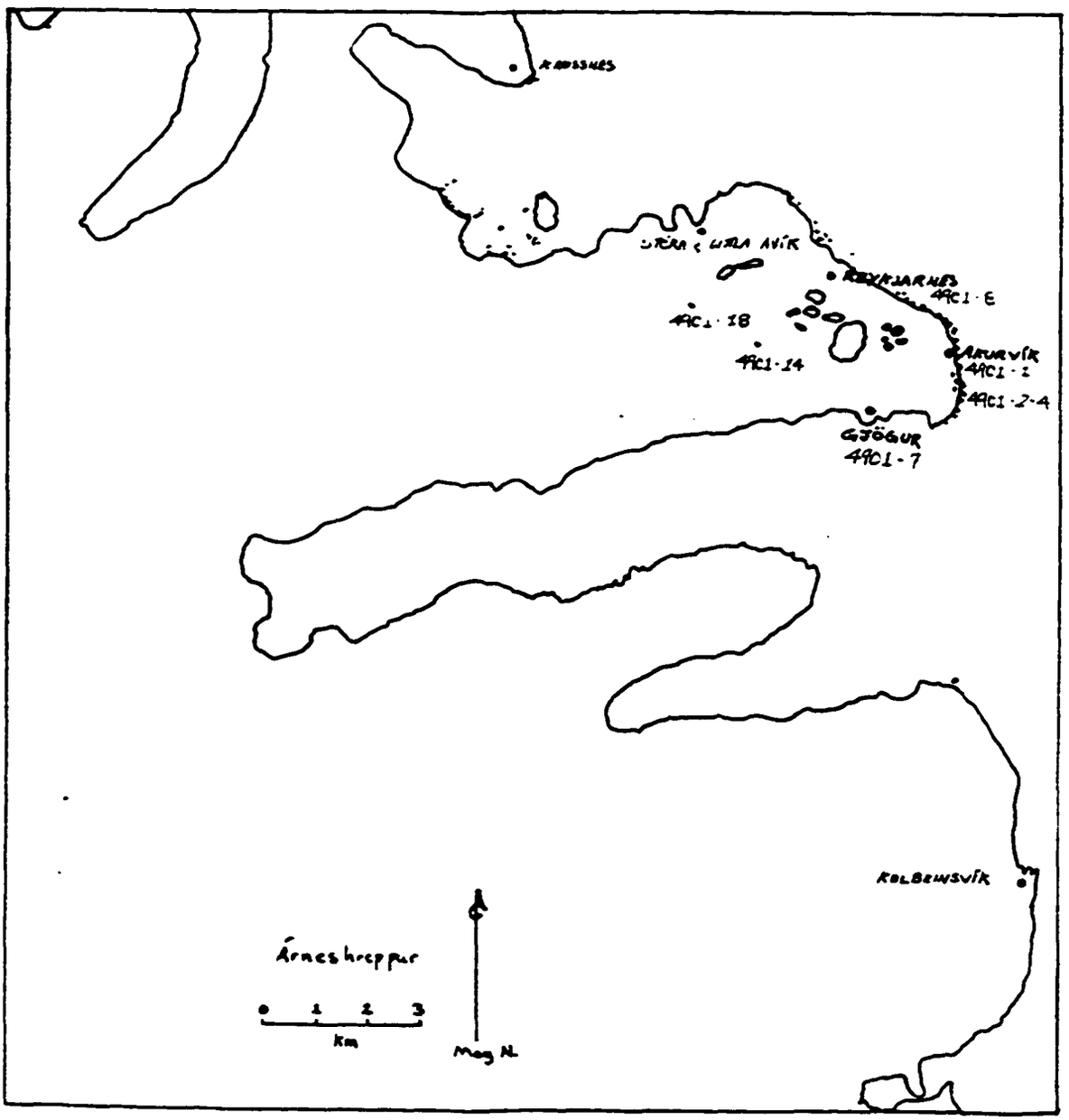

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Figure 5.98 - The 1988 Pace and compass site plan of the Akurvik site. Included on this same plan is a profile of the south facing profile designated as Profile #2.

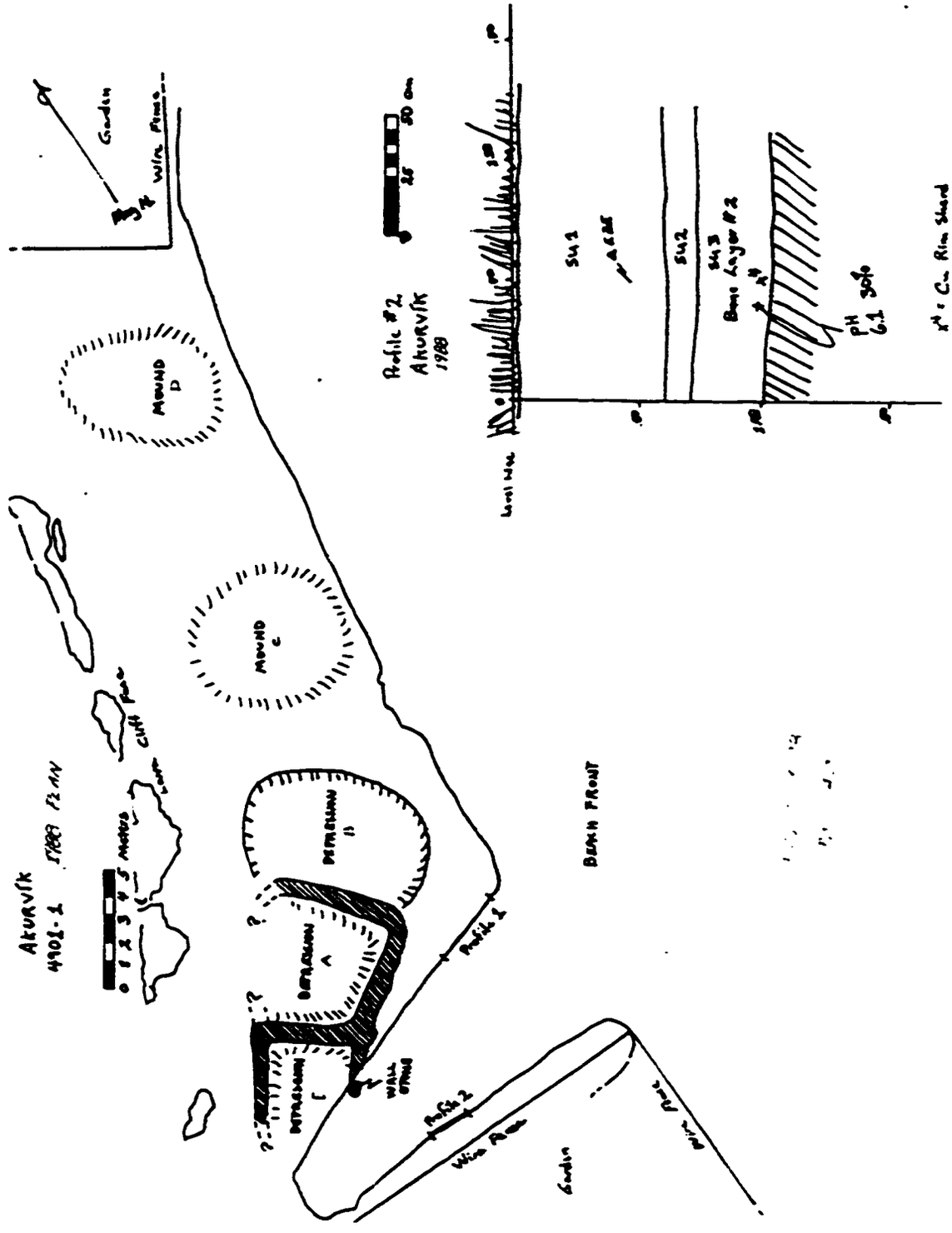

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Figure 5.99 - The EDM map of the Akurvik site area (mapped by P.C. Buckland 1990).

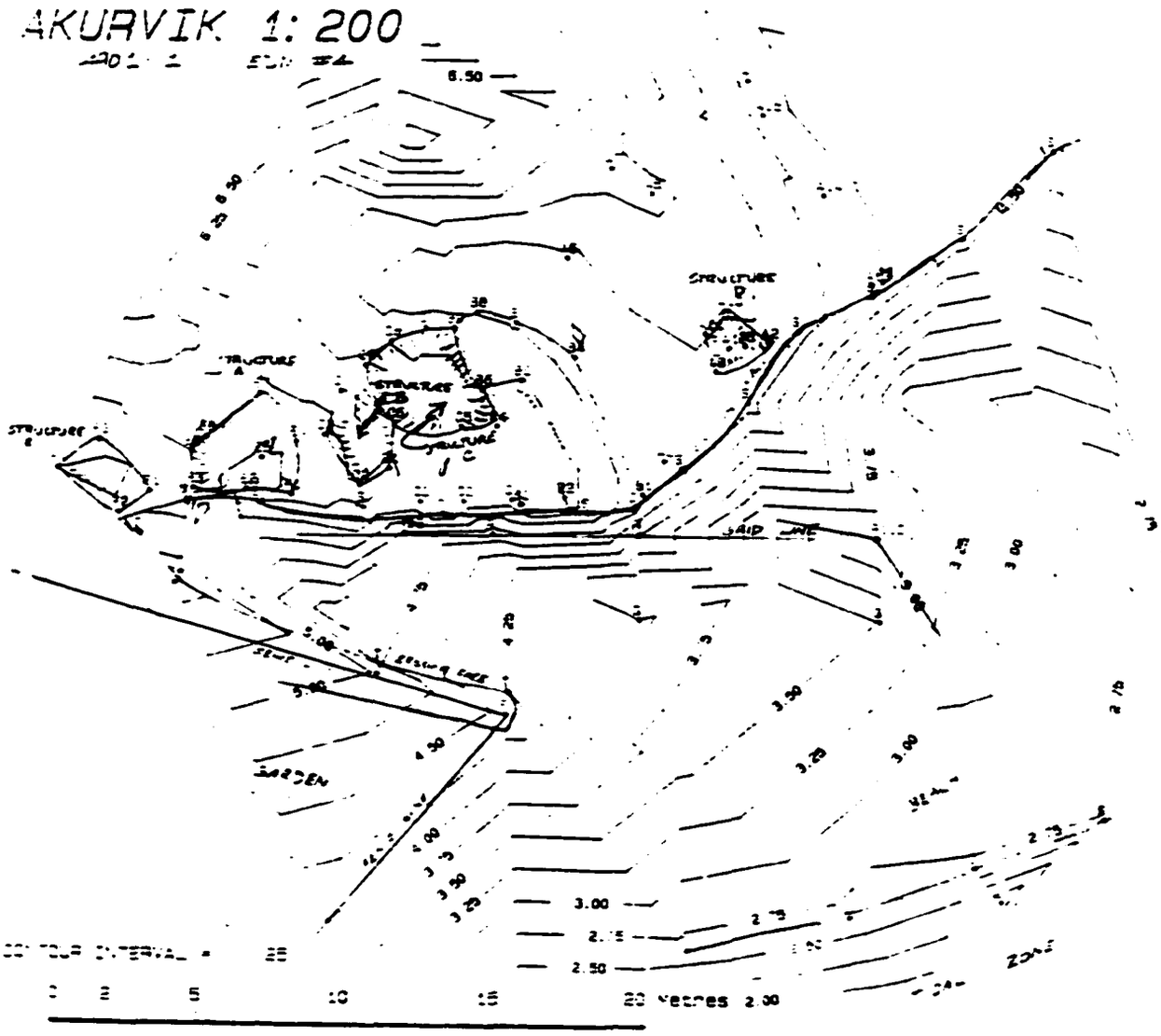

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Figure 5.100 - Plan view #49, the plan of Structure F at the Akurvik site.

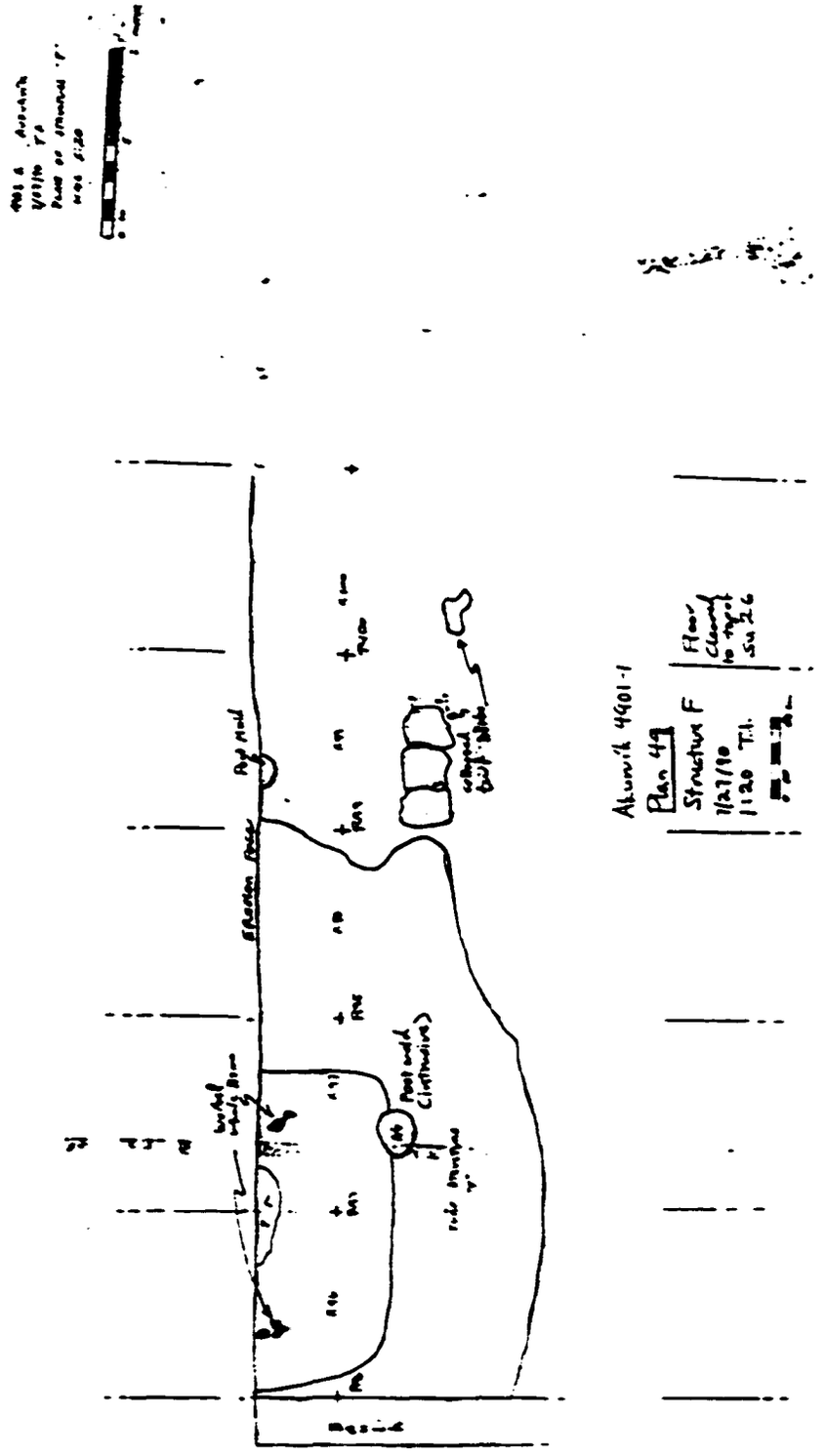

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Figure 5.101 - Plan View #50, the plan of Structure F at the Akurvik site. Plan shows the floor layer that was encountered with the turf fishing booth (plan drawn by T.H. McGovern).

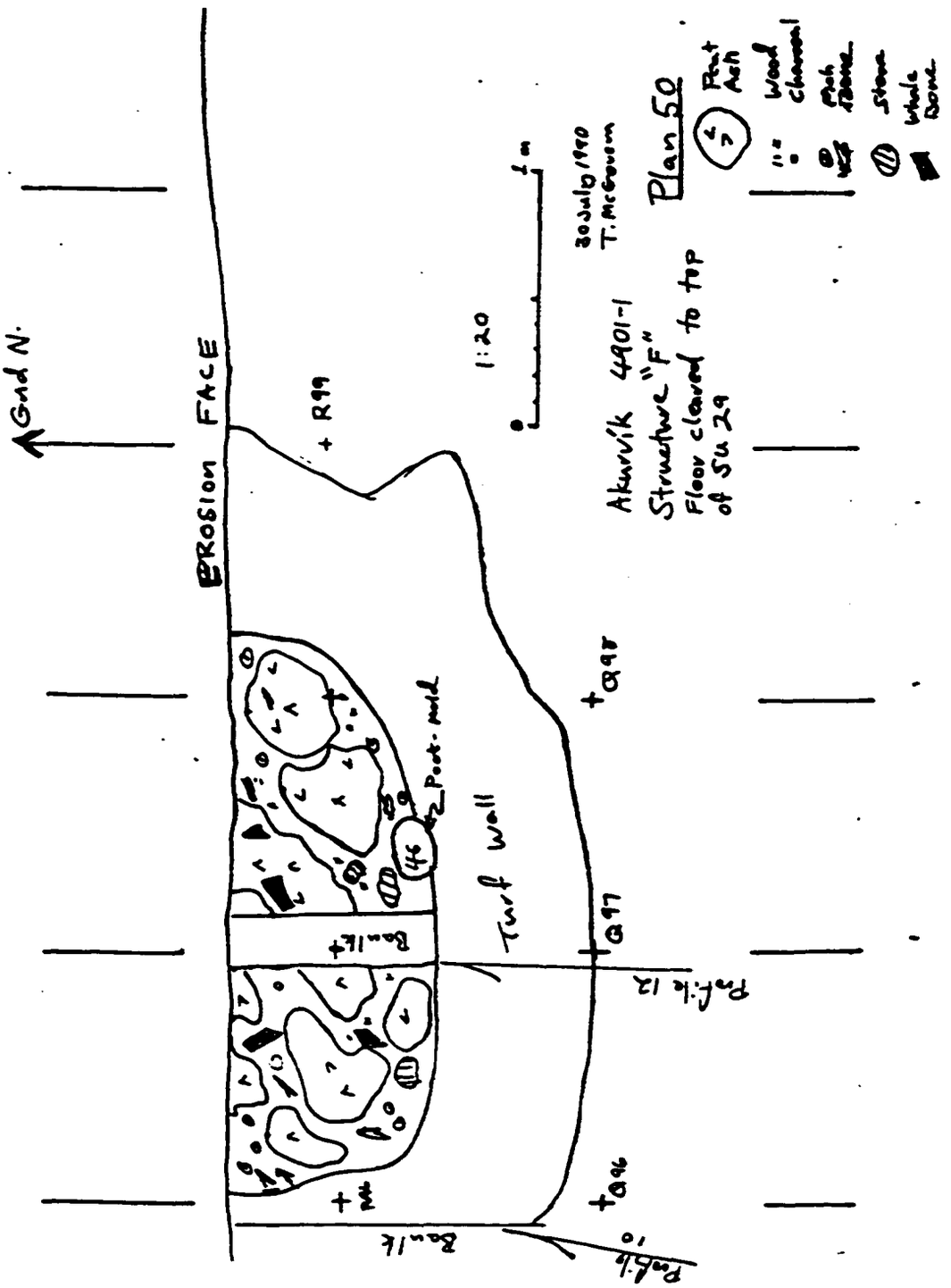

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Figure 5.102 - Profile #11, the North profile of the Akurvik site (plan is drawn by T. Amorosi and T.H. McGovern).

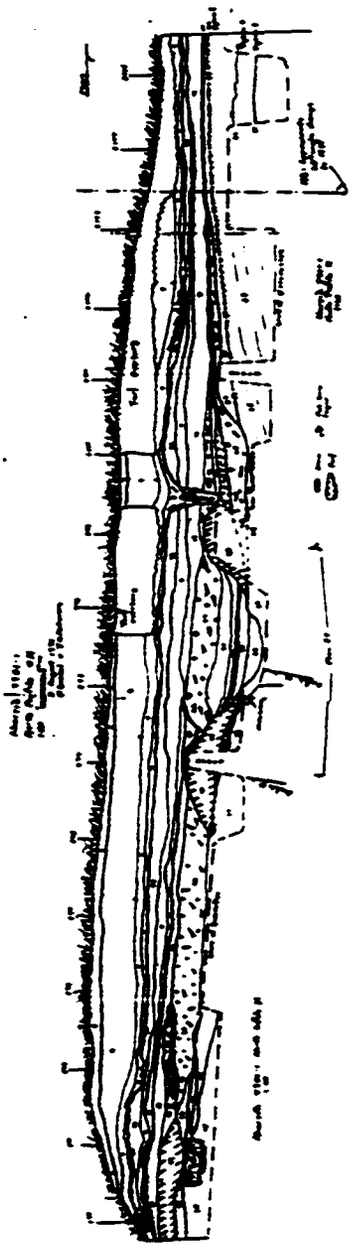

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Figure 5.103 - Sketch plan of the floor layers in Structure F at the Akurvik site. Note the sketch is not drawn to scale.

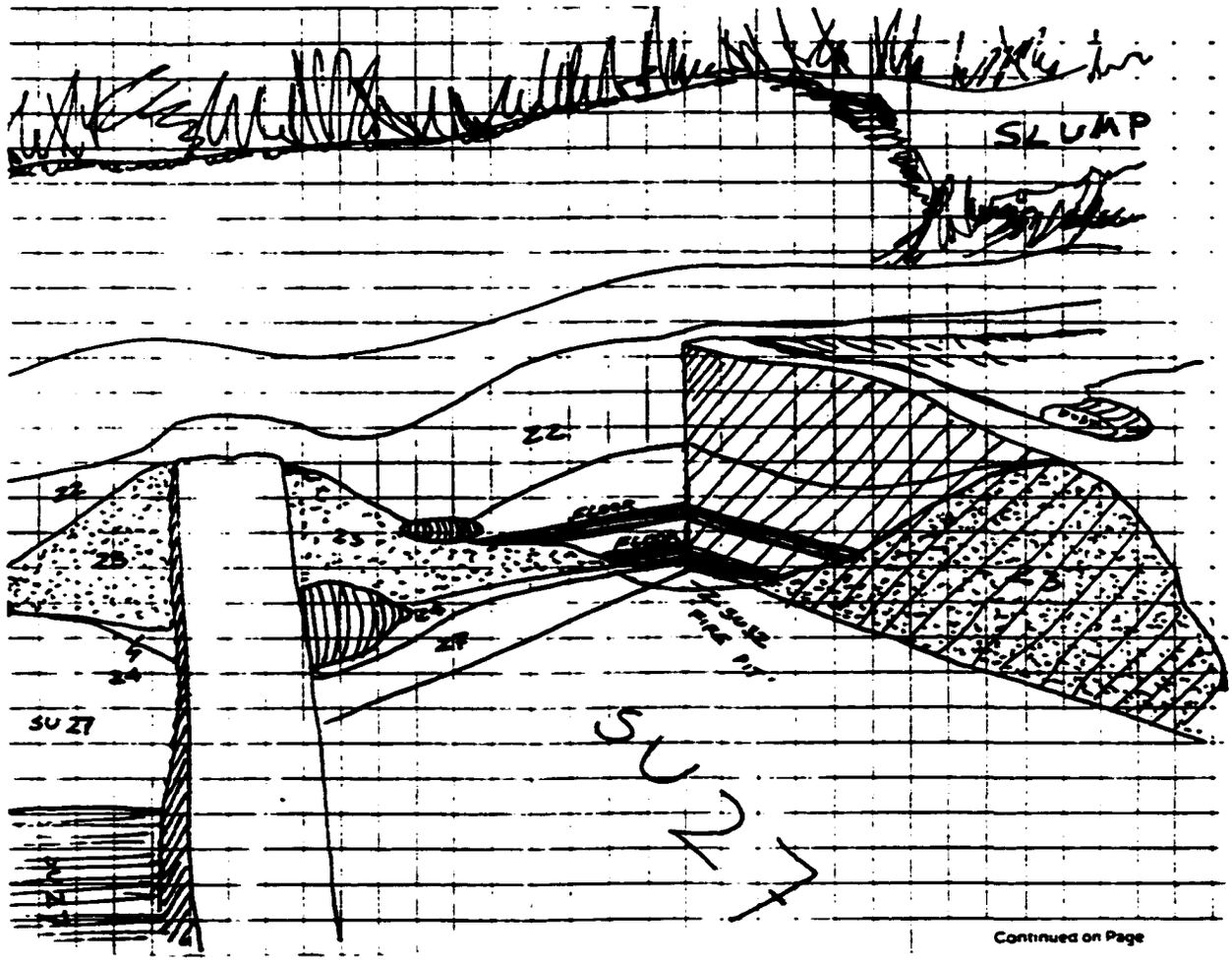

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Figure 5.104 - Sketch plan of the structural turf in Structure F at the Akurvik site. Note sketch is not drawn to scale.

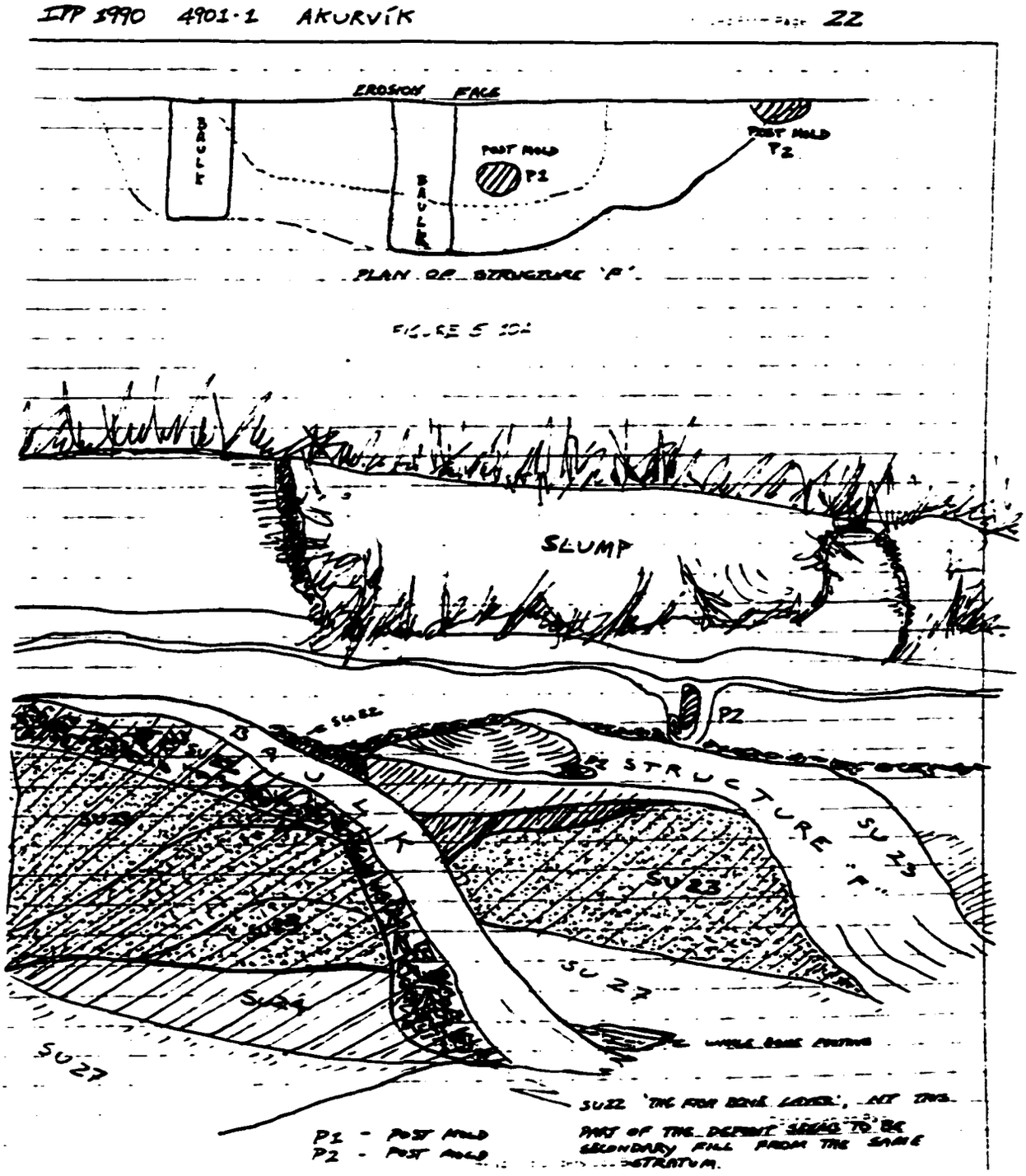

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Figure 5.105 - Profile #10, the profile along the grid co-ordinate Q,R, S 96 of Structure F at the Akurvik site.

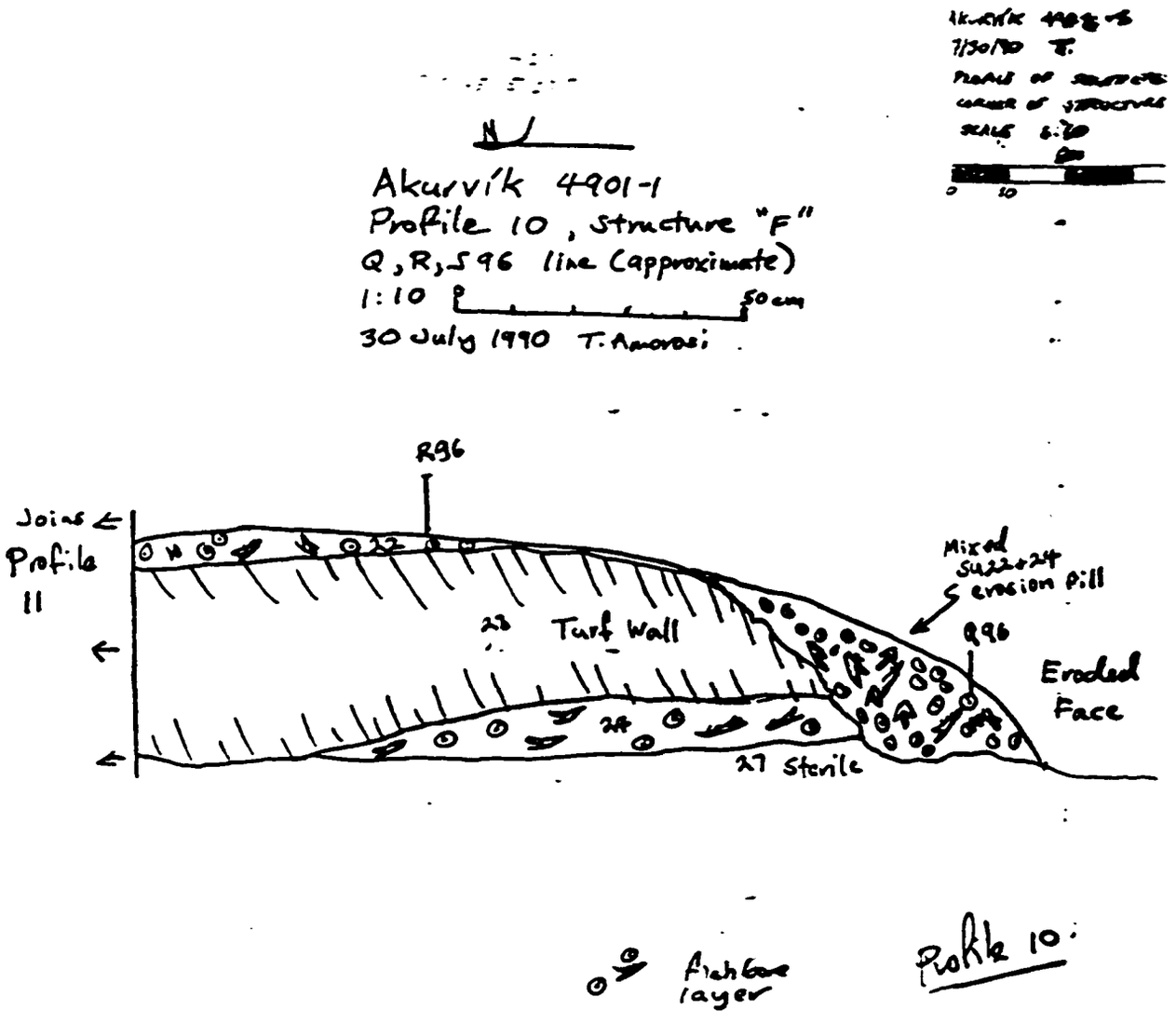

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Figure 5.106 - Profile #12, the profile along the grid co-ordinates R, S 97 of Structure F at the Akurvik site (Plan is drawn by T.H. McGovern).

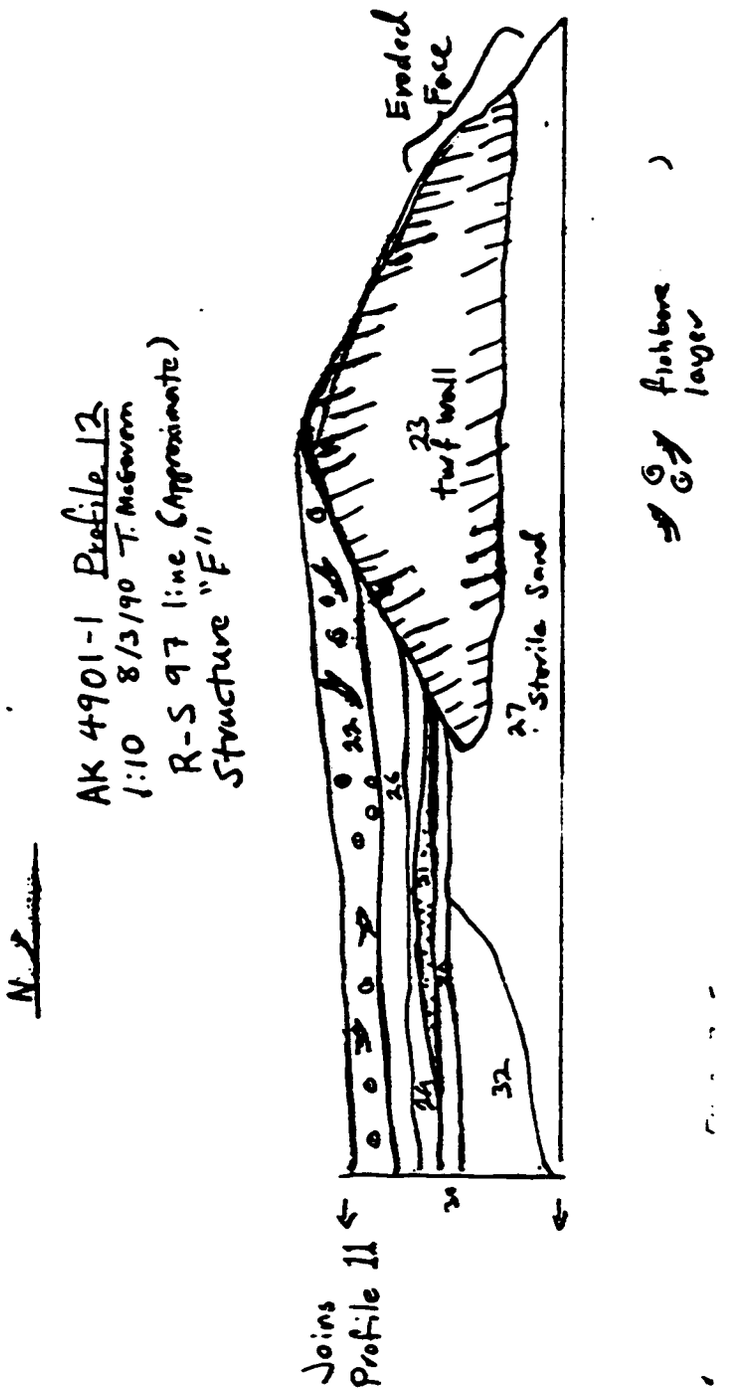

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Figure 5.107 - Illustration of the diagnostic artifacts recovered from the Akurvik site. Artifacts portrayed are A6 - jasper strike-lite, A14 - an iron knife?, A4 - a copper object and A16 - a burin cut sheep tibia.

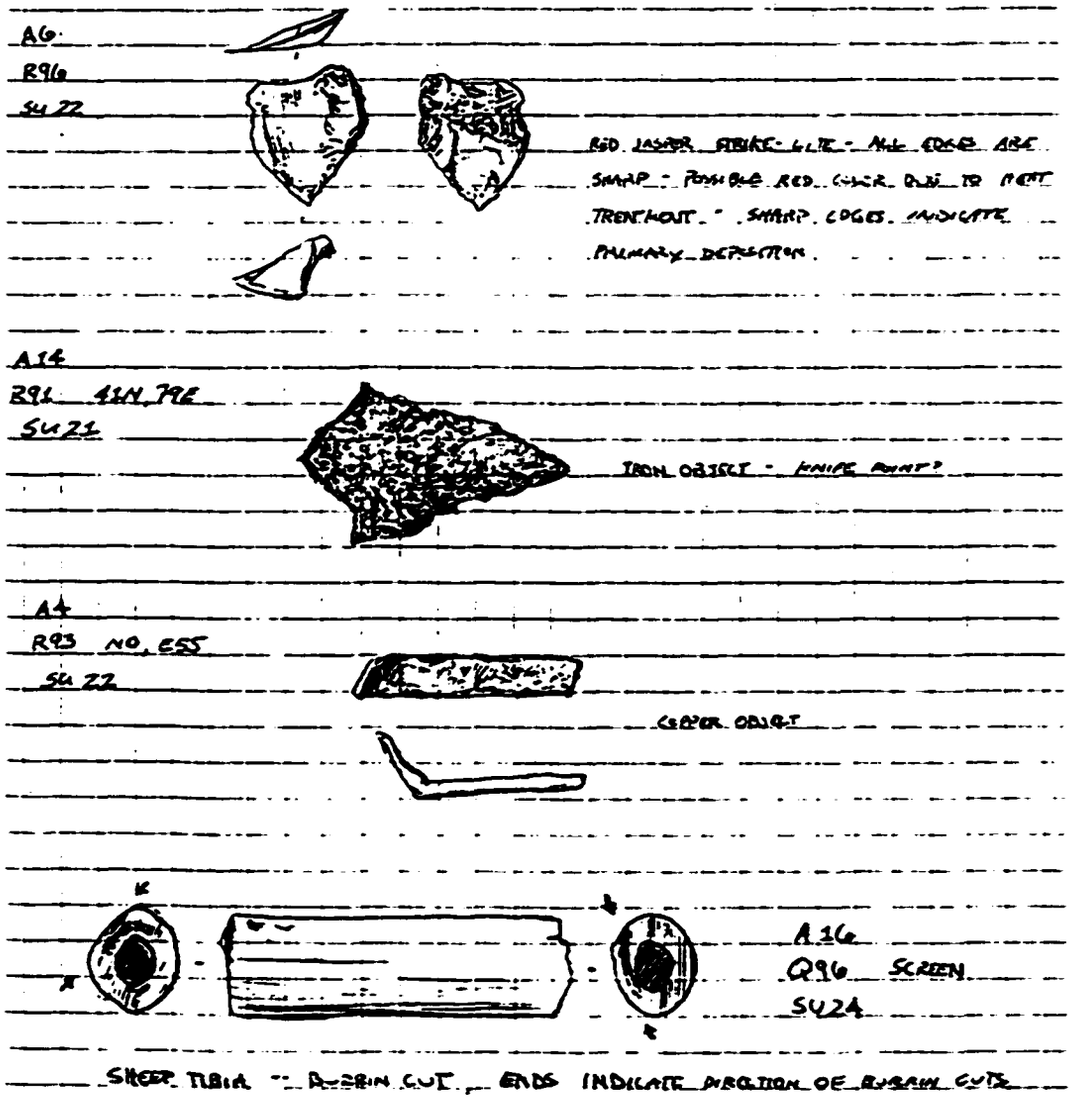

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Figure 5.108 - Illustration of the diagnostic artifacts recovered from the Akurvik site. Artifacts portrayed are A15- a whale bone preform, A2 - a copper sheet fragment and A12 - an iron object, possibly the head of boat nail.

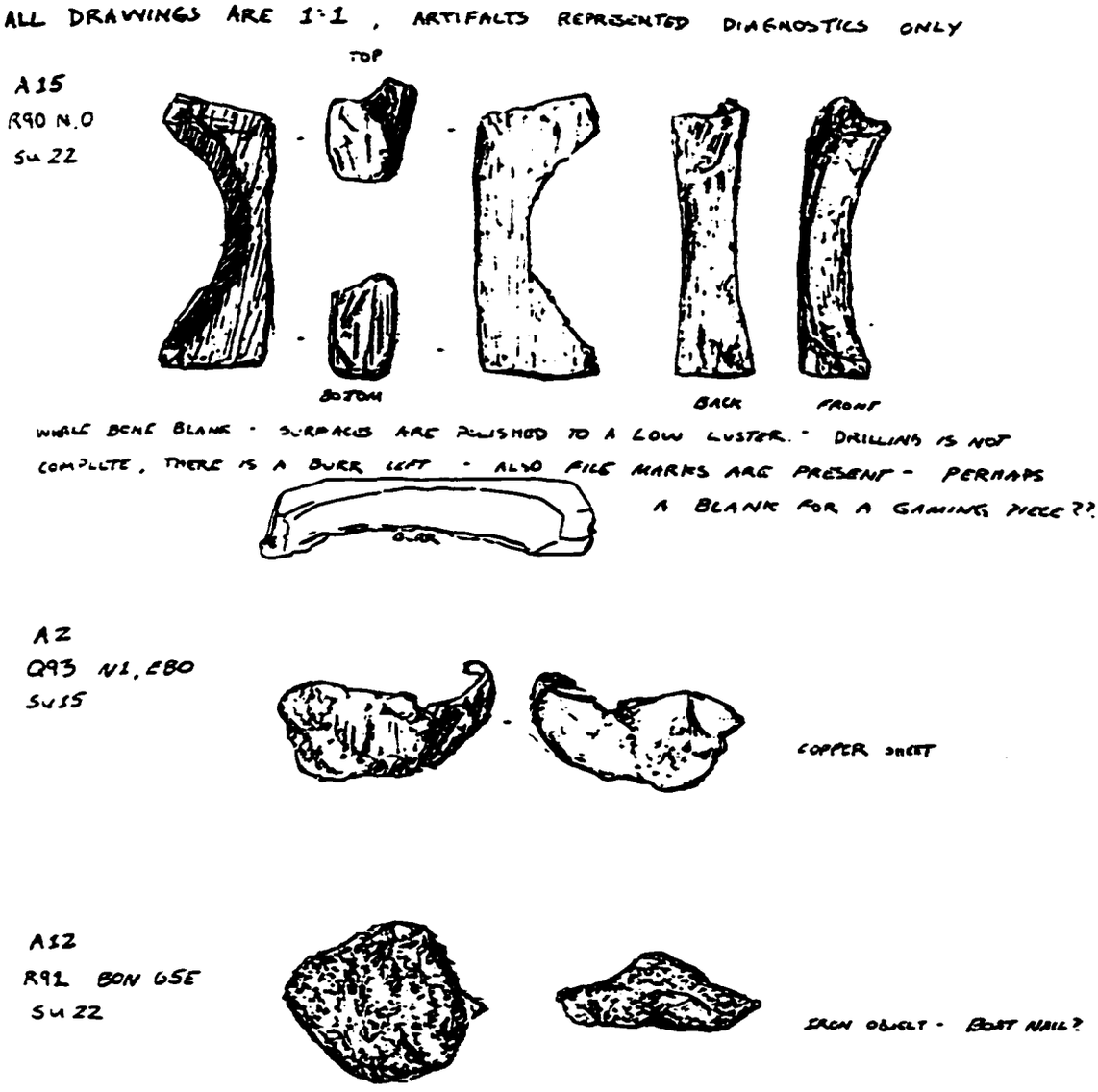

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Figure 5.109 - The deposit model for the formation of the Akurvik site.

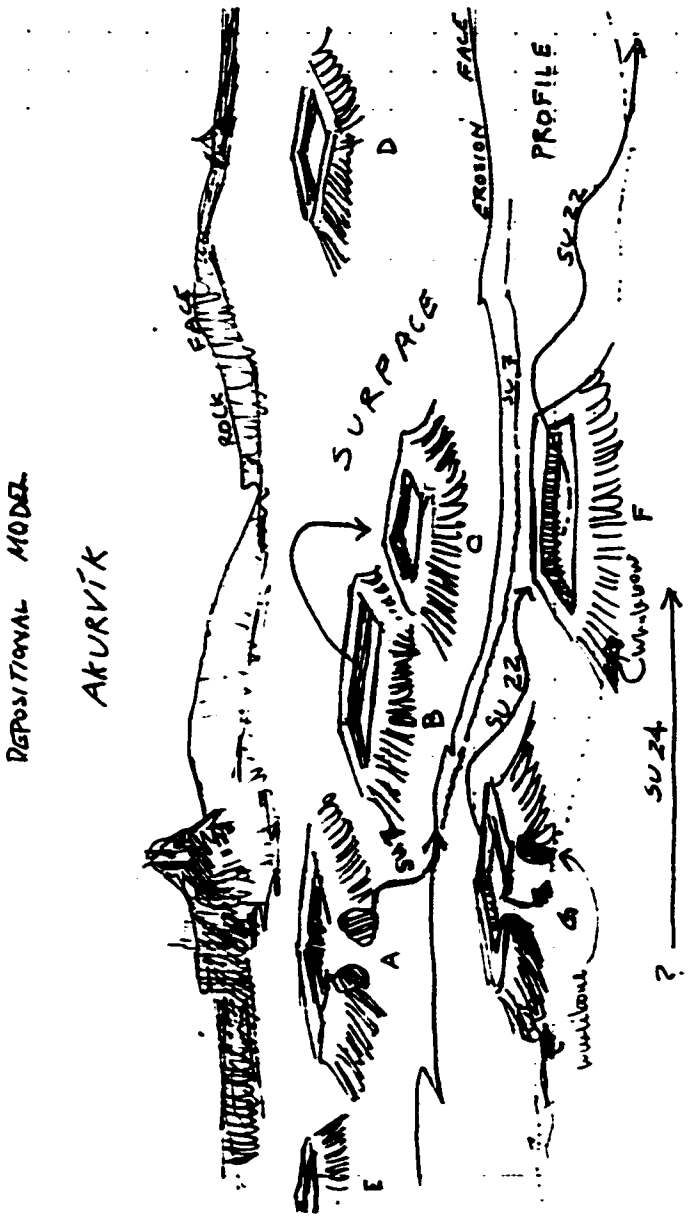

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Figure 5.110 - The EDM for the Gjogur site (4901-7), Arneshreppur, Strandasysla (mapped by T. Amorosi, P.C. Buckland and J. Sadler).

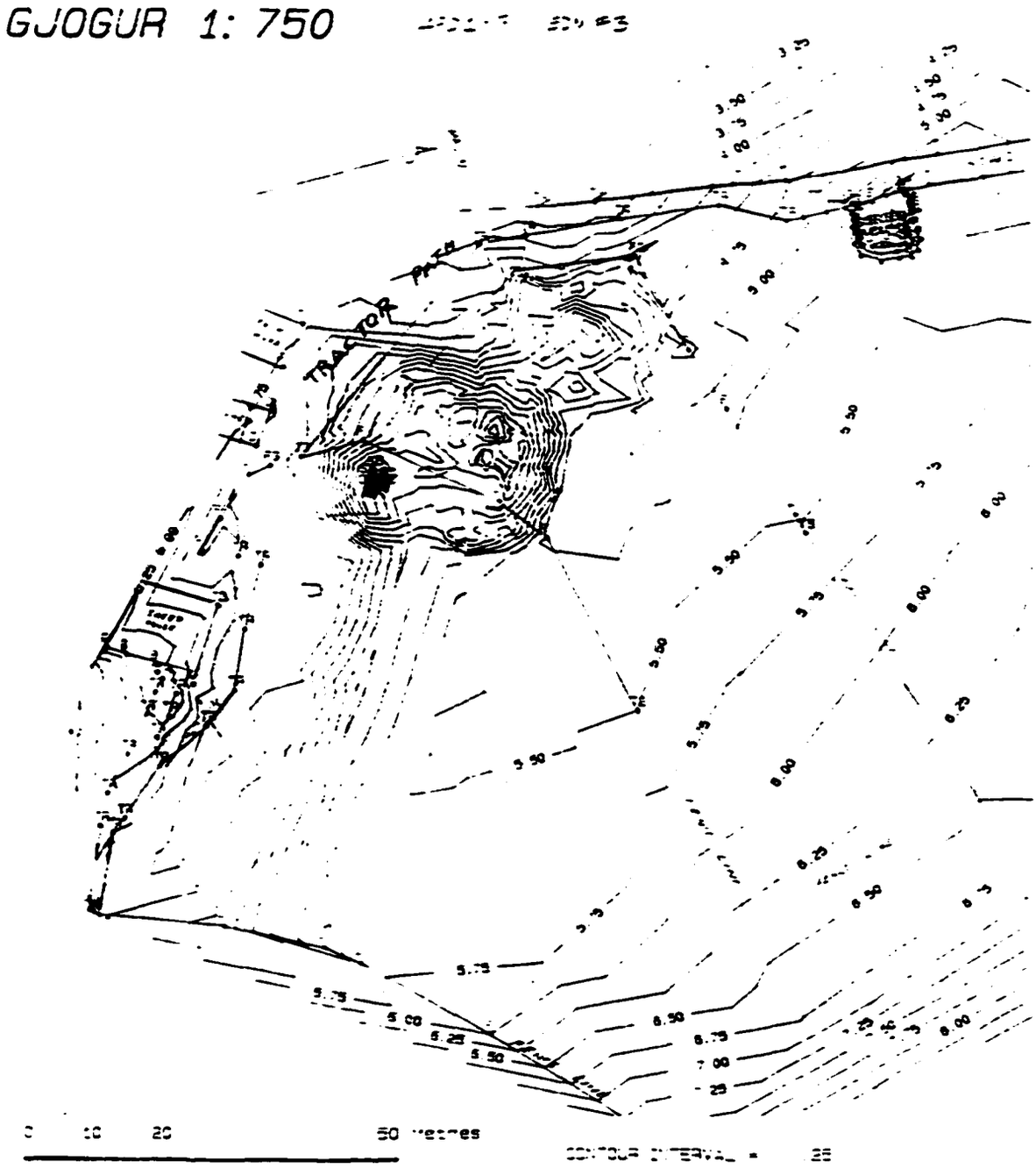

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Figure 5.111 - The East profile of the 1988 test trench at Gjogur site (4901-7).

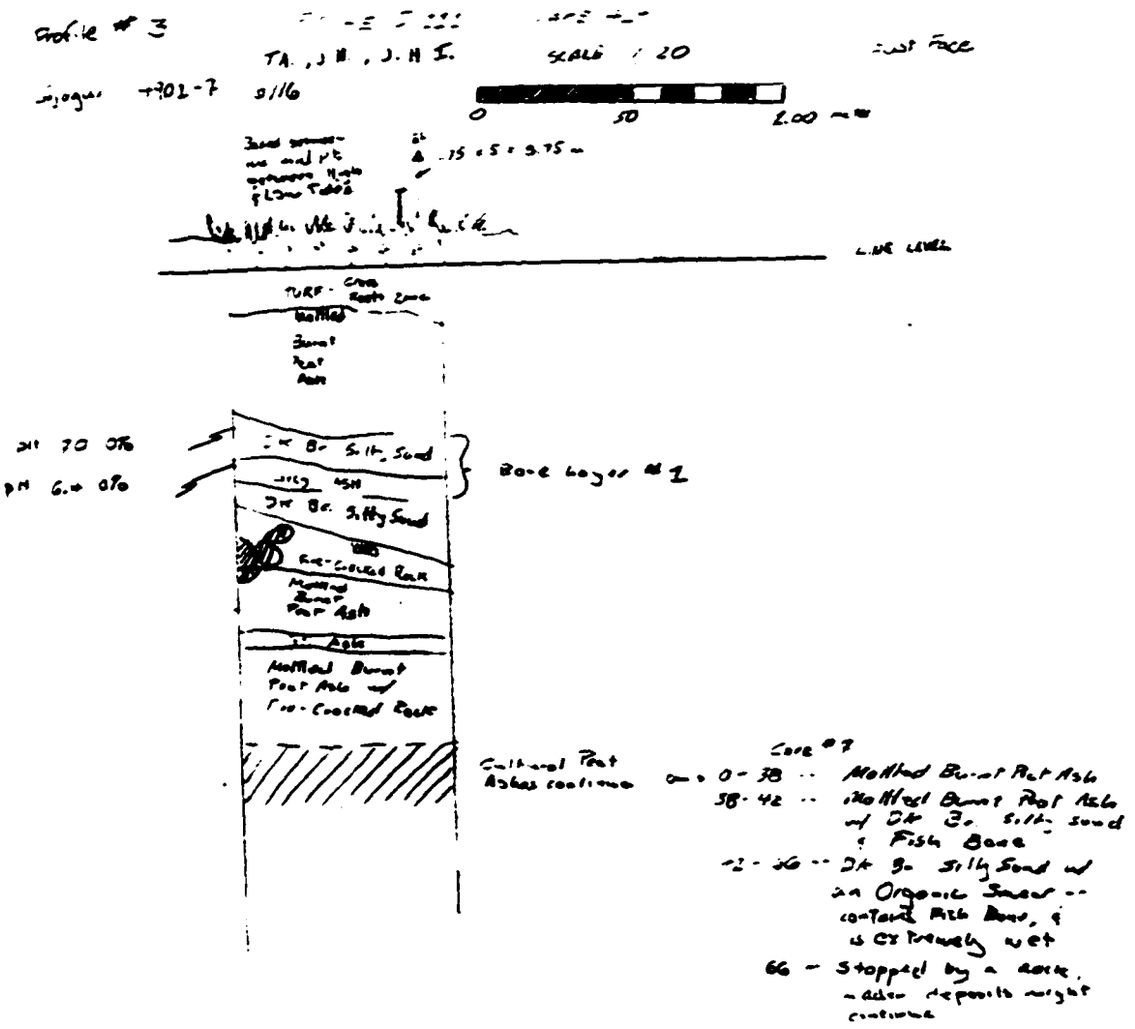

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Figure 5.112 - The South profile of the 1988 test trench at the Gjogur site.

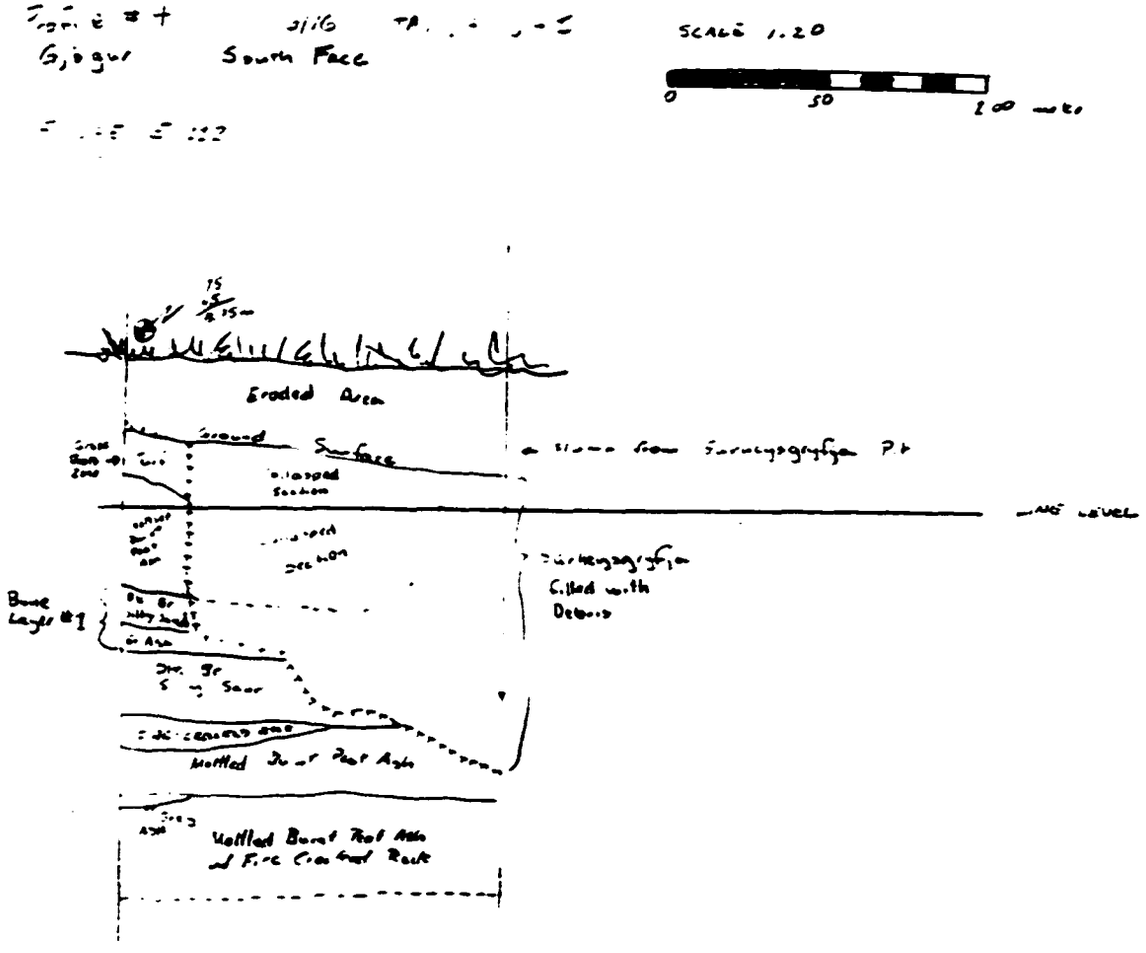

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Figure 5.113 - The 1988 pace and compass site map of the Gjogur site.

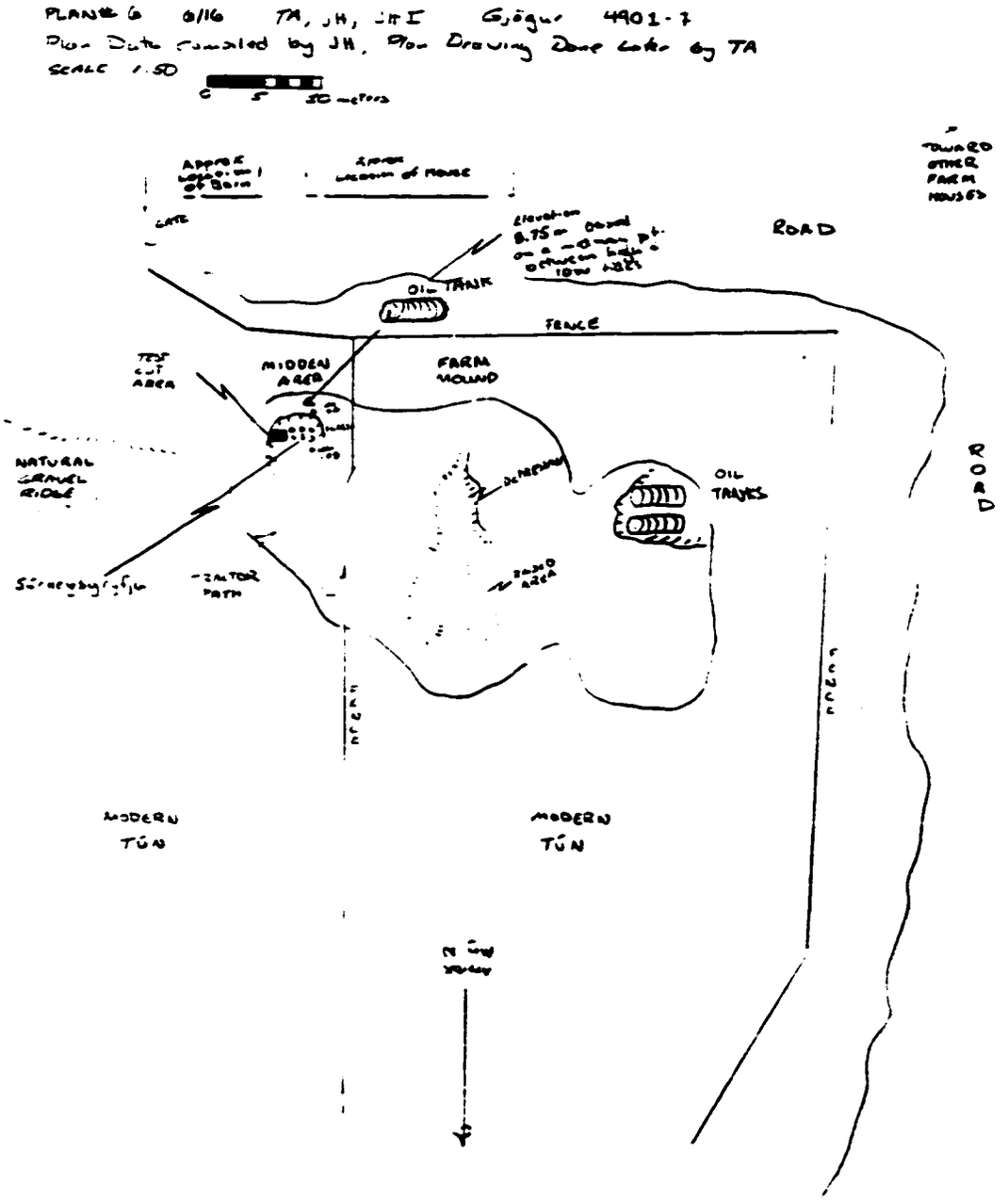

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Figure 5.114 - Sketch of the Gjogur site grid plan. Note the sketch is not drawn to scale.

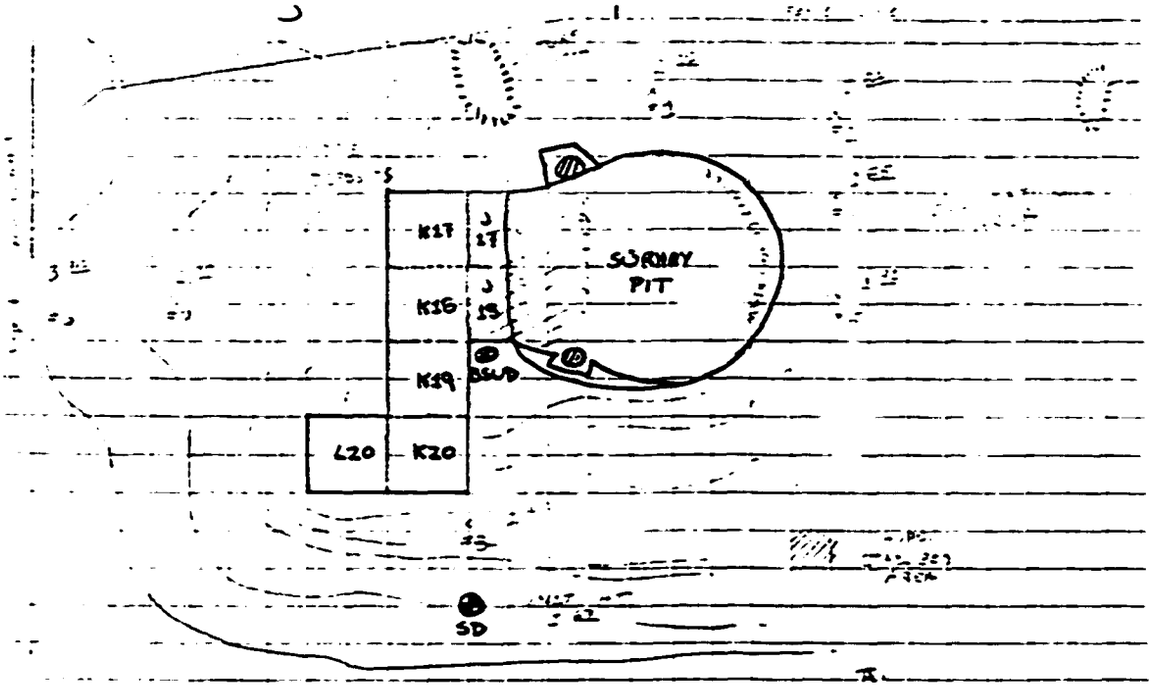

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Figure 5.115 - Oblique sketch view of the Gjogur site grid plan. Note the sketch is not drawn to scale.

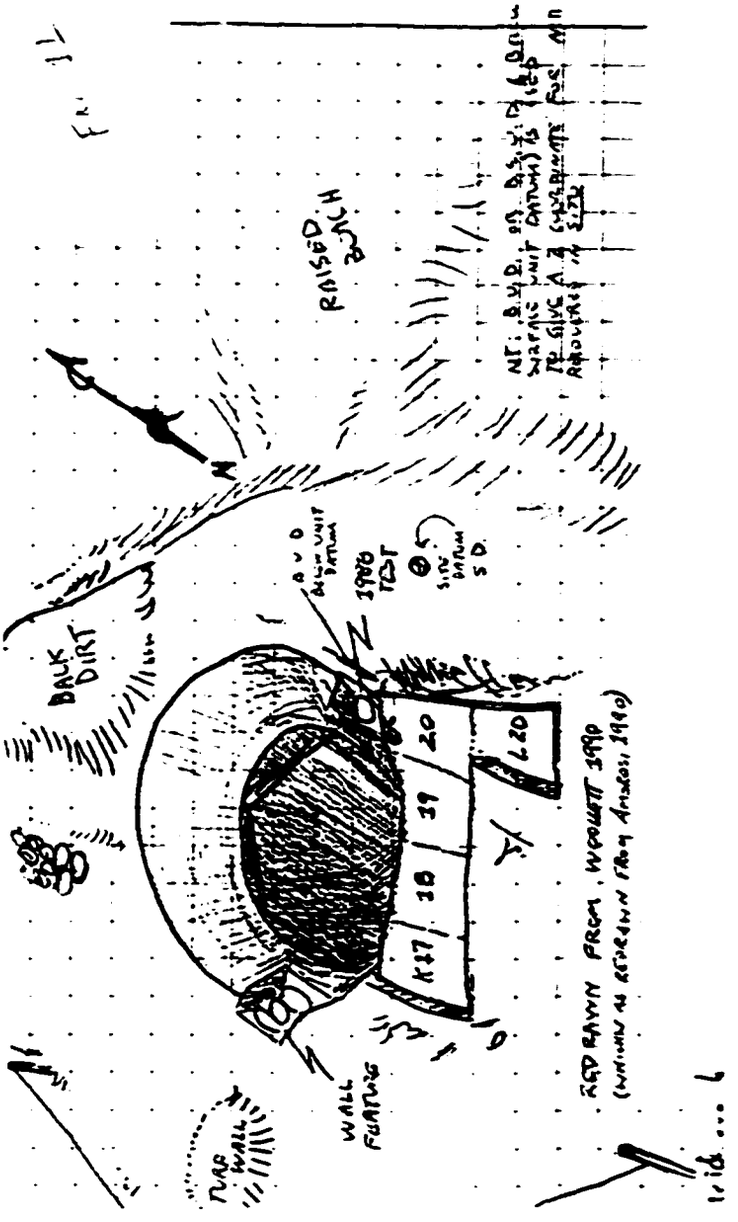

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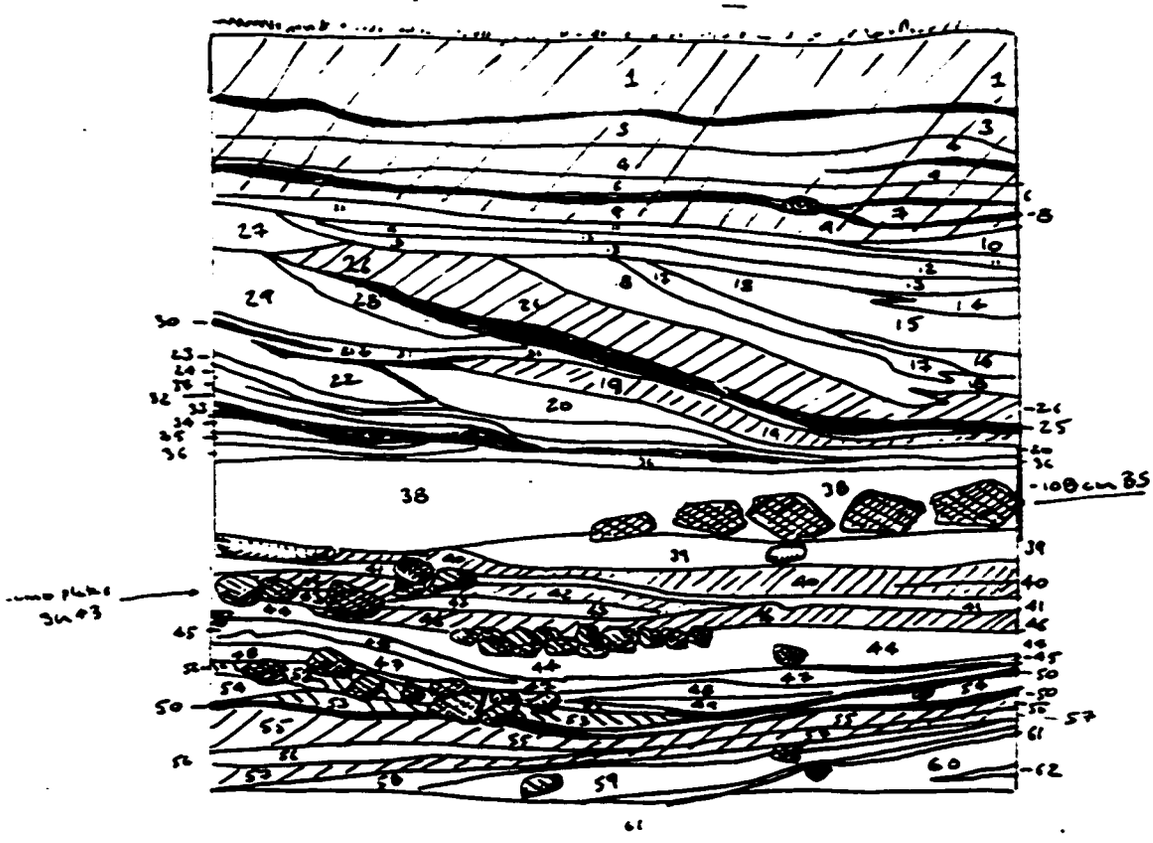
Figure 5.116 - Sketch of the South profile of the Surhey Pit. Note the profile is not drawn to scale (the profile is drawn by J. Woollett).



C901-7 Gjoger South wall Profile 1cm=20cm
Surhey Pit

Sketch Profile

- soil
- charcoal
- [illegible]

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Figure 5.117 - Illustration of the diagnostic artifacts recovered from the Gjogur site. Artifacts portrayed are G2 - an iron knife blade, G1 - an iron spike and G43 - a wooden peg.

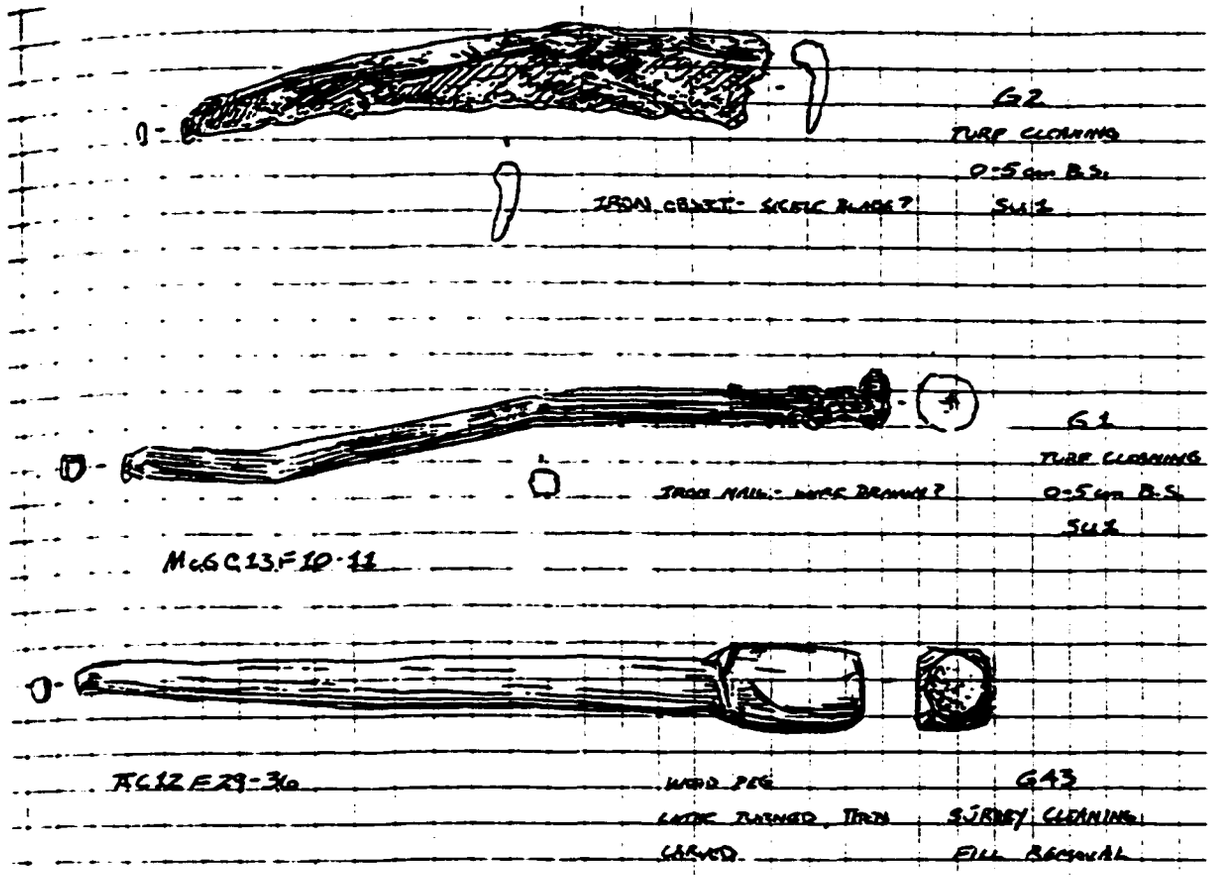

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Figure 5.118 - Illustration of the diagnostic artifacts recovered from the Gjogur site. Artifacts portrayed are G6 - an iron nail with iron sheet, possible boat nail, G20 - an iron nail, G13 - a copper or bronze rivet and G39 - a copper or bronze "dog nail".

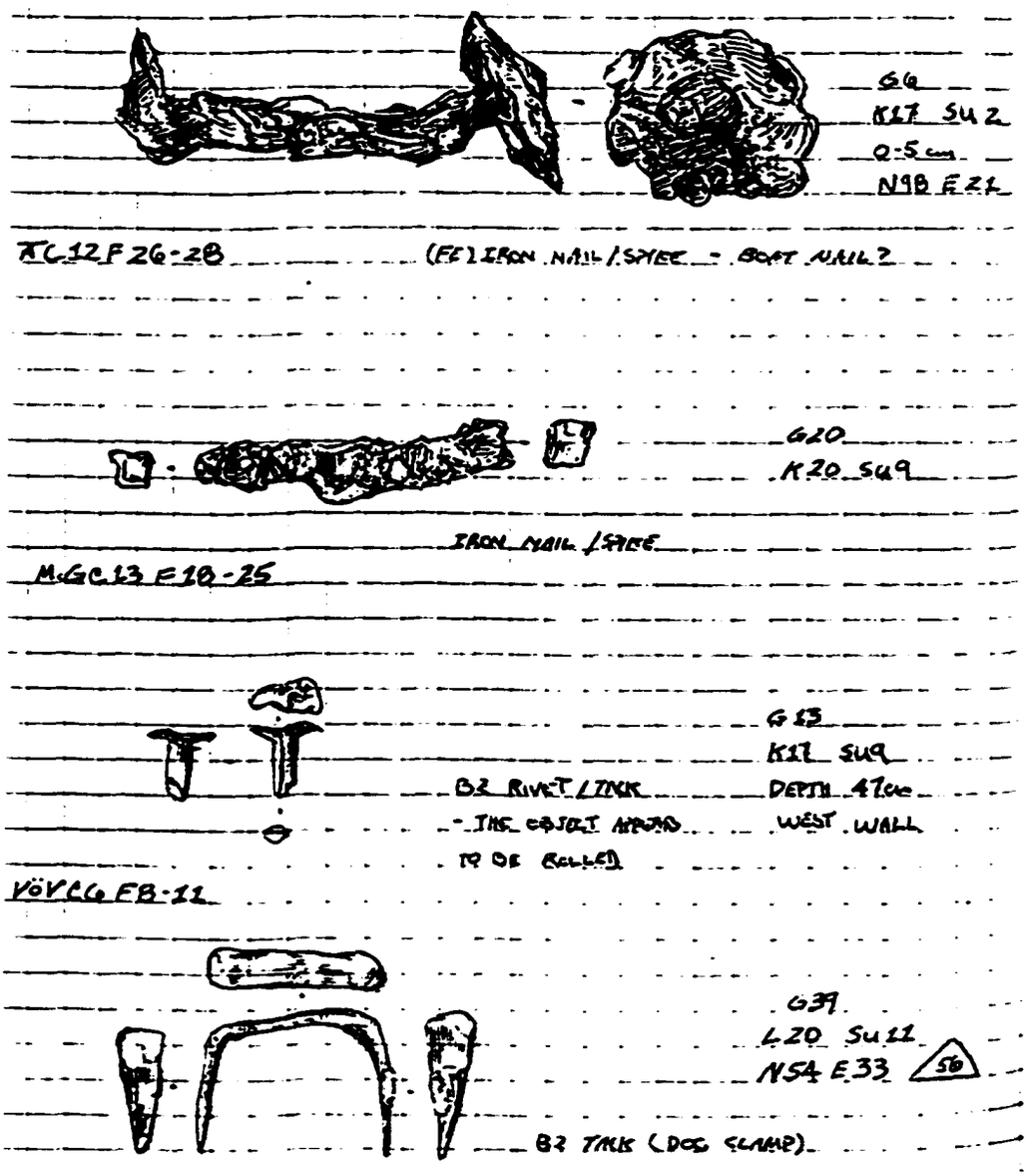

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Figure 5.119 - Illustration of the diagnostic artifacts recovered from the Gjogur site. Artifacts portrayed are G35 - a copper or bronze sheet, G23 - a bronze buckle and G30 - a bronze disc shaped object.

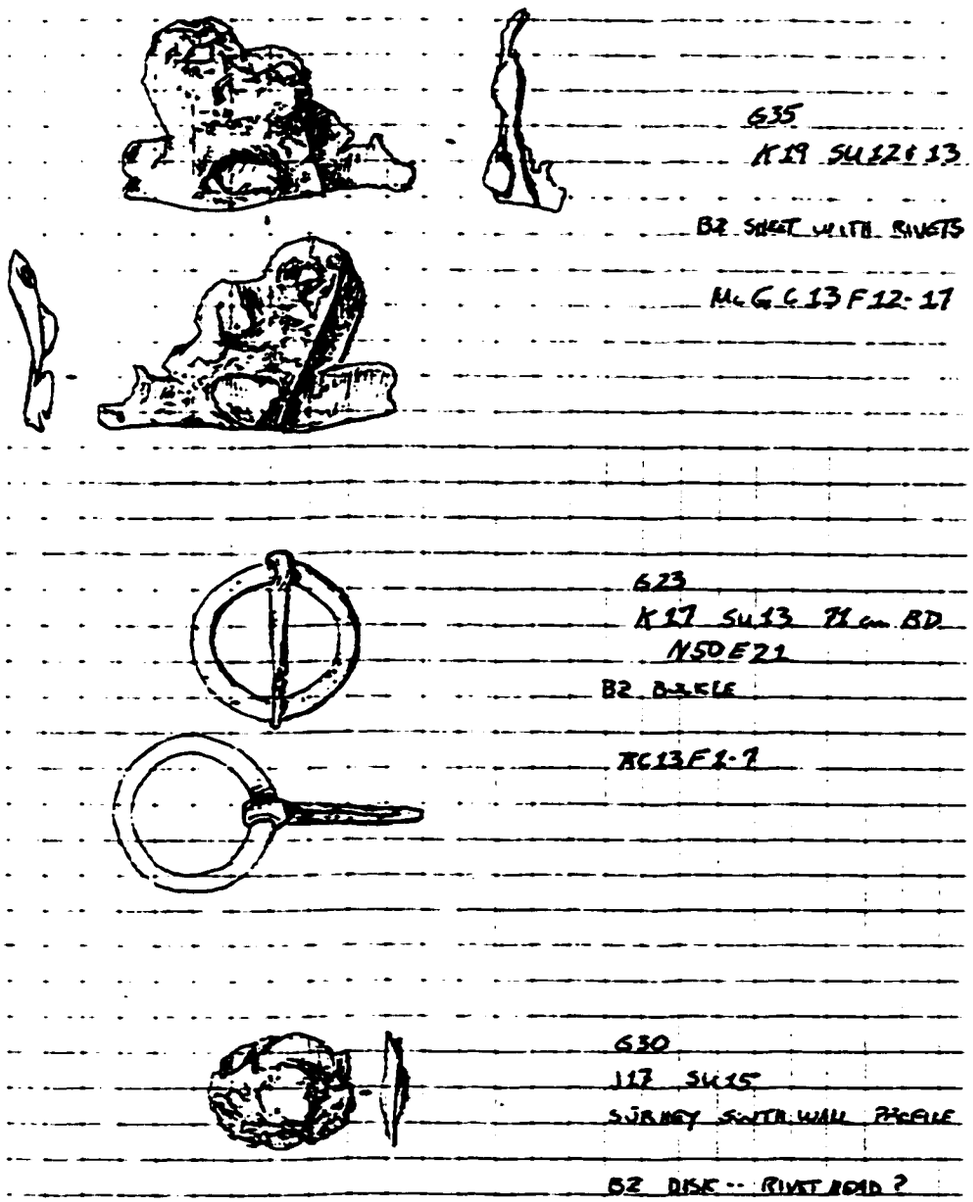

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Figure 5.120 - Illustration of the diagnostic artifacts recovered from the Gjogur site. Artifacts portrayed are G114 - a worked piece of terrestrial mammal bone, possible toggle clamp part, G102 - whet stone, possibly Norwegian in origin and G95 - a bronze sheet with perforations.

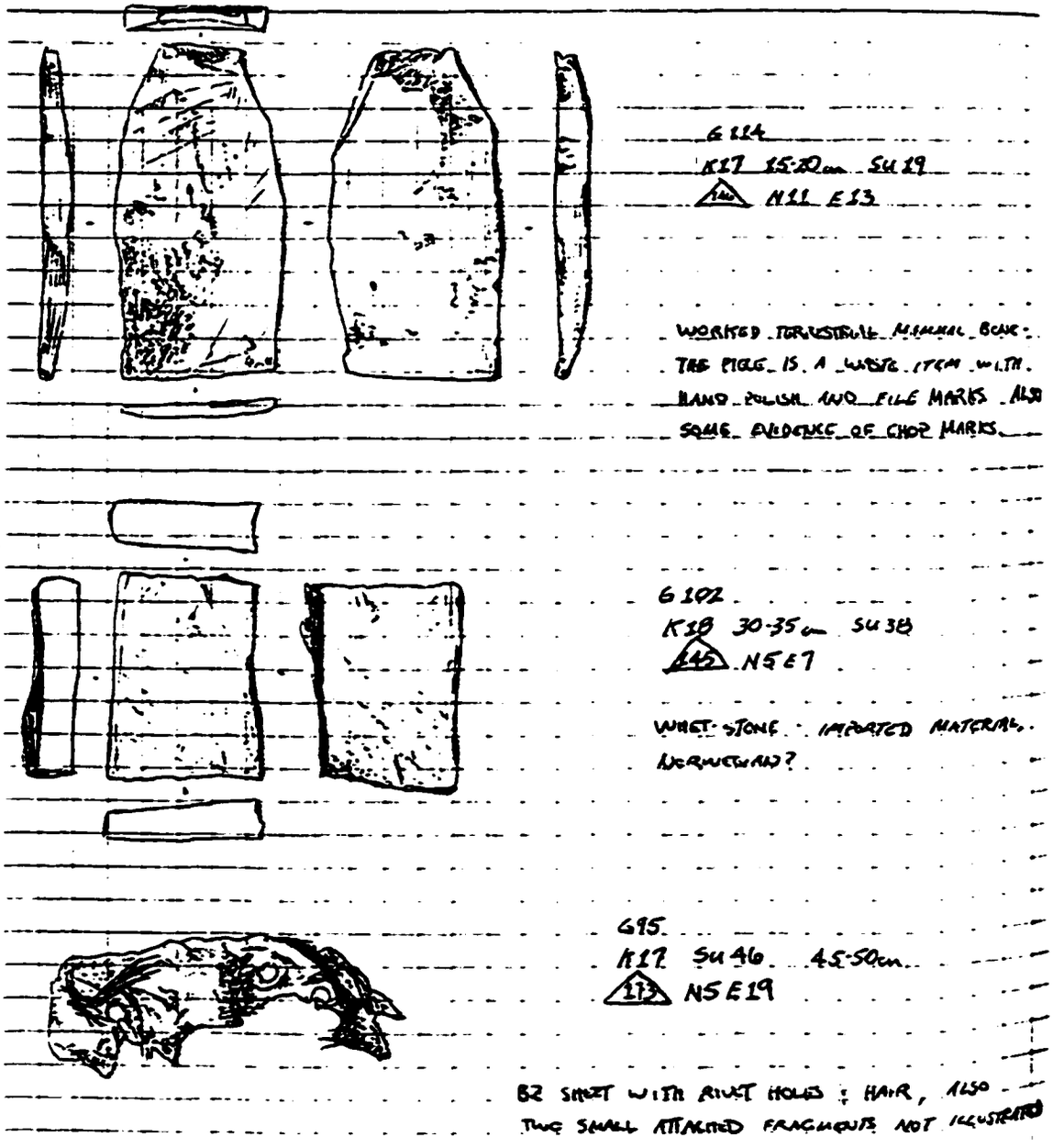

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Figure 5.121 - Illustration of the diagnostic artifacts recovered from the Gjogur site. Artifacts portrayed are G21 & G22 - Composite bone comb plate and G28 - an iron nail?.

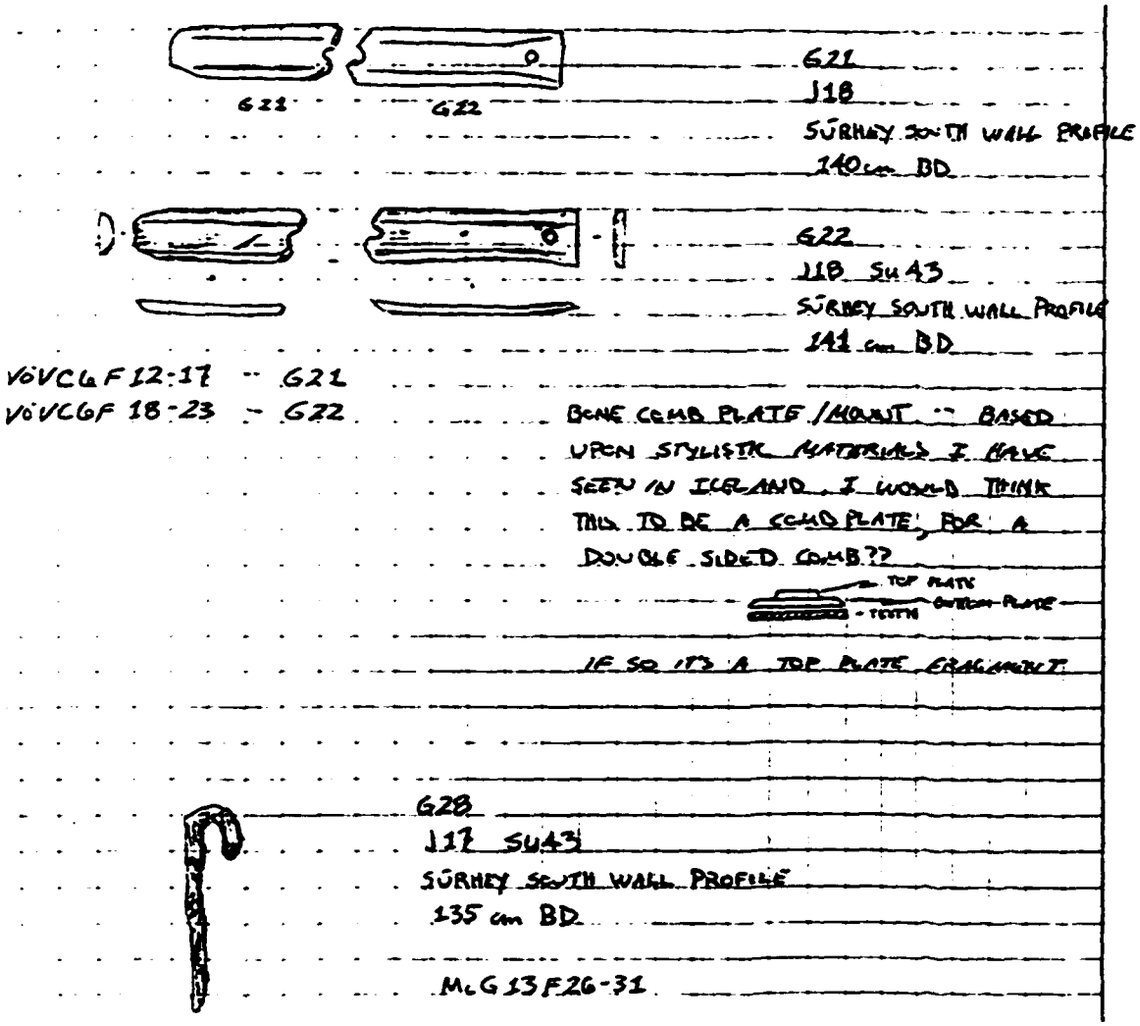

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Figure 5.122 - Illustration of the diagnostic artifacts recovered from the Gjogur site. Artifacts portrayed are G90 - a possible whet stone, G130 - a whet stone and G134 - a whet stone.

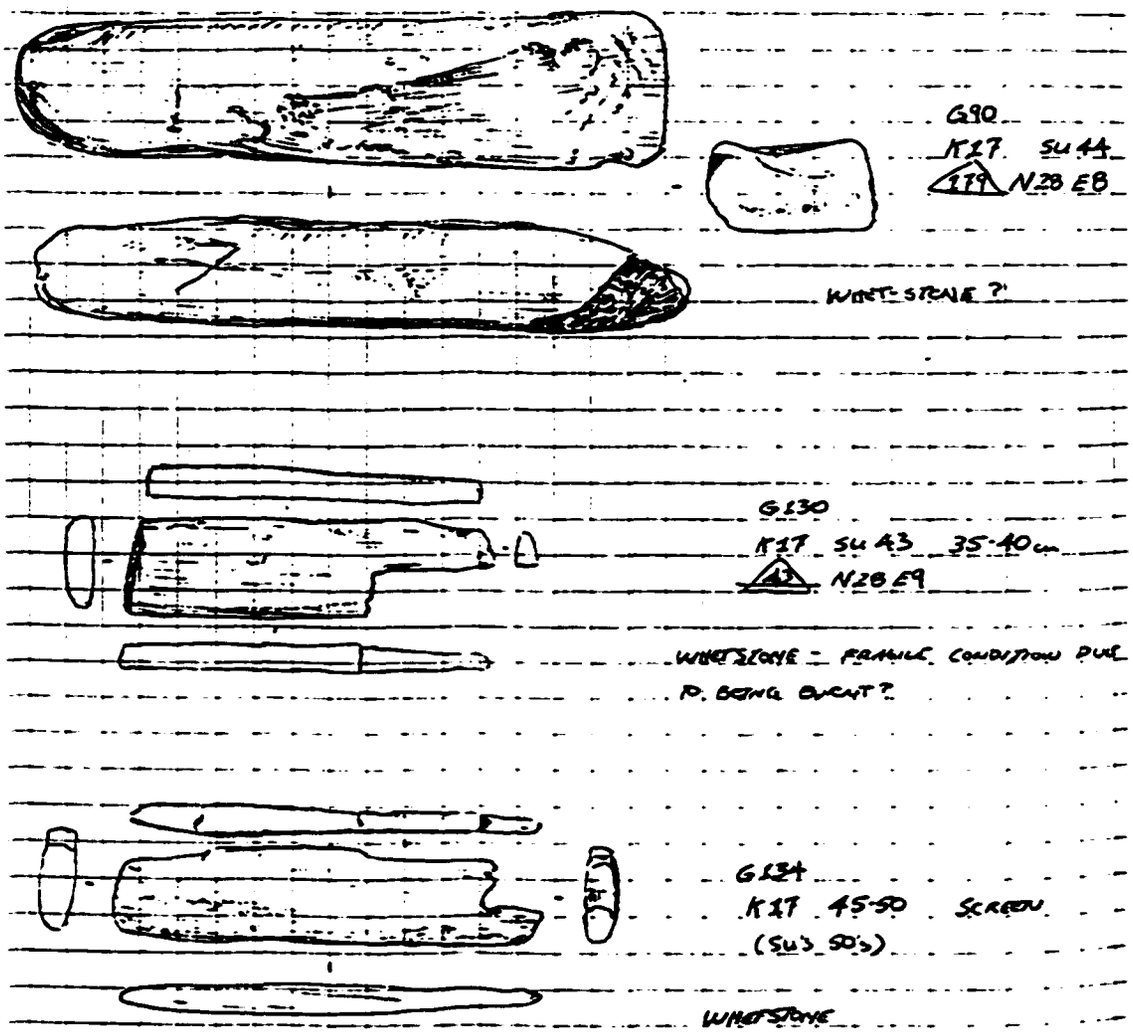

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Figure 5.123 - Illustration of the diagnostic artifacts recovered from the Gjogur site. Artifacts portrayed are G133 - a worked whale bone toggle clamp part and G51 & 47 - the base of a steatite bowl.

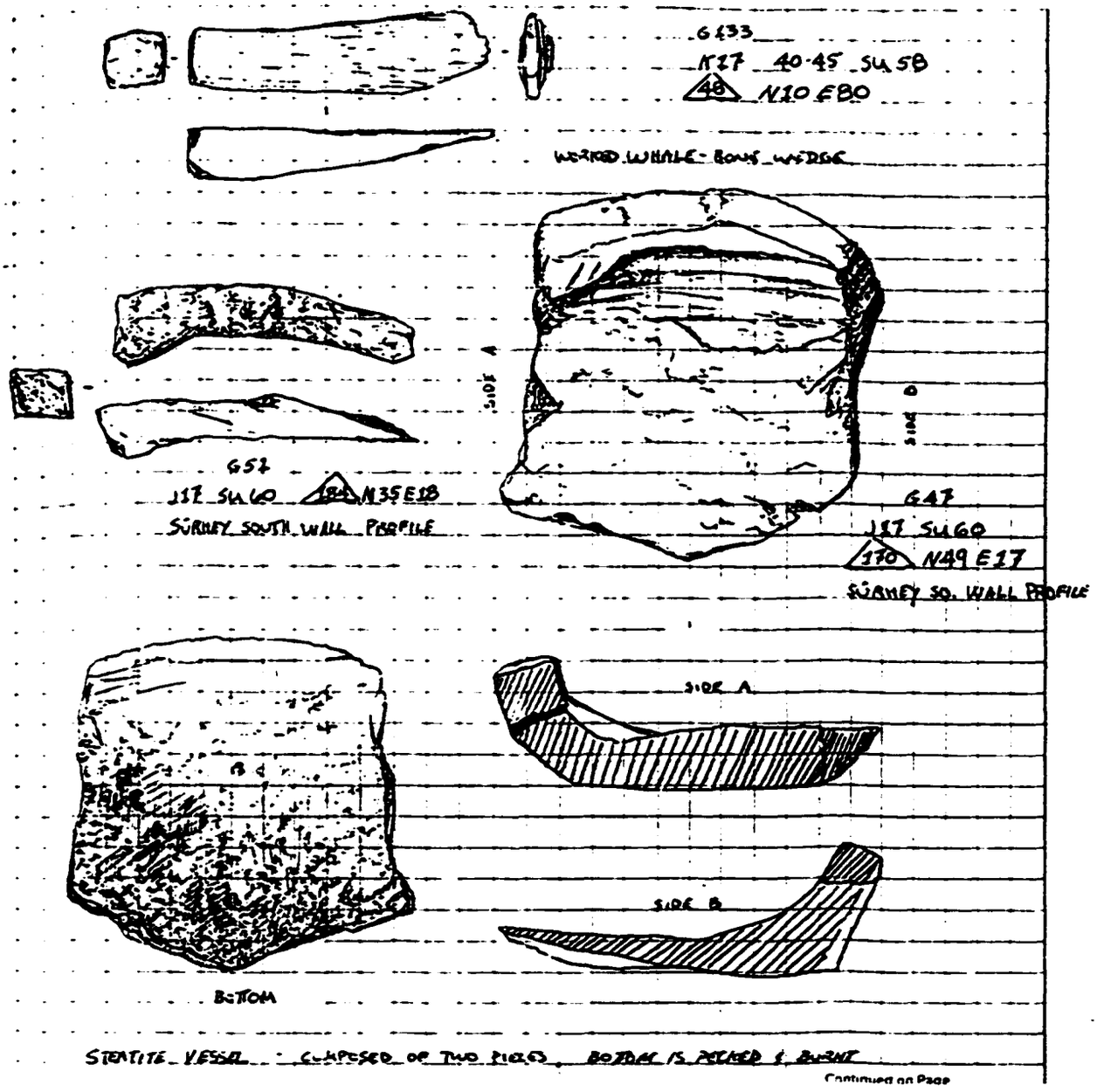

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Figure 5.124 - Illustration of the diagnostic artifacts recovered from the Gjogur site. Artifacts portrayed are G49 - a worked whale bone clamp part, G137 - a whet stone and G136 - a worked whale bone clamp part with iron rivet.

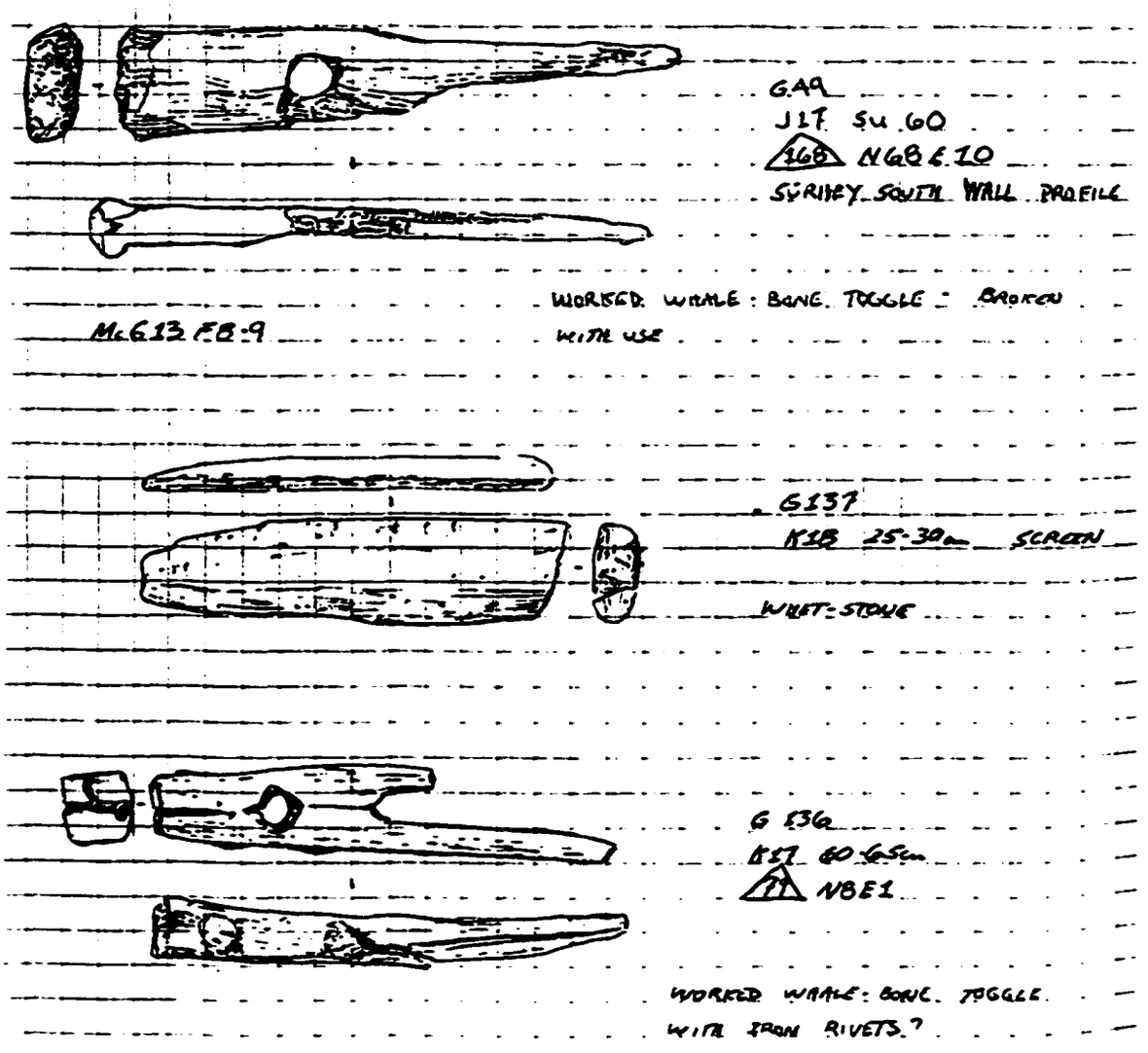

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Figure 5.125 - Illustration of the diagnostic artifacts recovered from the Gjögur site. Artifacts portrayed are G144 - an iron hook and G142 - a jasper strike-lite.

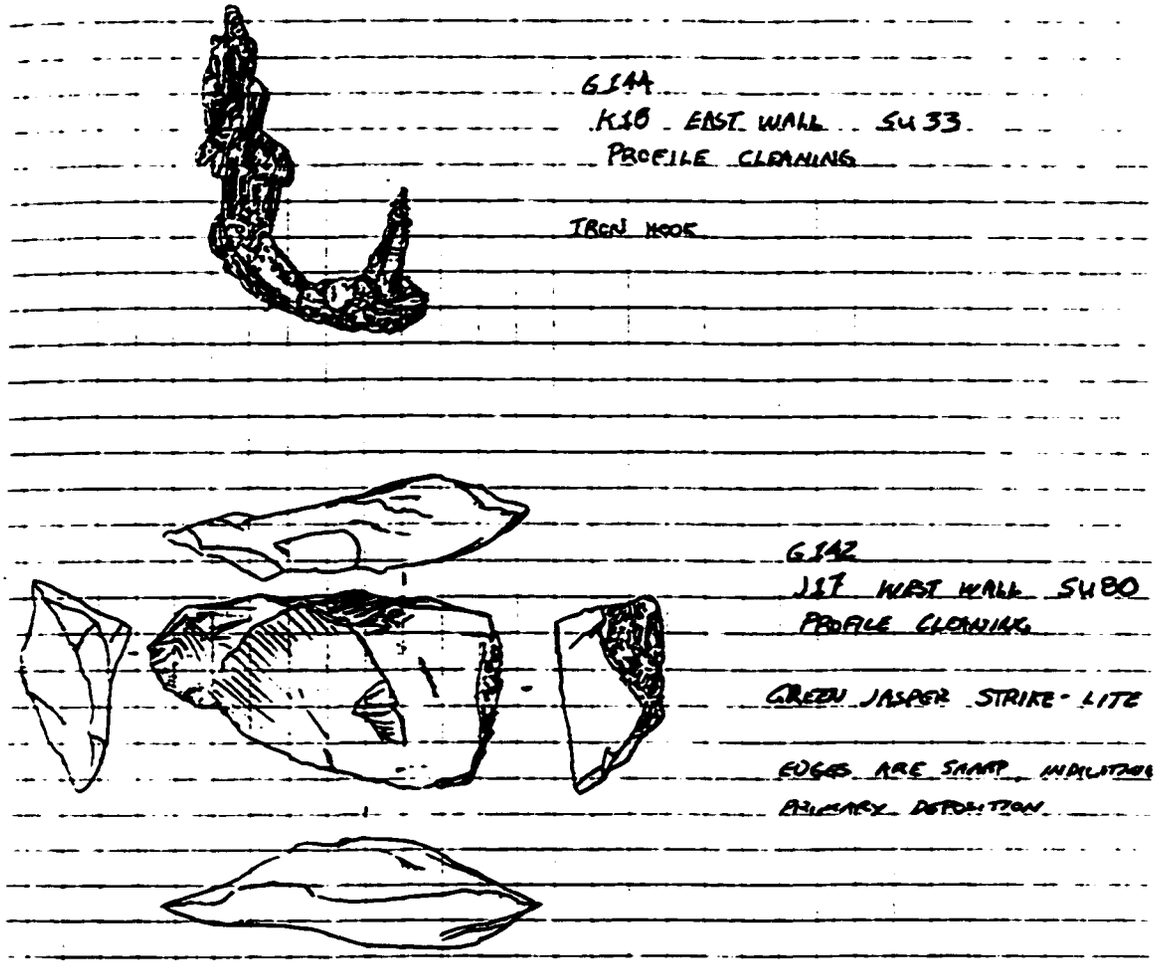

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Figure 5.126 - Sketch of the positioning of Stratigraphic Units (SU) 1-10, 12, 13, 14, 15, 16, 17, 18, 26, 38 and 39 along the south profile (grid co-ordinates K19, K18, K17). Also visible is the eastern profile (grid co-ordinates K20 & K20). The wall feature can also seen in the lower right hand corner. Note sketch is not drawn to scale.

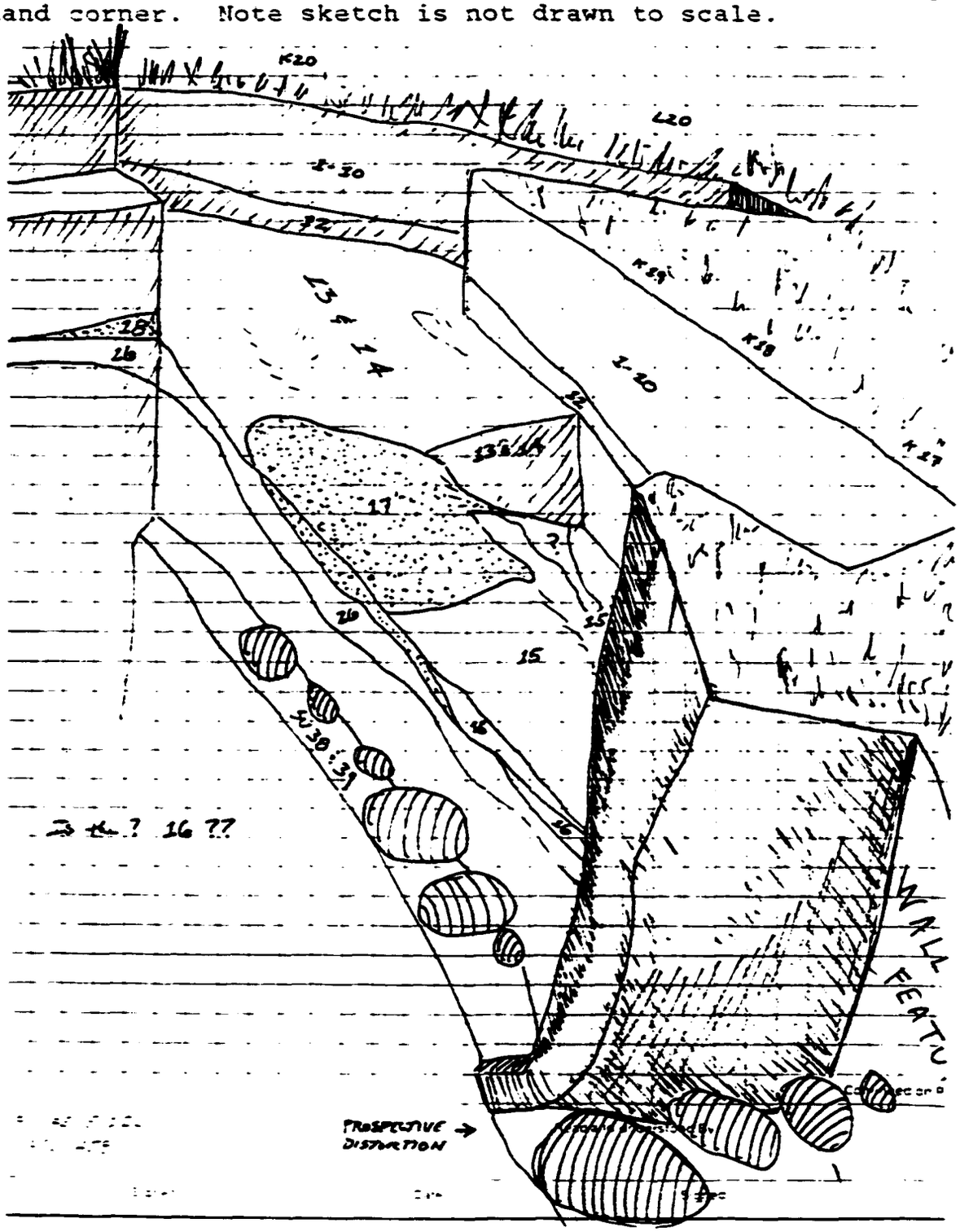

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Figure 5.127 - The South profile (Profile #19) of the 1990 test at Gjogur.

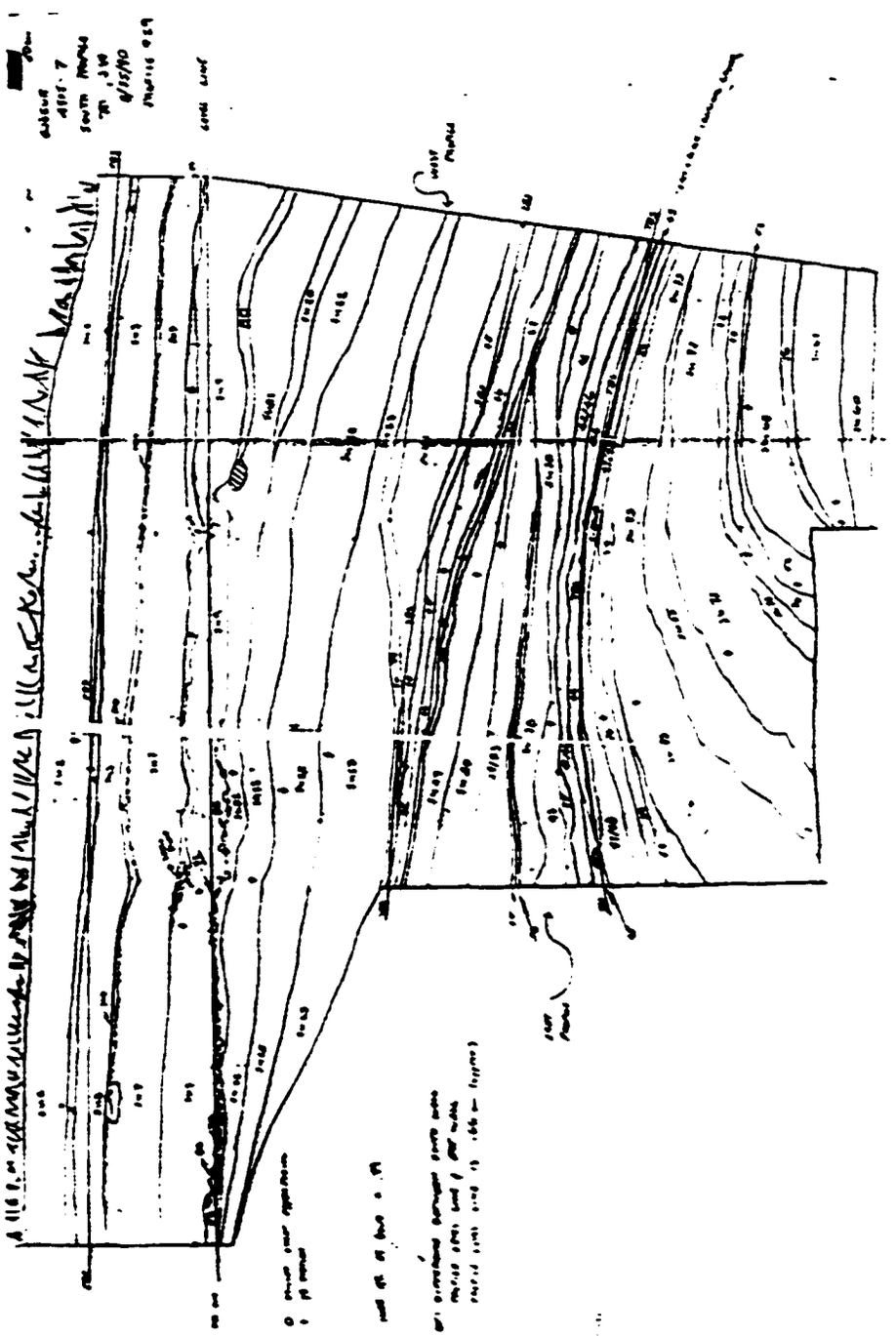

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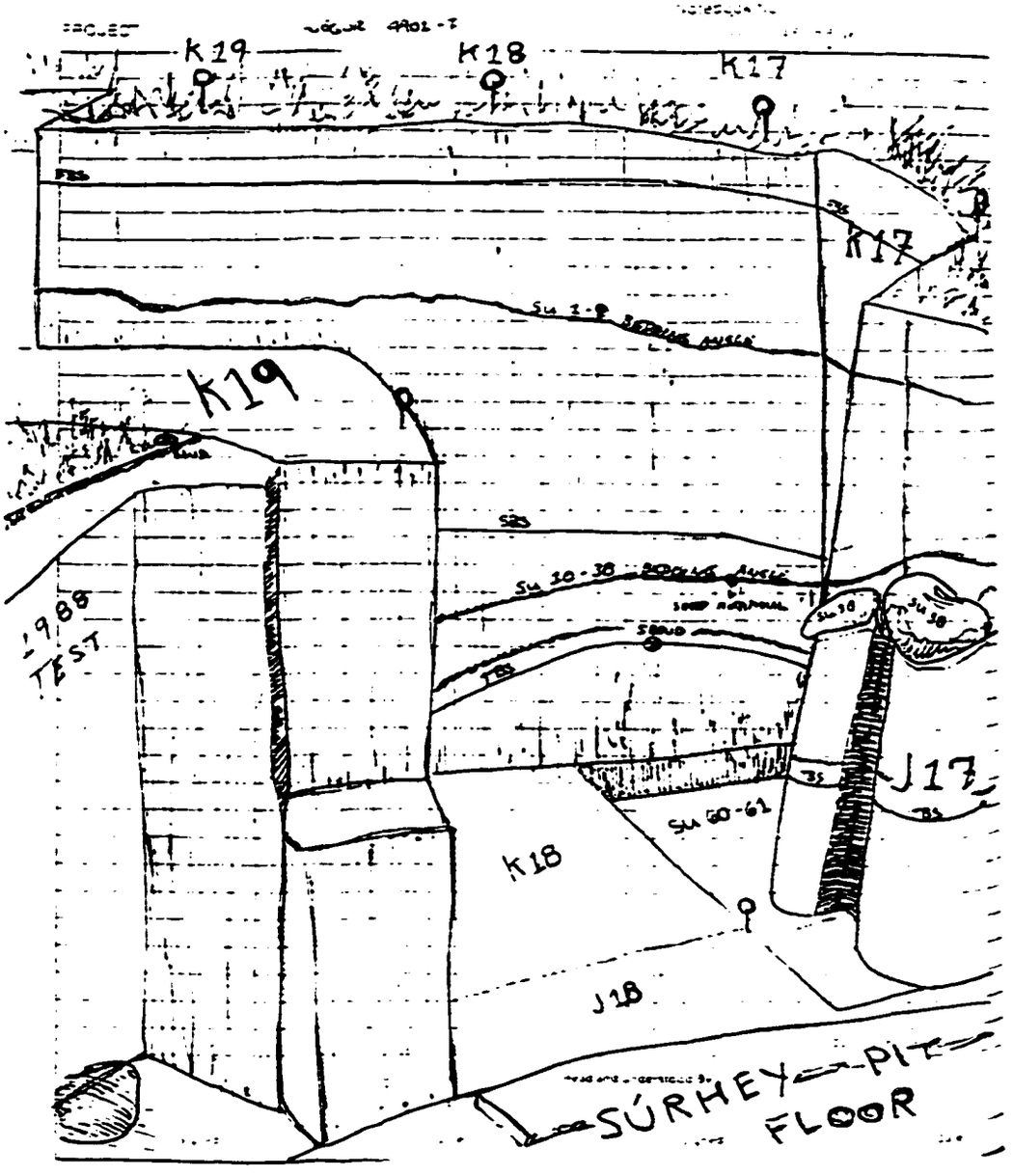
Figure 5.128 - Sketch of the closing of the 1990 test at Gjogur. The sketch orientation is the south profile (along grid co-ordinates K19, K18 and K17). The 1988 test position is also located. Note sketch is not drawn to scale.



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ICELANDIC ZOOARCHAEOLOGY:

NEW DATA APPLIED TO ISSUES OF HISTORICAL ECOLOGY.

PALEOECONOMY AND GLOBAL CHANGE

by

THOMAS AMOROSI

VOLUME IV

A dissertation submitted to the Graduate Faculty in Anthropology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

1996

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Figure 7.1 - The location of the Granastadir site in the Eyjafjordur, northern Iceland. The broken lines show the county or syslumork boundaries. Siglunes and Torfufell are the area's local weather stations. Klaufanes is a Viking period farmstead. The site of Gasir is believed to be an Early Medieval trading post. Vallathing is assumed to be an assembly site. Holar is a church farm (figure and caption are from Einarsson 1994a:71).

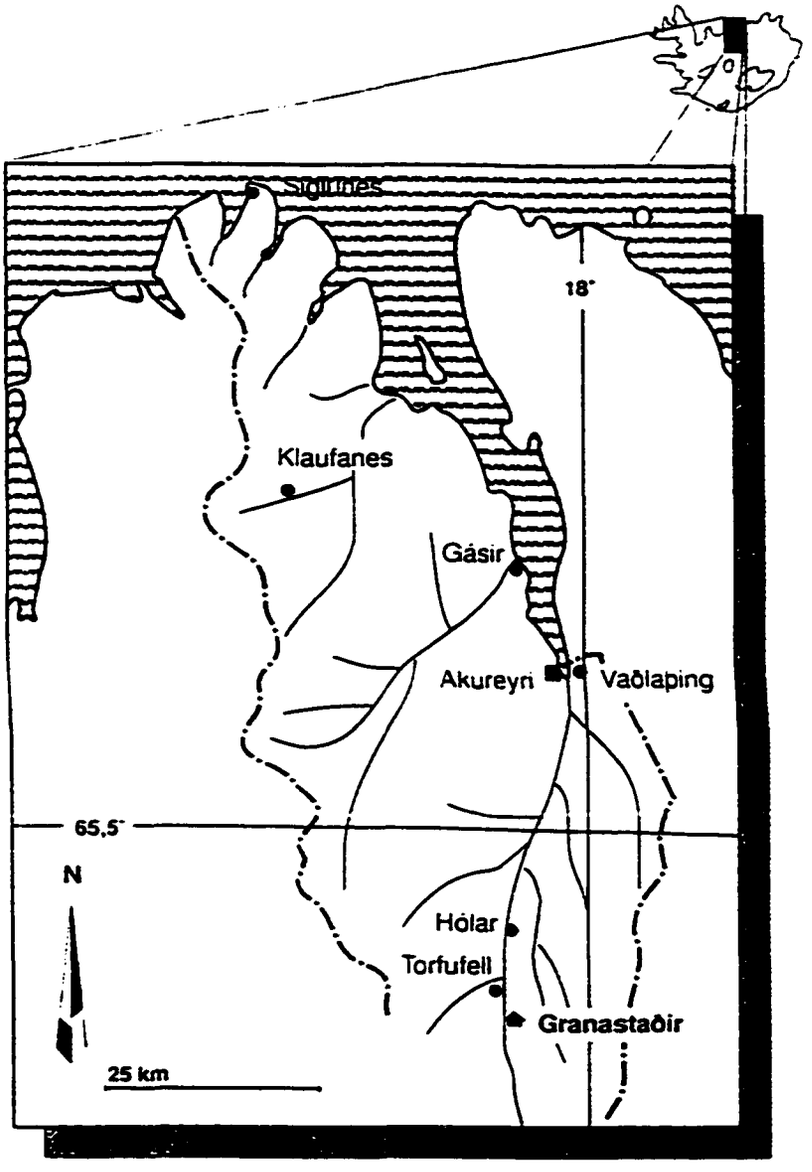

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Figure 7.2 - The locations of the Granastadir site (marked by the large arrow; figure is from Einarsson 1994a:73).

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Figure 7.3 - The site plan for the Granastadir site. No. 1 is a modern sheepfold, 2 is a modern building, 3 is a pit-house seen in Figure 7.4, 4 is a pit-house contemporary with the other of Granastadir's structures seen in Figure 7.4, Nos. 5-8 are natural gullies formed by the river, 9 is the "long house" seen in Figure 7.4, 10 is the river embankment, 11 is a grave that is roughly contemporary with the Granastadir site, 12 is a possible grave, 13 & 15 are modern structures, 16 is a modern barn, and 18 is a smithy contemporary with the Granastadir site (figure and caption are from Einarsson 1994a:74).

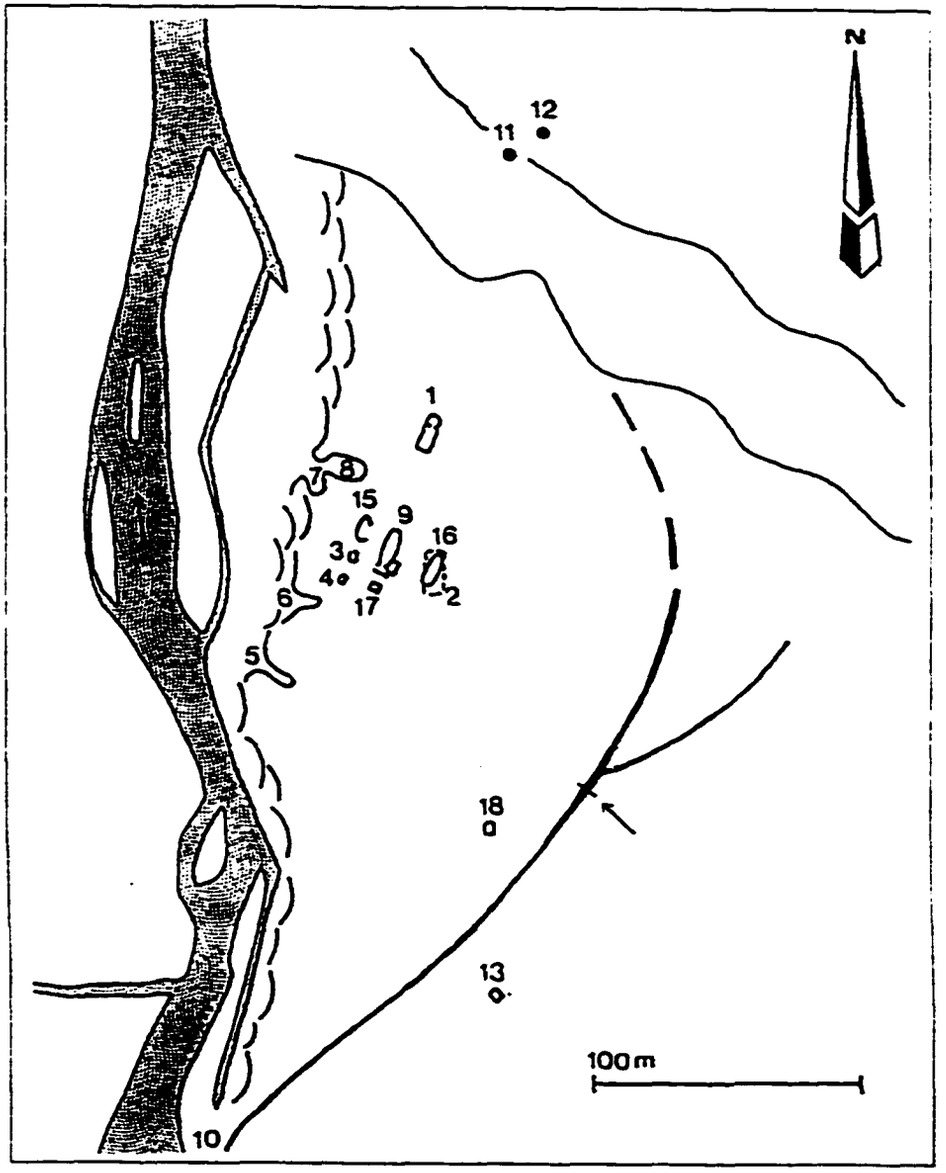

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Figure 7.4 - The site plan of the main portion of the Granastadir site and the structures where the archaeofauna was recovered (figure is from Einarsson 1994a:75).

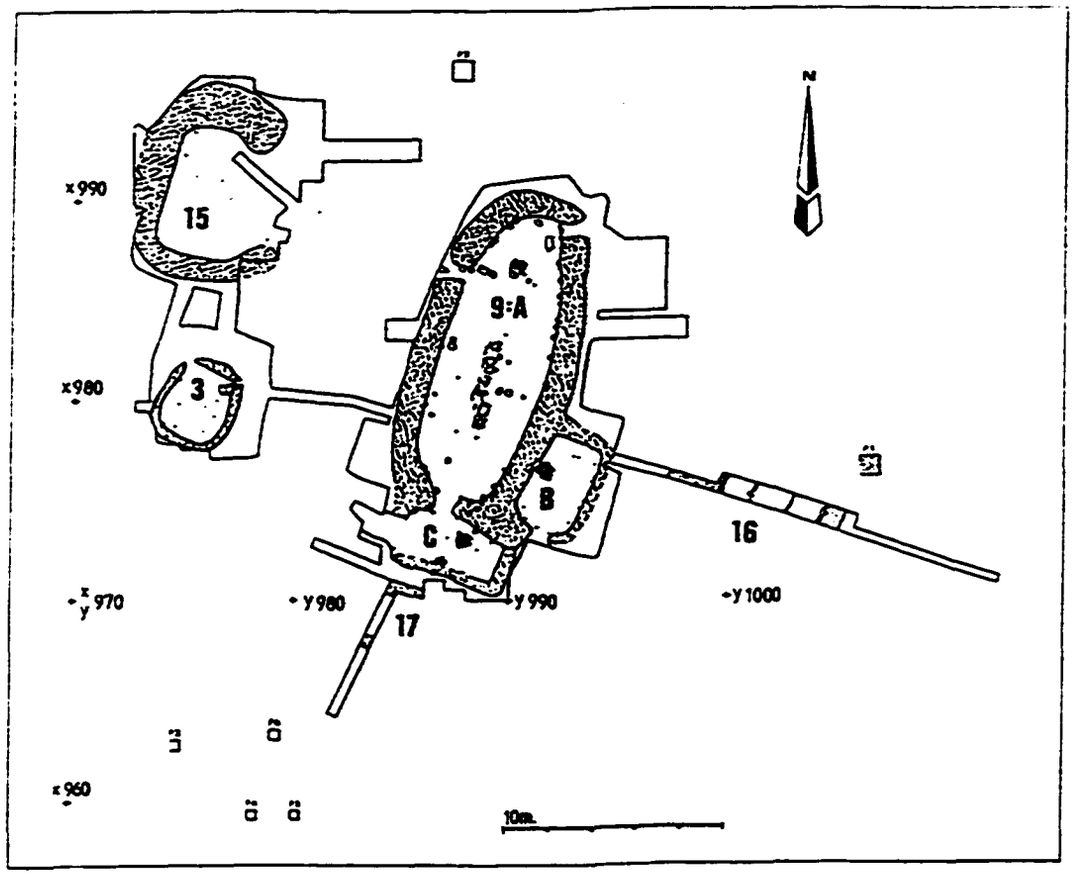

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Figure 7.5 - The comparison of the quantification measures used in the analysis of the Granastadir site.

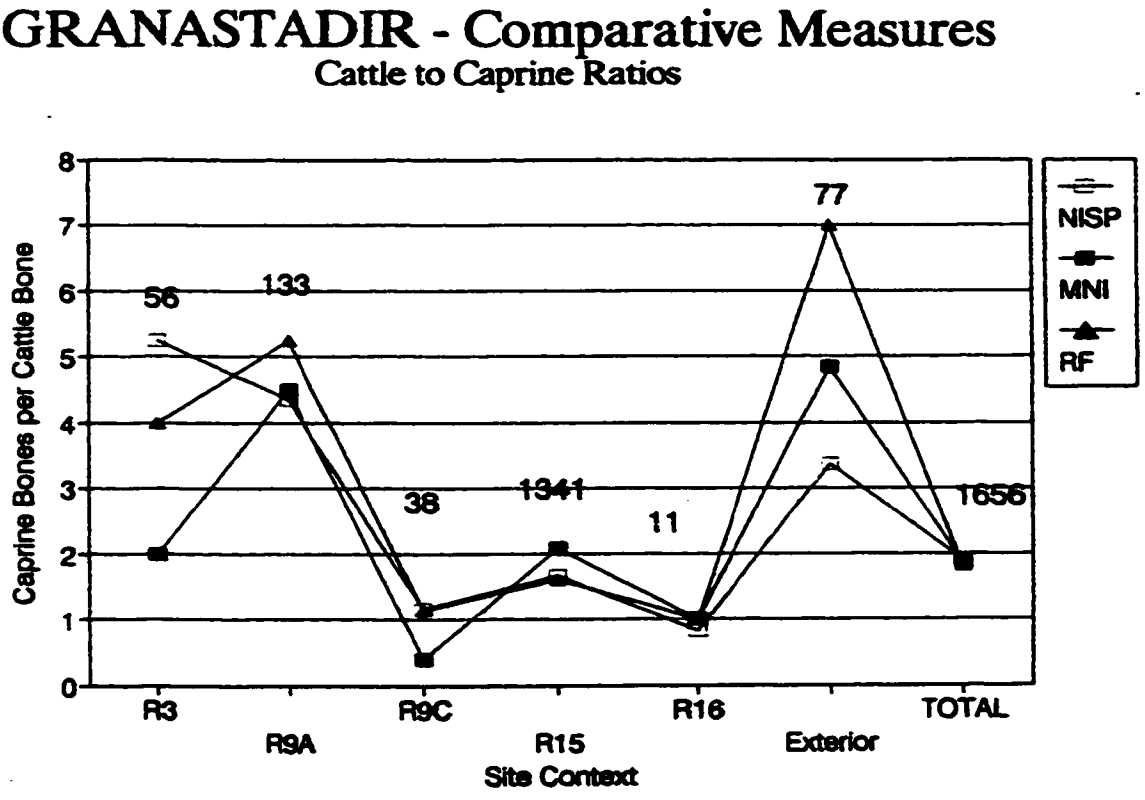

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Figure 7.6 - The relative percentage of the major taxa recovered from the Granastadir site.

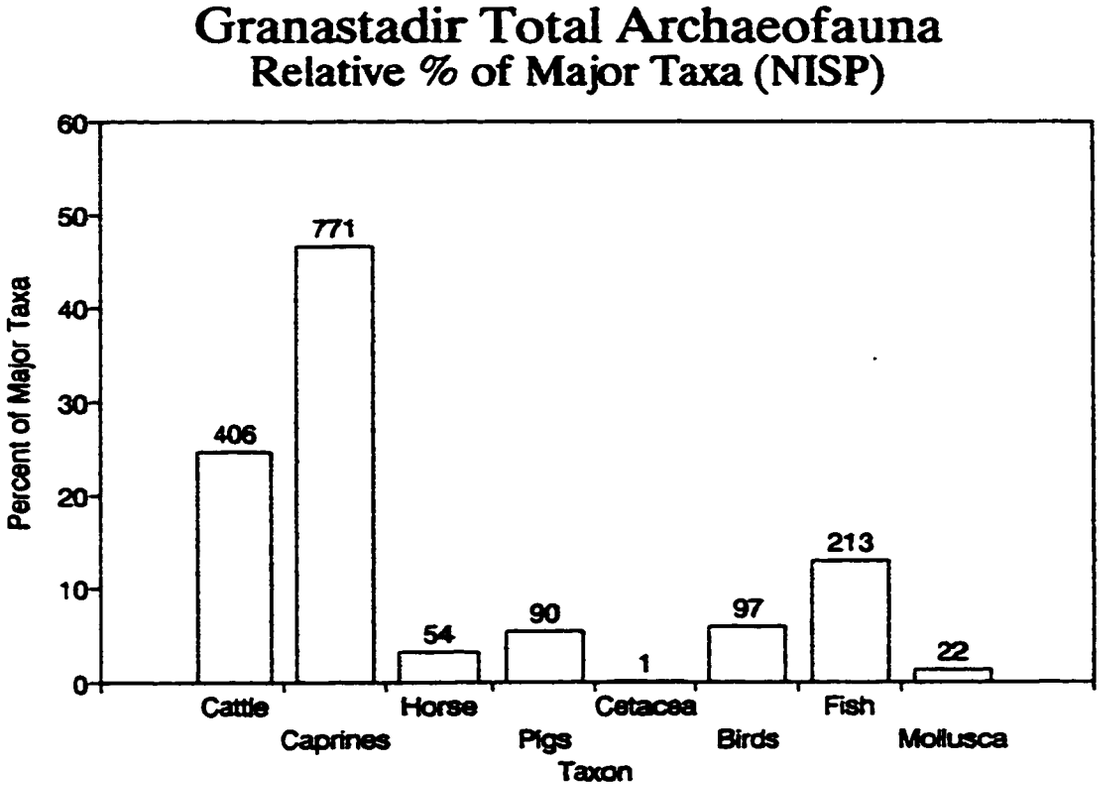

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Figure 7.7 - The relative percentage of the domestic mammals recovered from the Granastadir site.

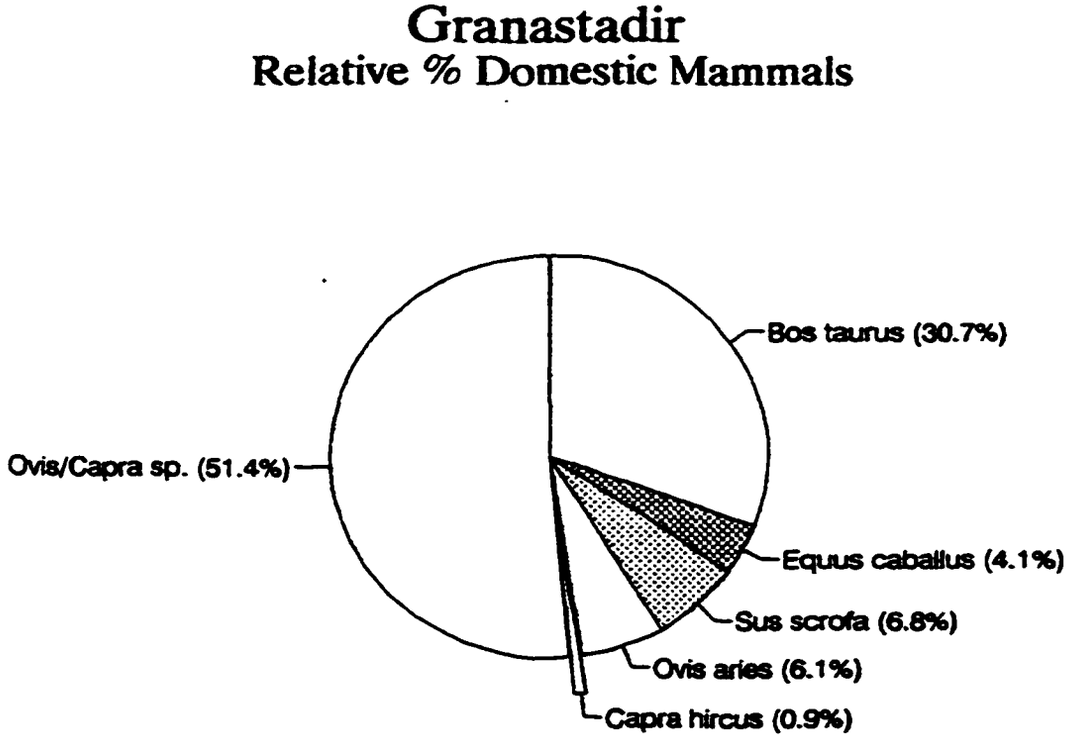

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Figure 7.8 - The percentage of bovid teeth recovered from the Granastadir site. The percentage is grouped according to structure and room designations.

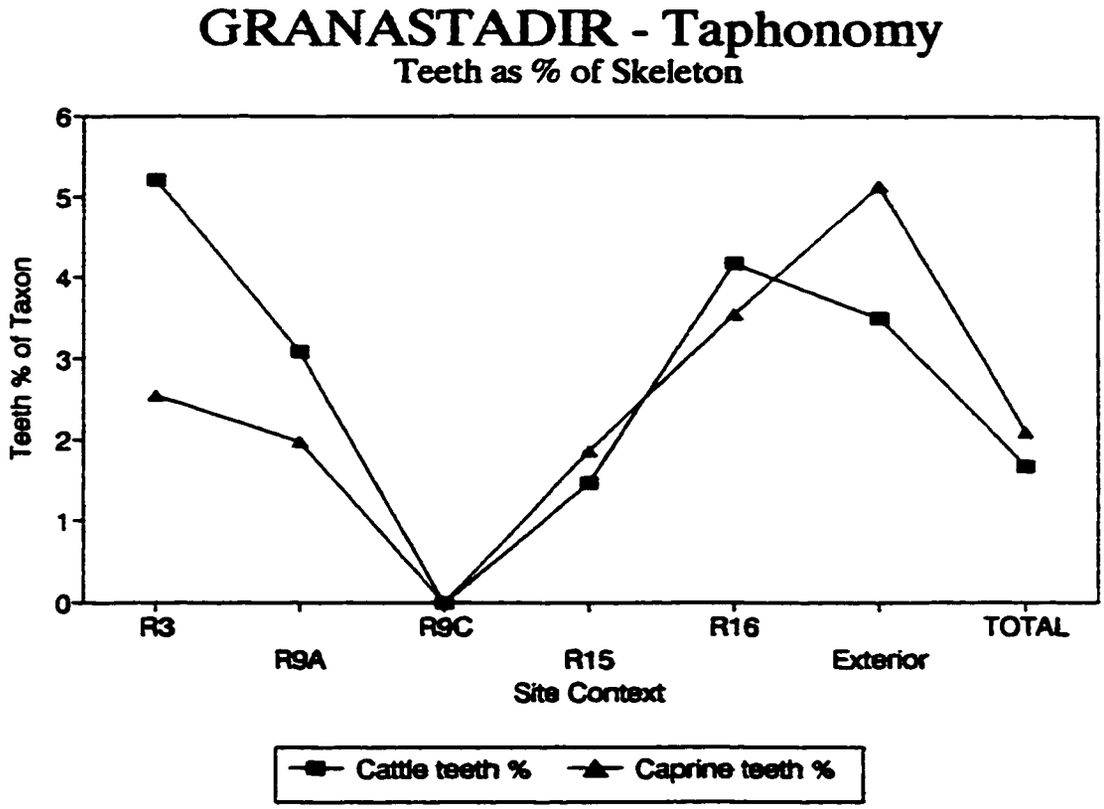

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Figure 7.9 - The Bone Density recorded at the Granastadir site. The density values are grouped according to structure and room designations.

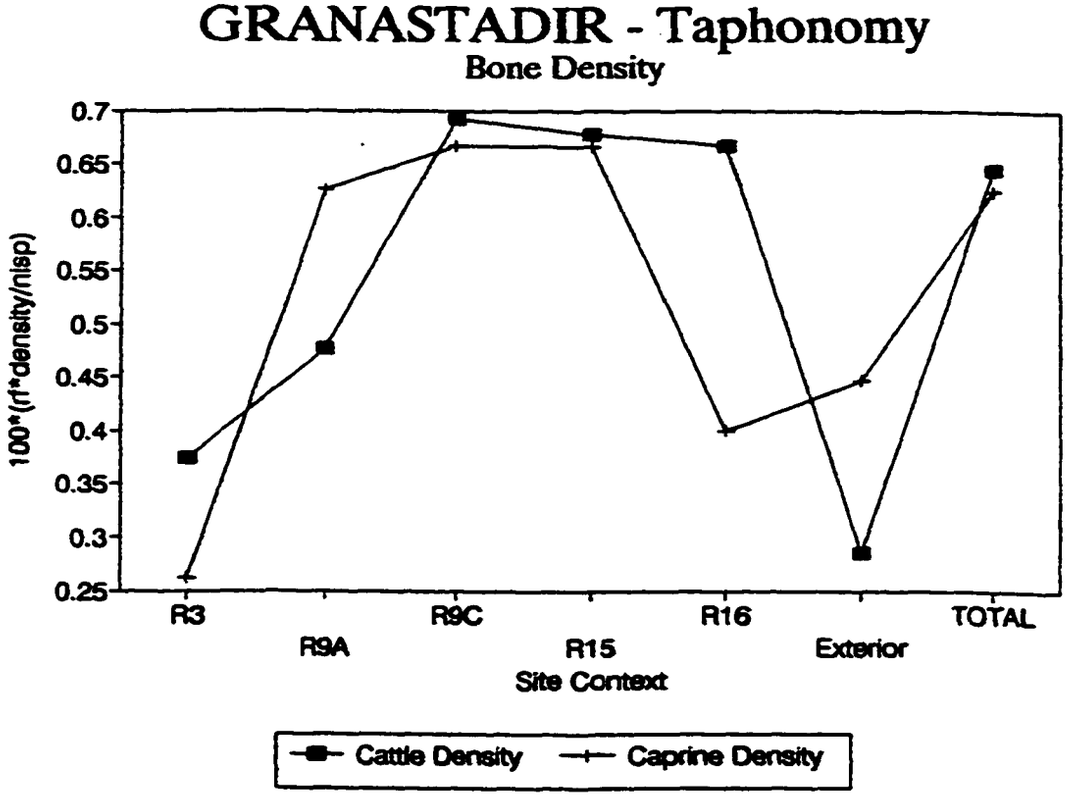

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Figure 7.10 - The distribution of the major taxa grouped according to structure and room designations.

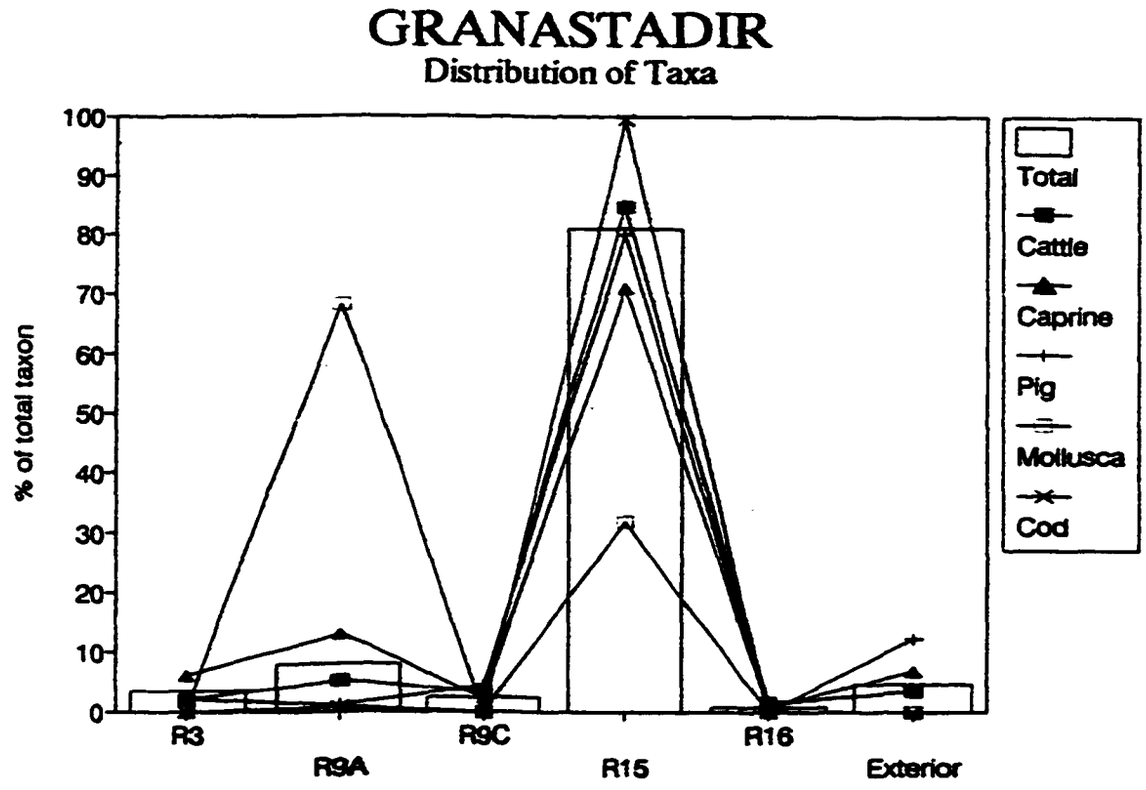

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Figure 7.11 - The meat utility index recorded for the Granastadir site. Values are grouped according to structure and room designations.

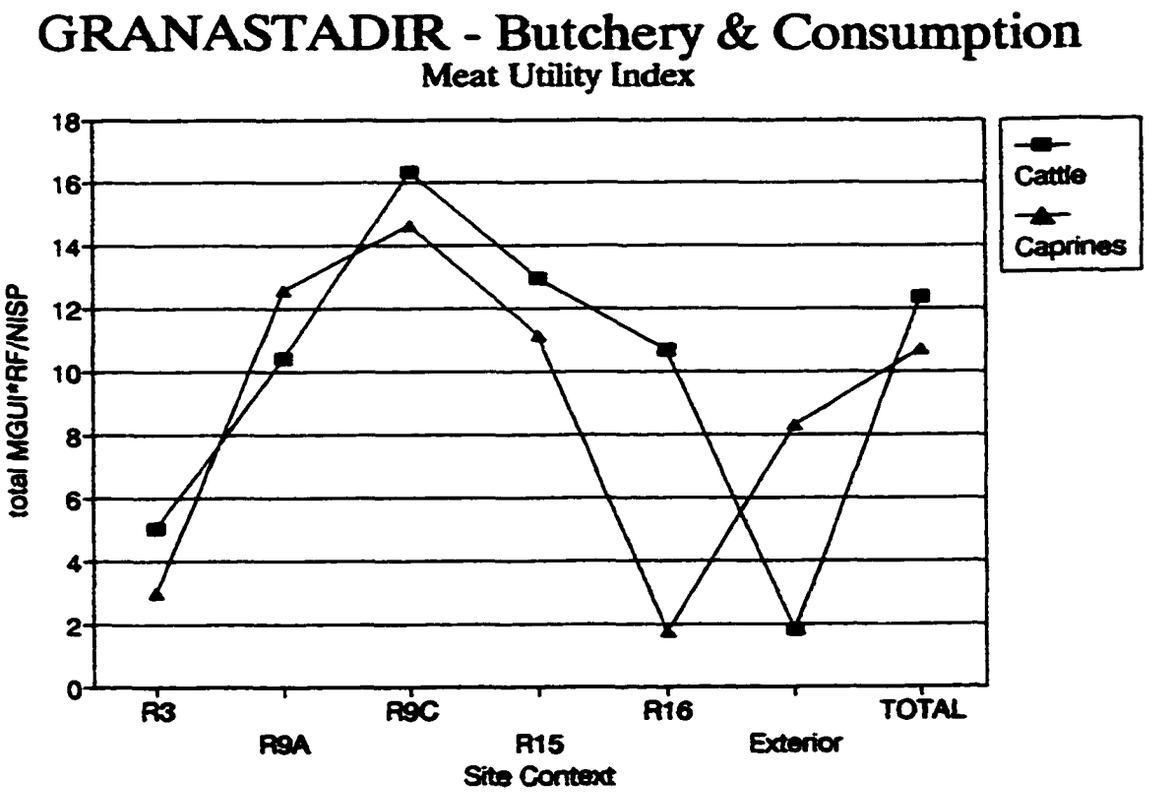

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Figure 7.12 - The caprine neonatal percentage for the Granastadir archaecfauna. Data are compared to the Iceland sites of Svalbard, Videy and Storaborg. V51 Sandnes and o17a Narssaq are temporally contemporary sites from Norse Greenland (data was kindly provide to the author by T.H. McGovern).

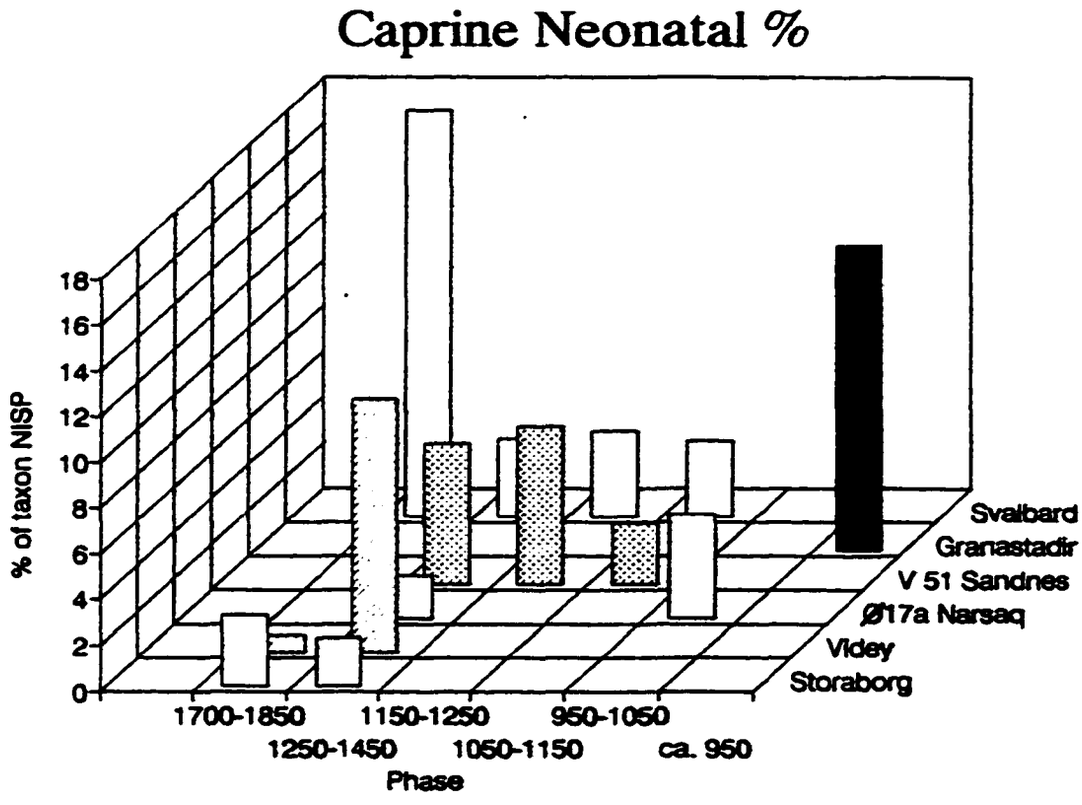

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Figure 7.13 - The osteometric data for the caprine proximal metacarpal graphed in a scatter plot.

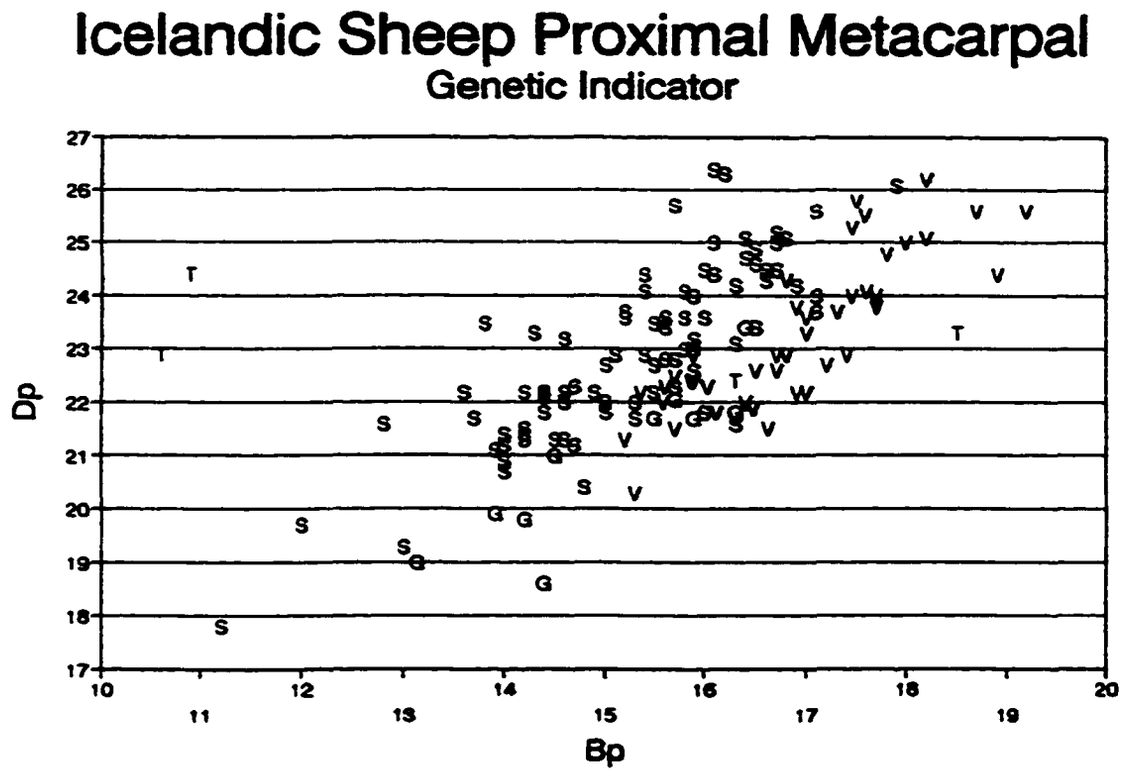

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Figure 7.14 - The osteometric data for the caprine metacarpal medial width vs. the distal width graphed in a scatter plot.

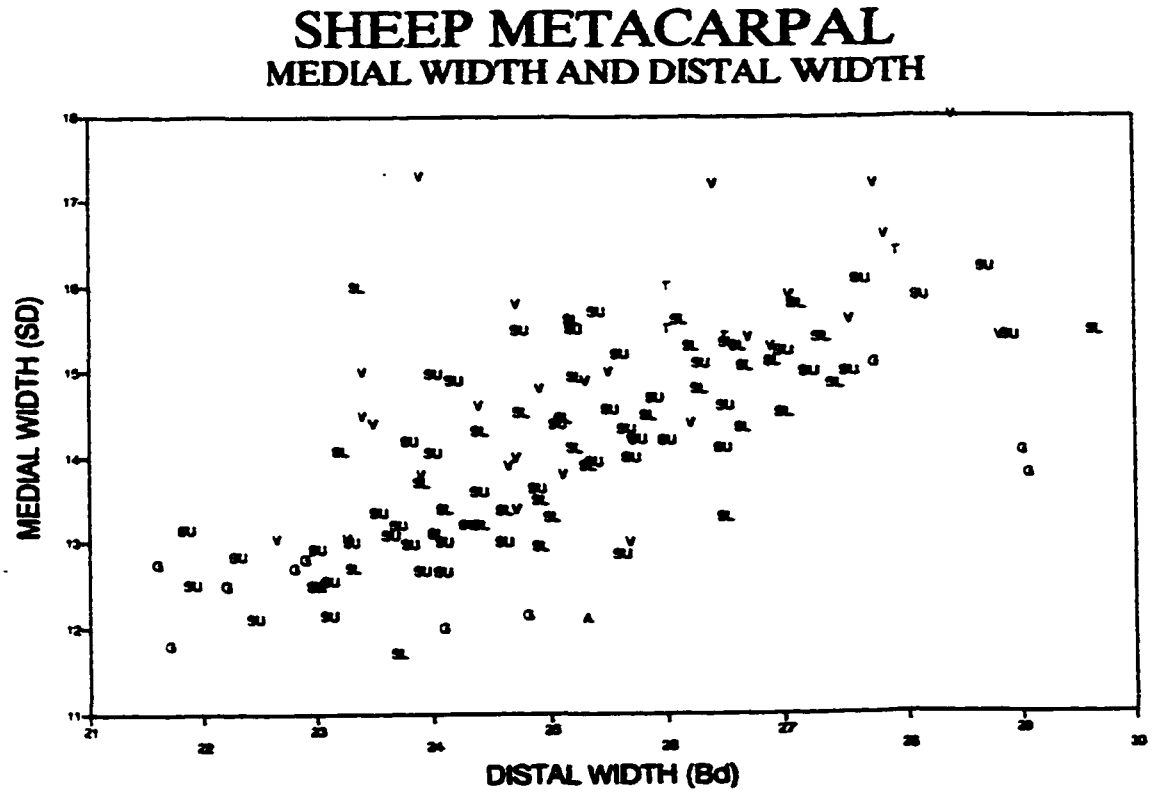

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Figure 7.15 - The osteometric data for the caprine metacarpals greatest length graphed.

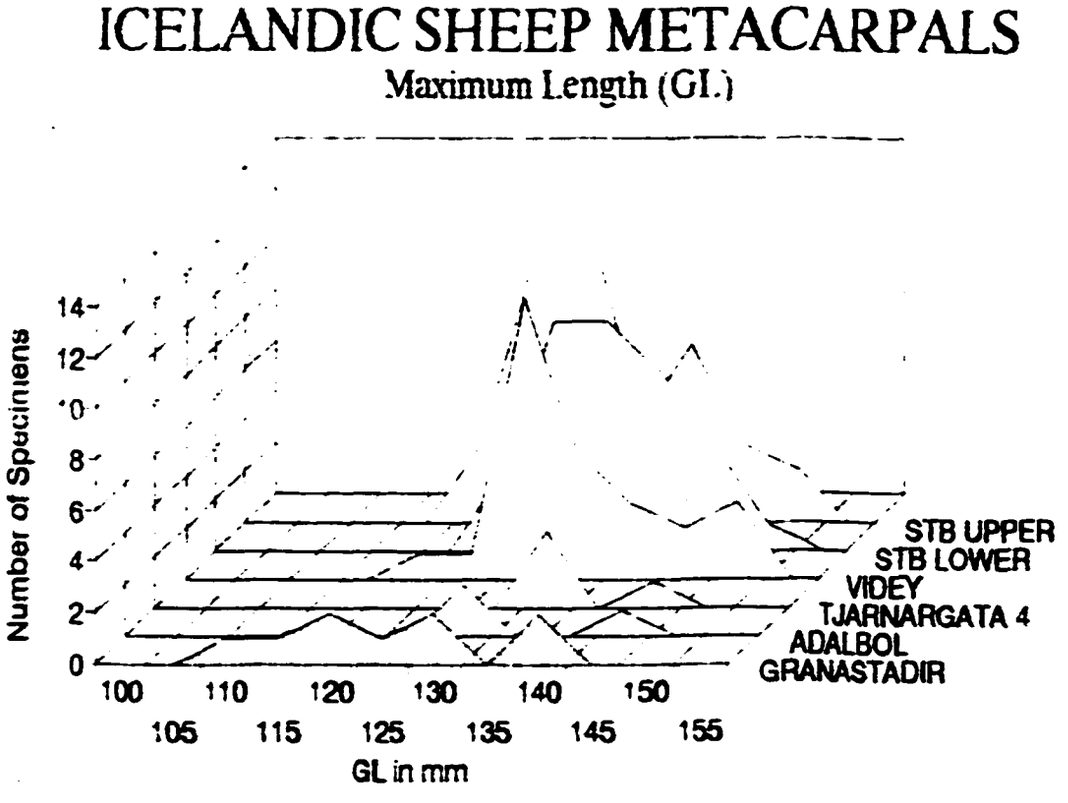

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Figure 7.16 - The osteometric data for the caprine metatarsals greatest length vs. medial width graphed as a scatter plot.

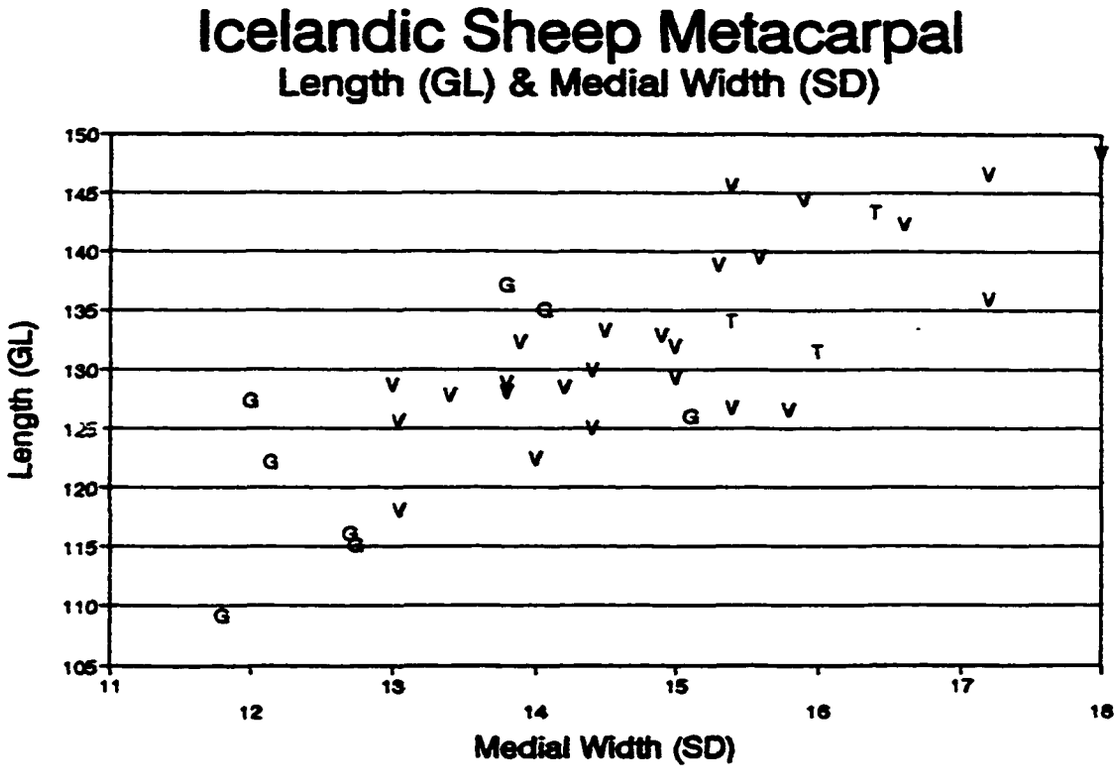

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Figure 7.17 - Photograph of caprine metacarpals recovered from the Granastadir site. The photograph demonstrates a narrowing of the mid-shaft of the metatarsal in neonatal and juvenile caprines.

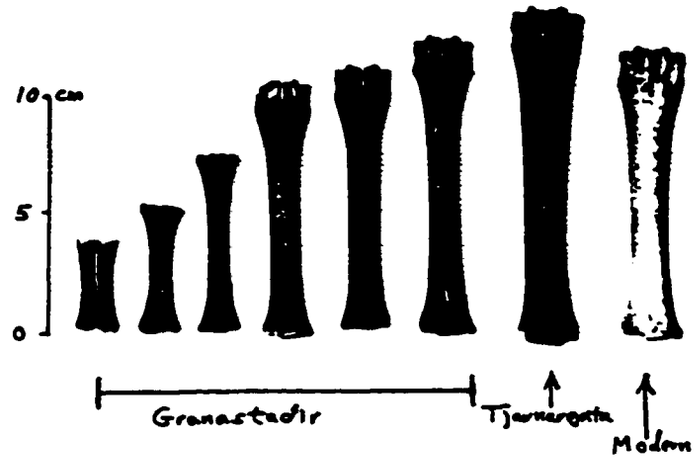

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Figure 7.18 - The osteometric data for the caprine first phalanx graphed.

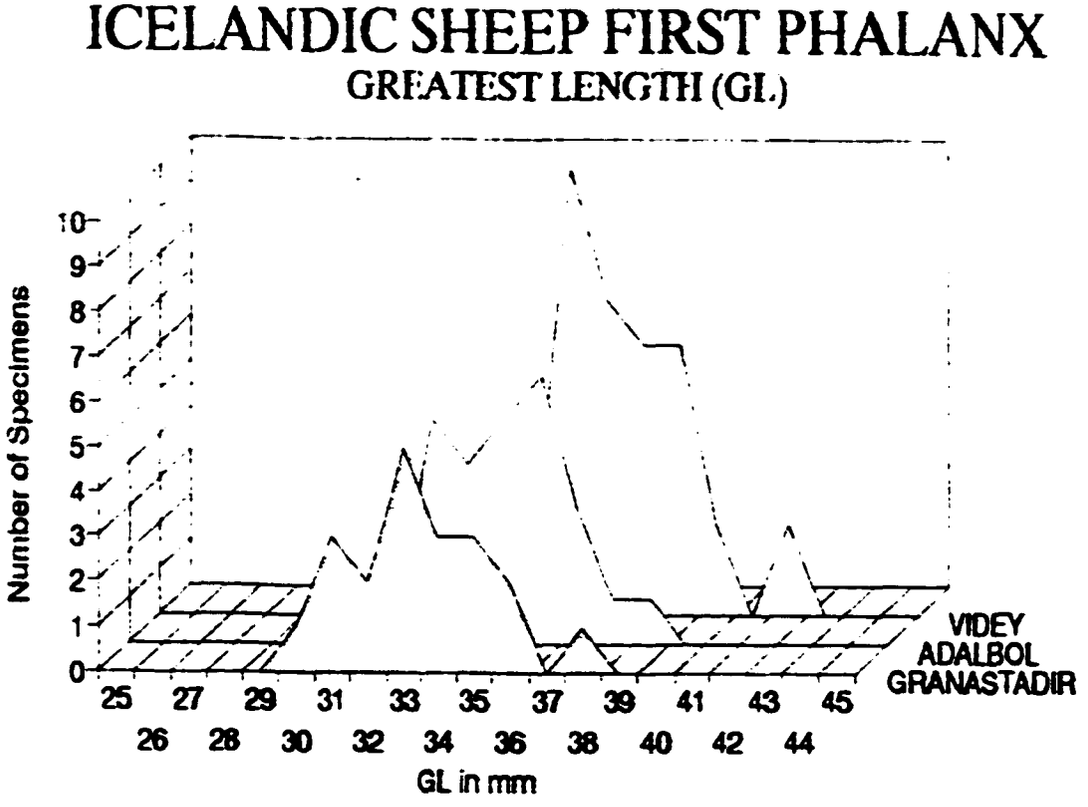

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Figure 7.19 - The osteometric data for the caprine distal humeri graphed with one standard deviation. The Greenlandic data is provided as a pint of reference (data courtesy of T.H. McGovern).

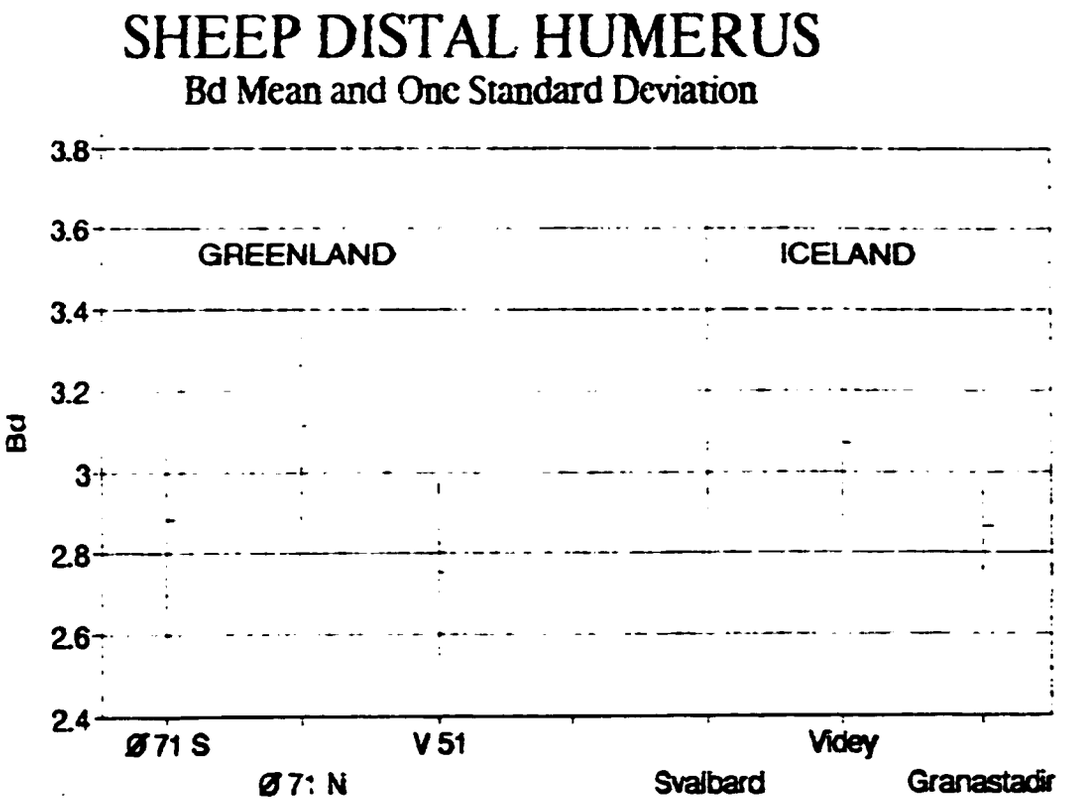

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Figure 7.20 - The osteometric data for the caprine radii from the Granastadir site compared with that from the site of Videy.

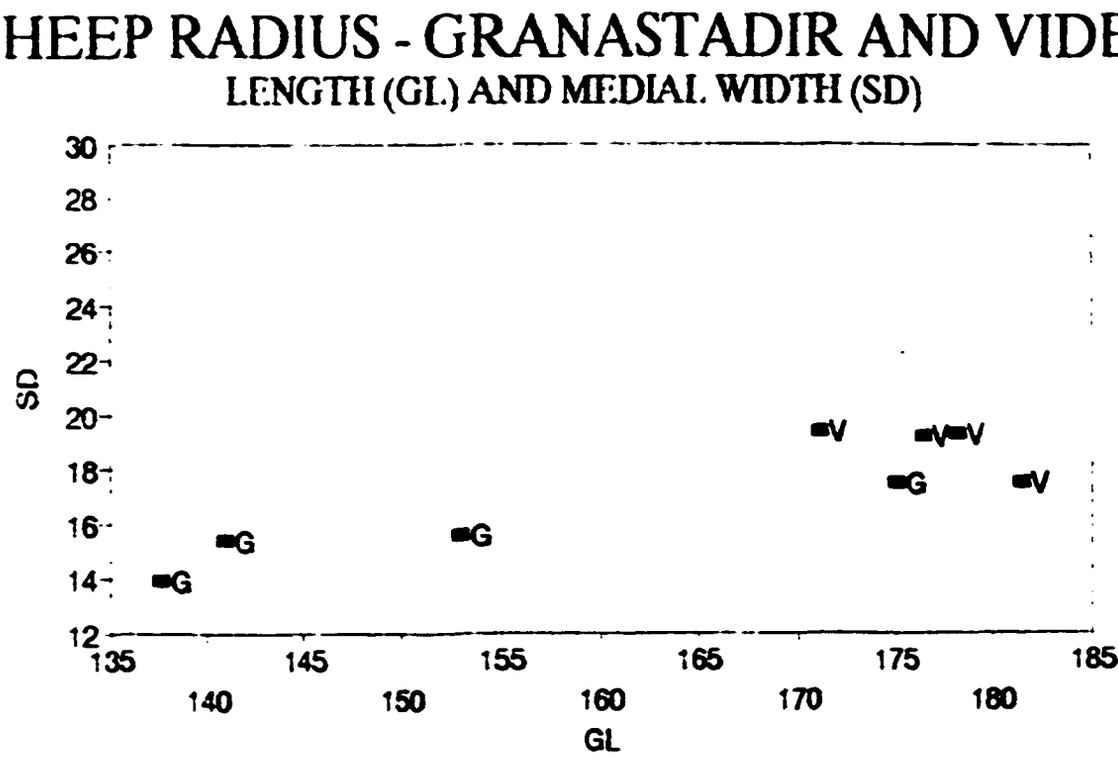

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Figure 7.21 - The osteometric data for the cattle metacarpals graphed in a scatter plot. The symbols in the graph are: G= Granastadir, T= Tjarnargata 4, and V= Videy.

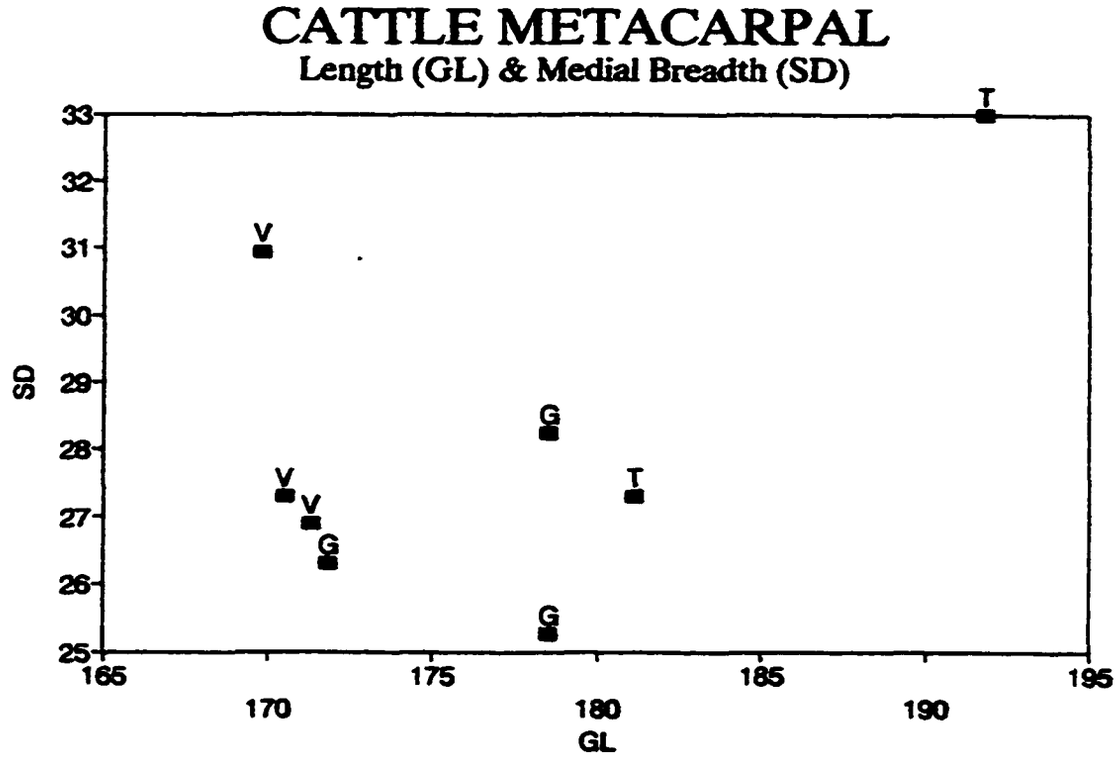

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Figure 7.22 - The osteometric data for the cattle first phalanx graphed.

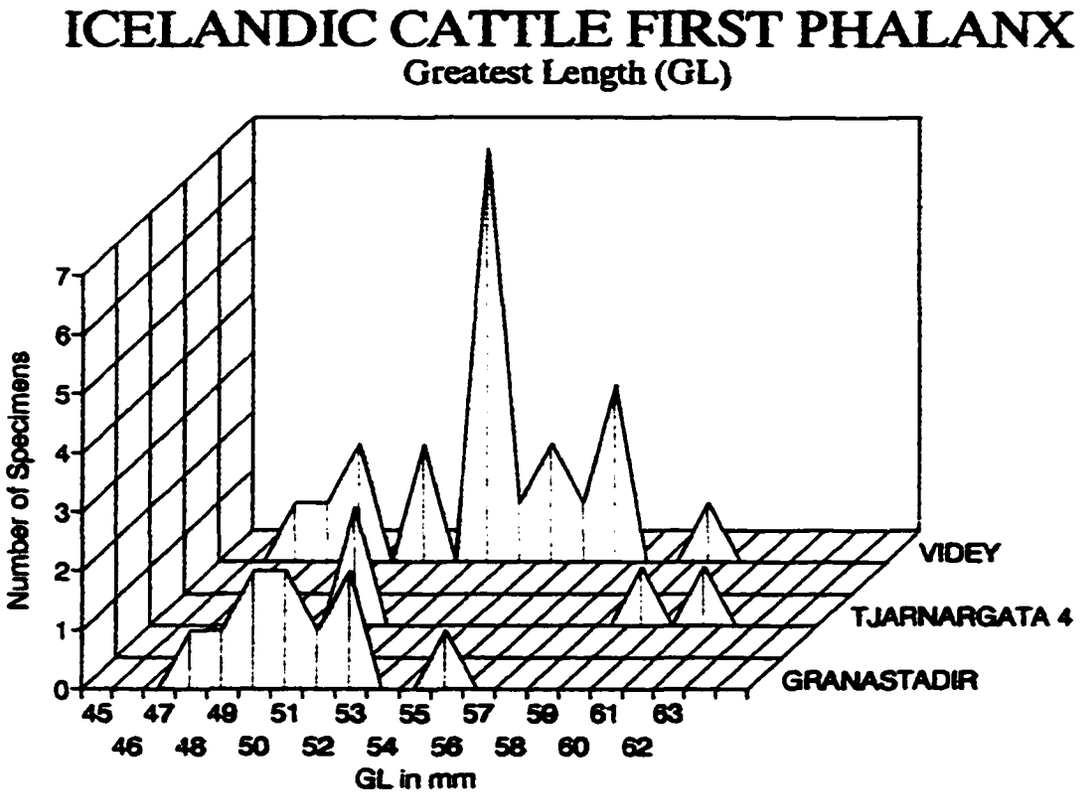

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Figure 7.23 - The osteometric data from Figure 7.22 graphed as a scatter plot. The symbols are: G= Granastadir, T= Tjarnargata 4 and V= Videy.

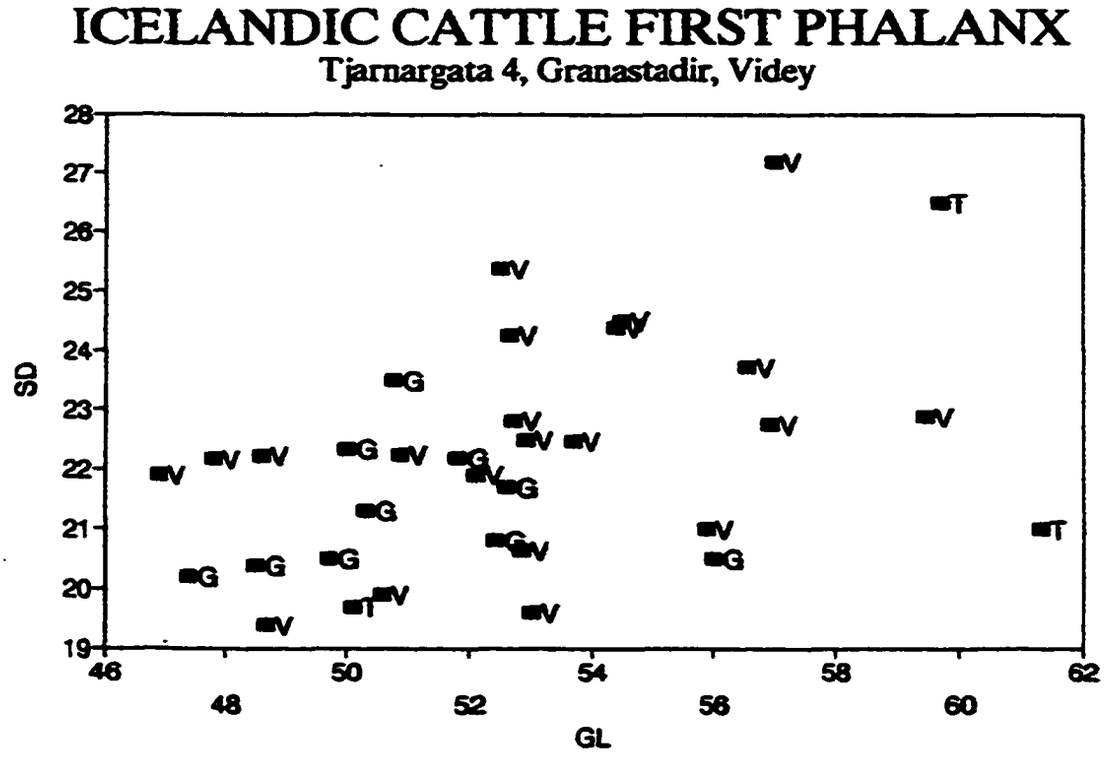

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Figure 8.1 - The location of the Storaborg farm mound on Iceland's south coast (from Sveinbjarnardottir, Buckland, Gerrard, Greig, Perry, Savory and Snaesdottir 1980).

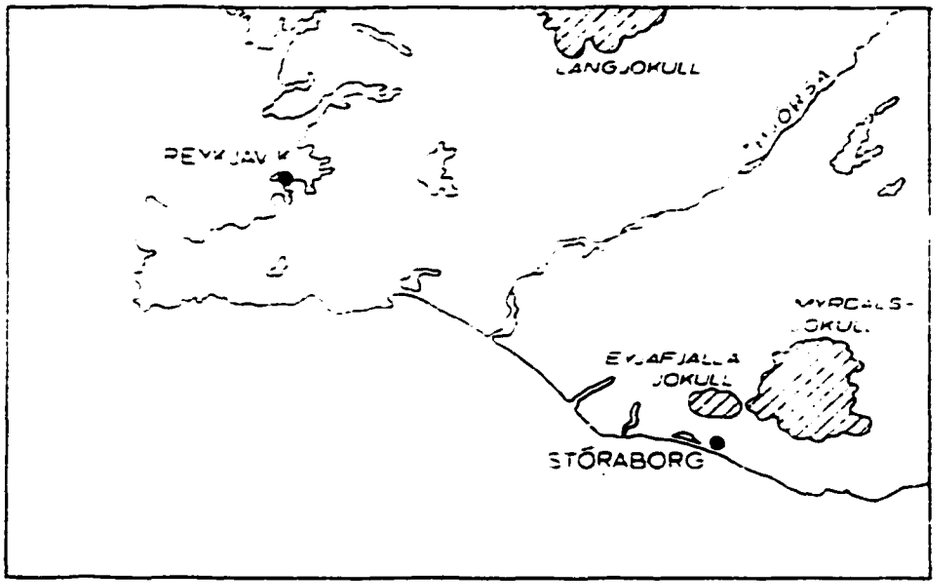

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Figure 8.2 - The minimum medial breadth graphed against the total length of the sheep metapodials.

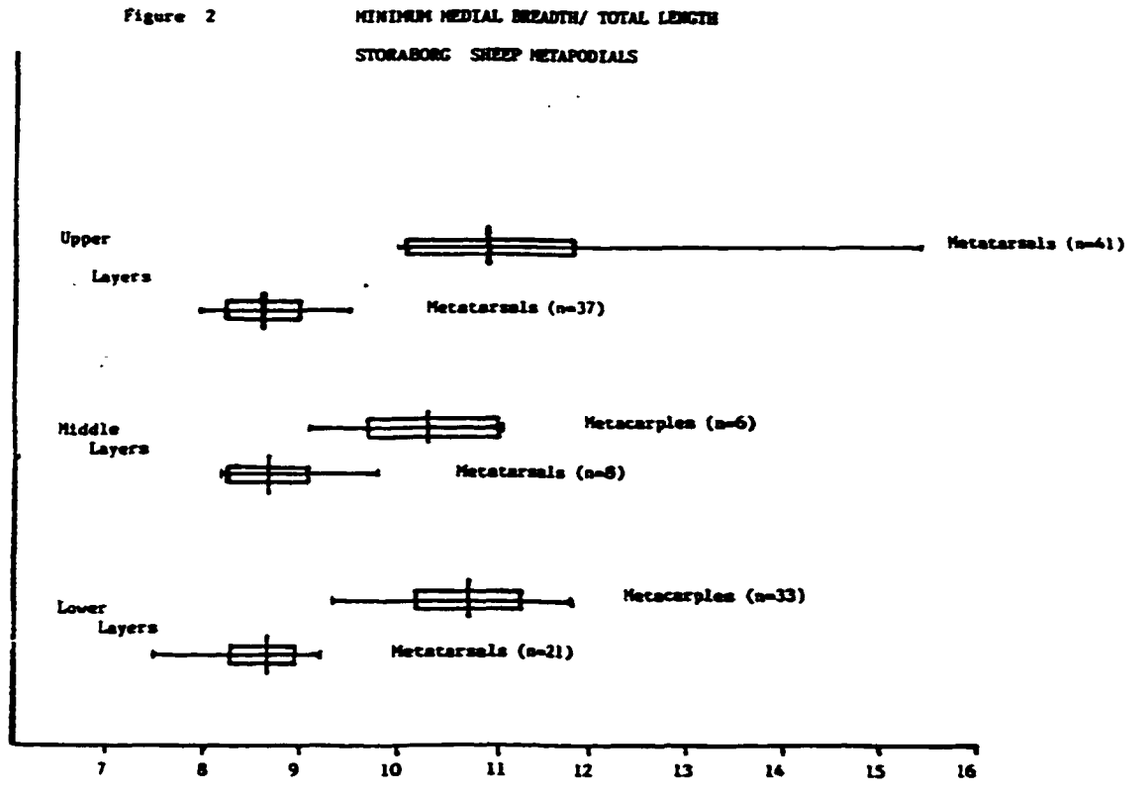

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Figure 8.3 - The distal measurements graphed against each other (Bp/Bd).

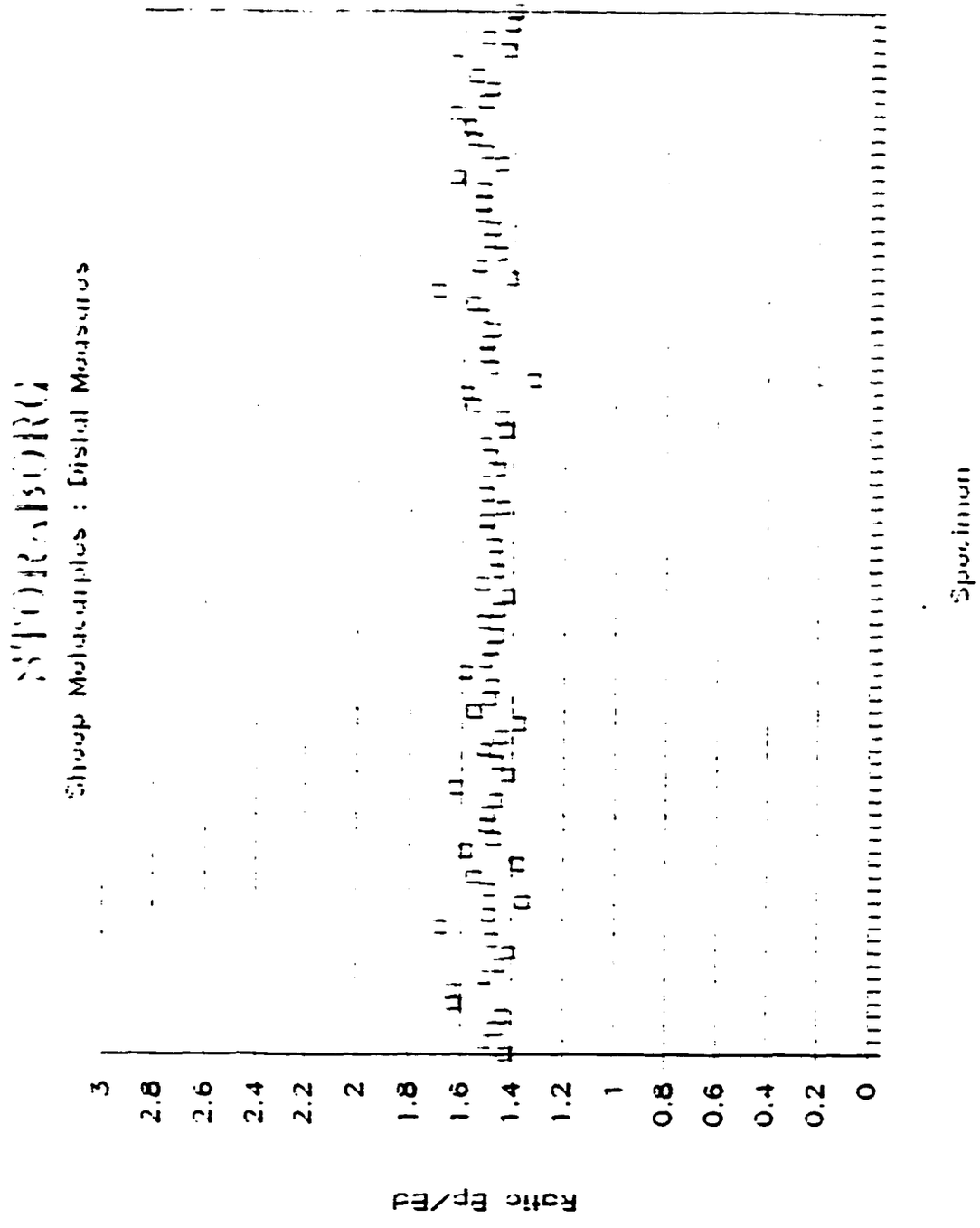

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Figure 8.4 - The frequency of the atlantic cod dentary measurements plotted in a similar manner and compared to the dentary sample recovered from the site of Sandwick, Shetland (data is drawn from Bigelow 1984).

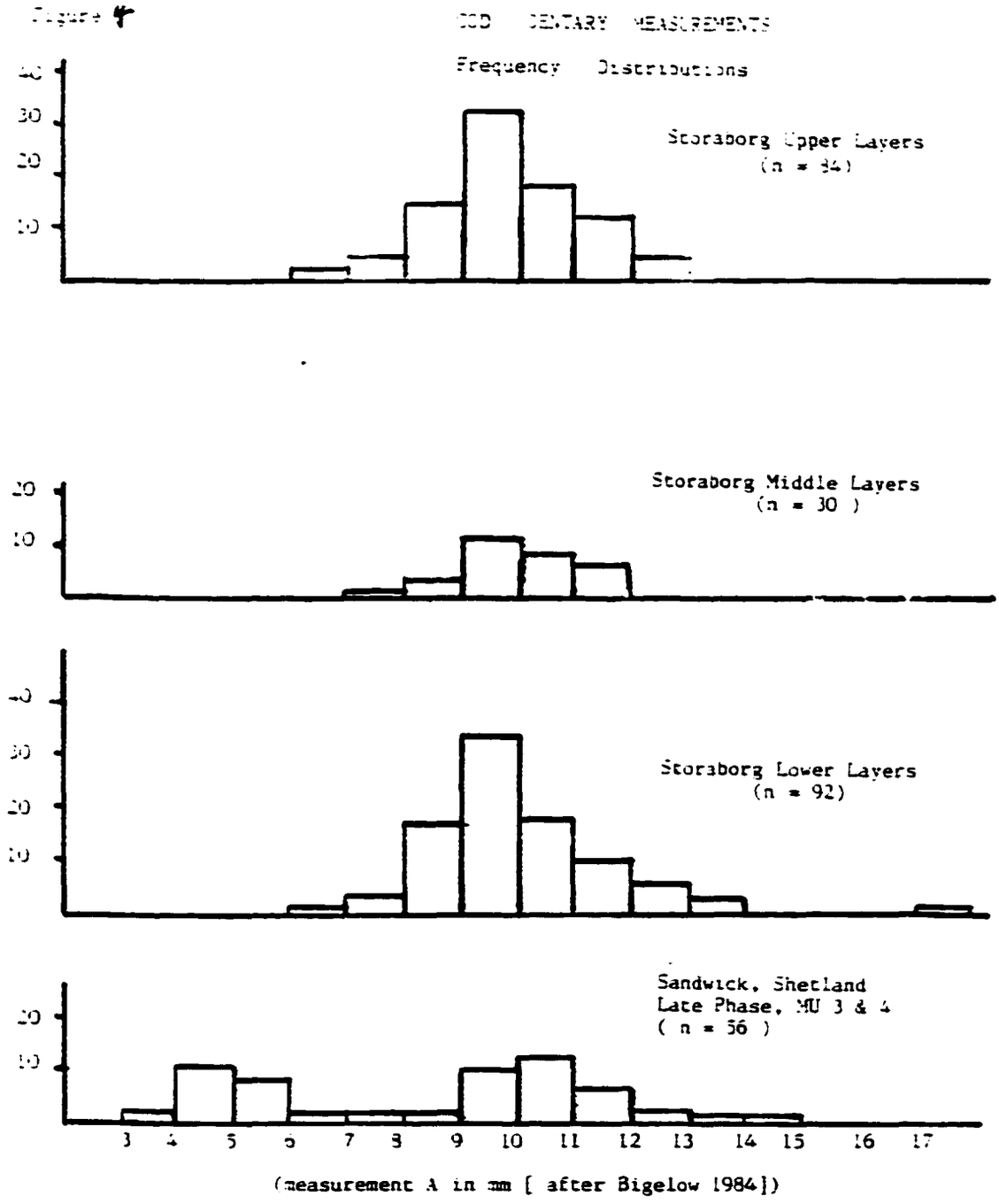

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Figure 8.5 - Comparison of modern (Palsson 1983) and archaeological cod lengths.

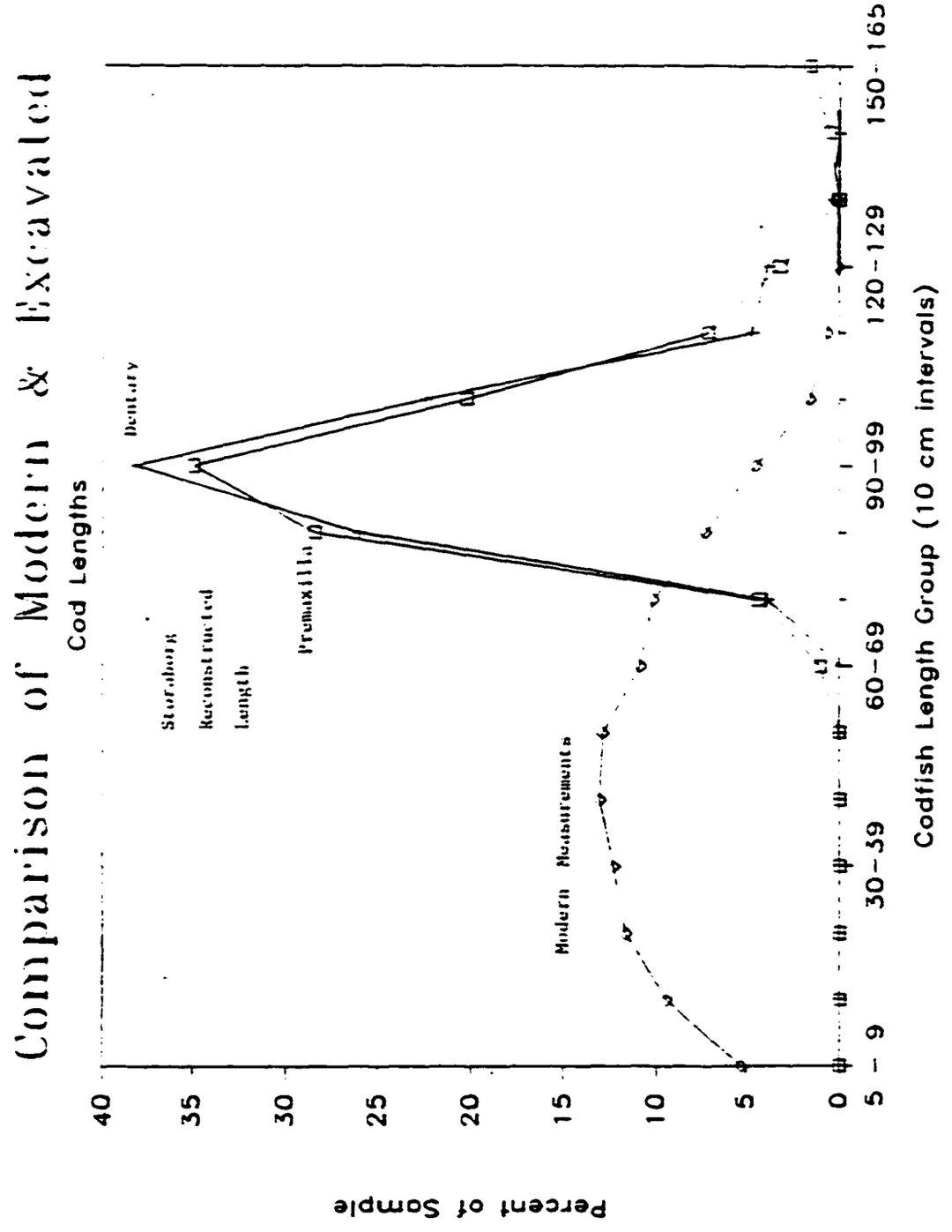

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Figure 8.6 - The distribution of the reconstructed cod length from each of the Storaborg structural phases.

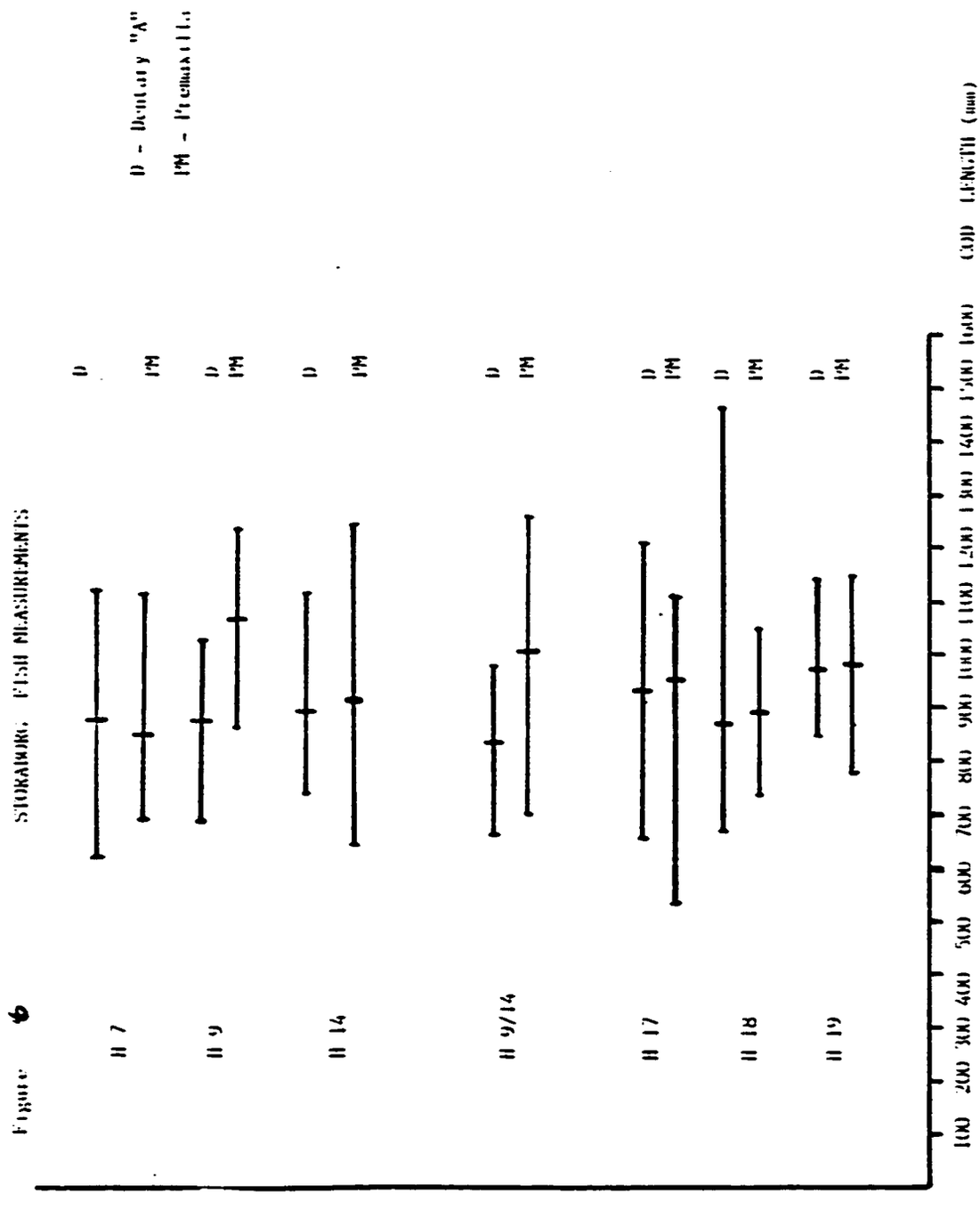

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Figure 8.7 - The distribution of the caprine tooth wear stages.

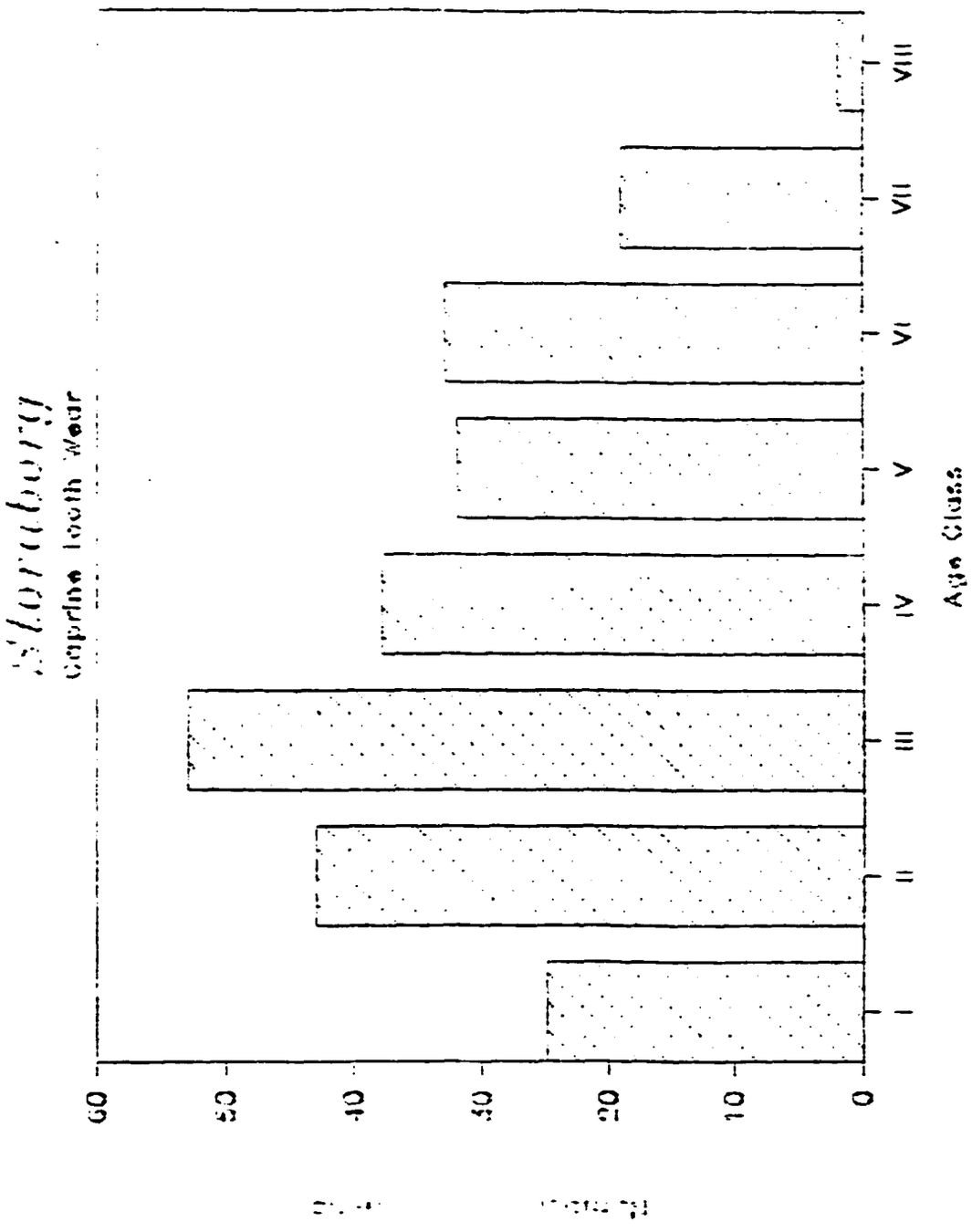

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Figure 8.8 - The distribution of the cattle tooth wear stages.

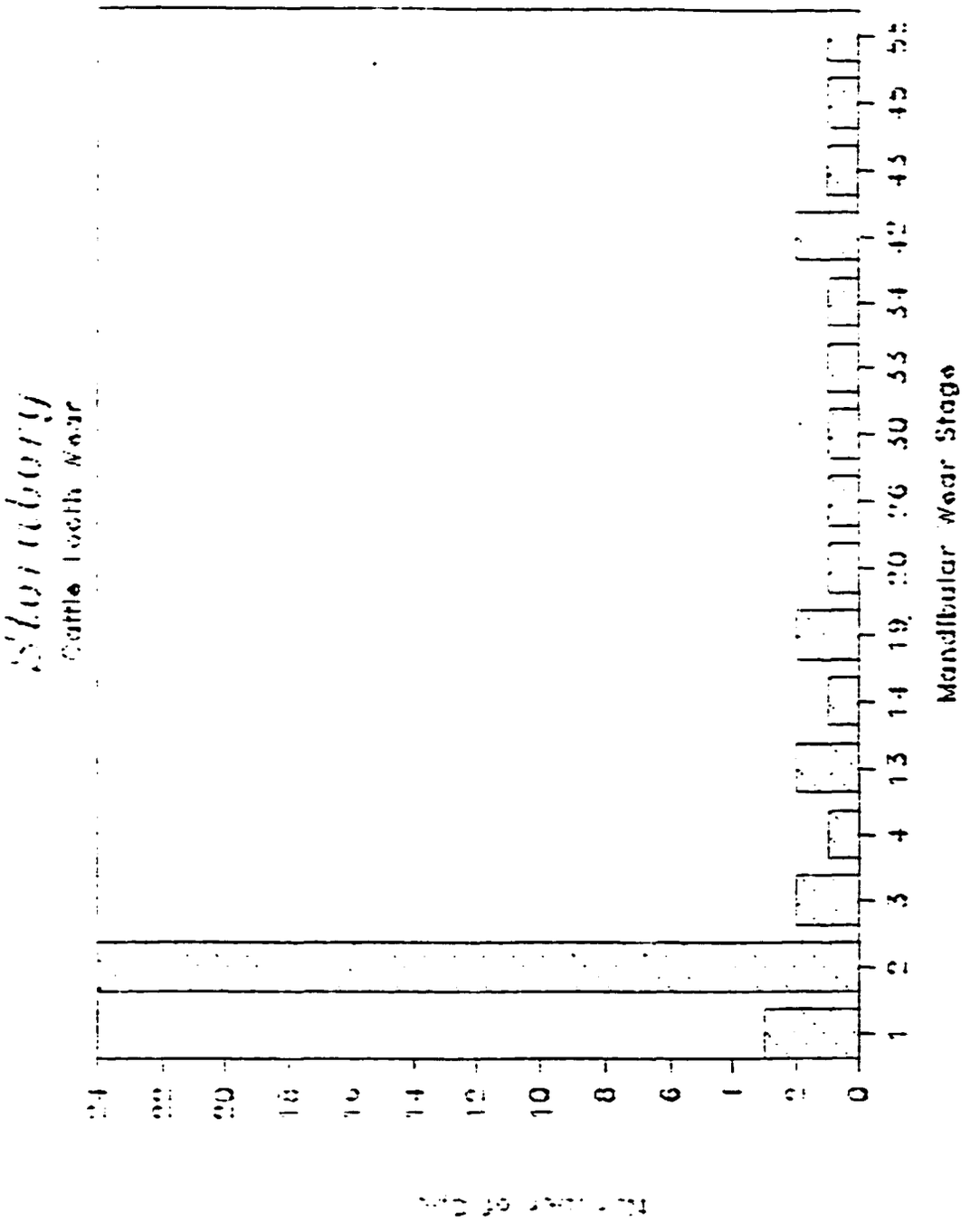

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Figure 10.1 - Comparison of the relative percentage of the Number of Identified Specimens (NISP) for the phased 1987-1988 archaeofauna recovered from Videy.

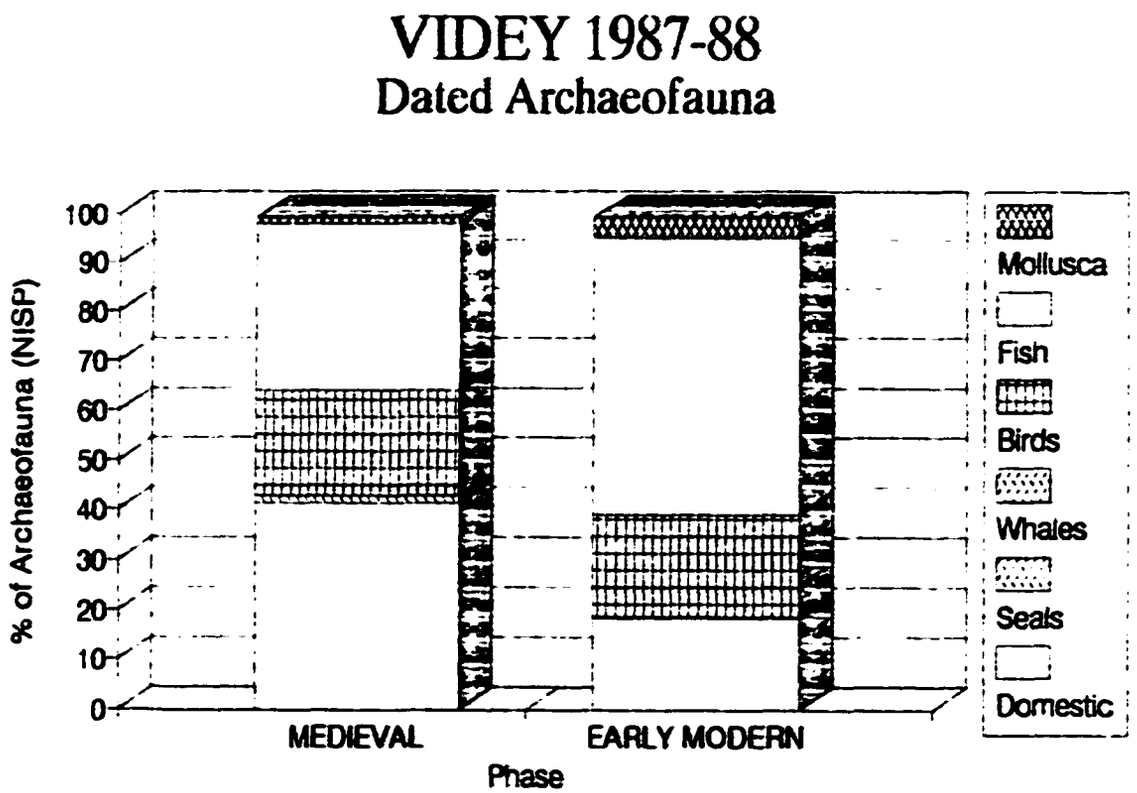

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Figure 10.2 - Comparison of the domestic mammals recovered from the Medieval and Early Modern phases from the 1987-1988 Videy faunal samples.

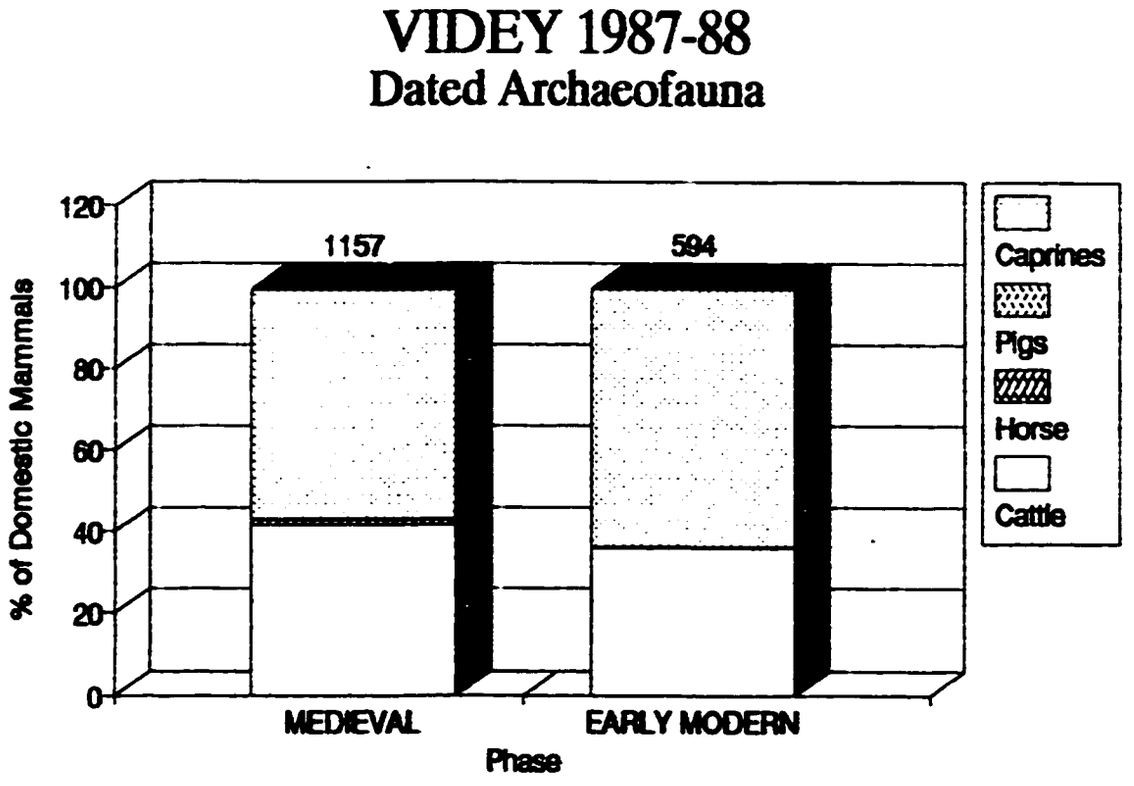

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Figure 10.3 - The data from Table 10.4 graphed, showing the relative percentage of bovid neonatals within the Medieval and Early Modern site contexts at Videy.

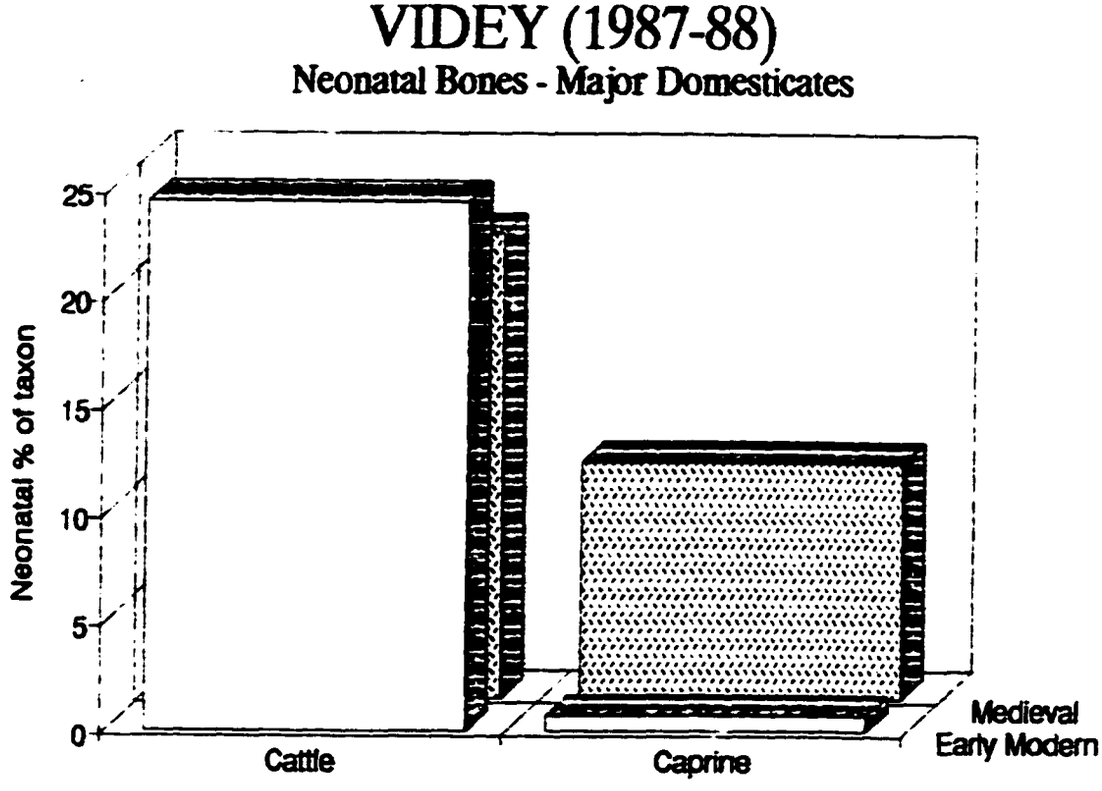

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Figure 10.4 - The relative percentage of NISP for the fish species recovered from the 1987-1988 Videy faunal samples.

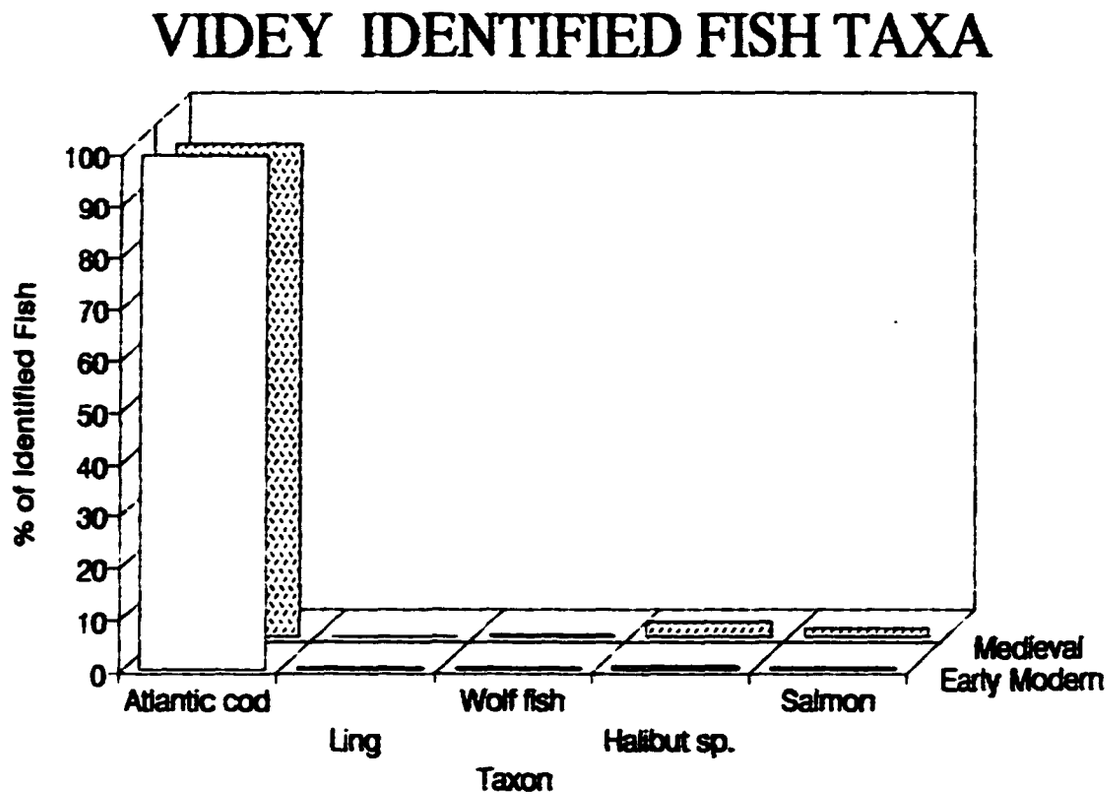

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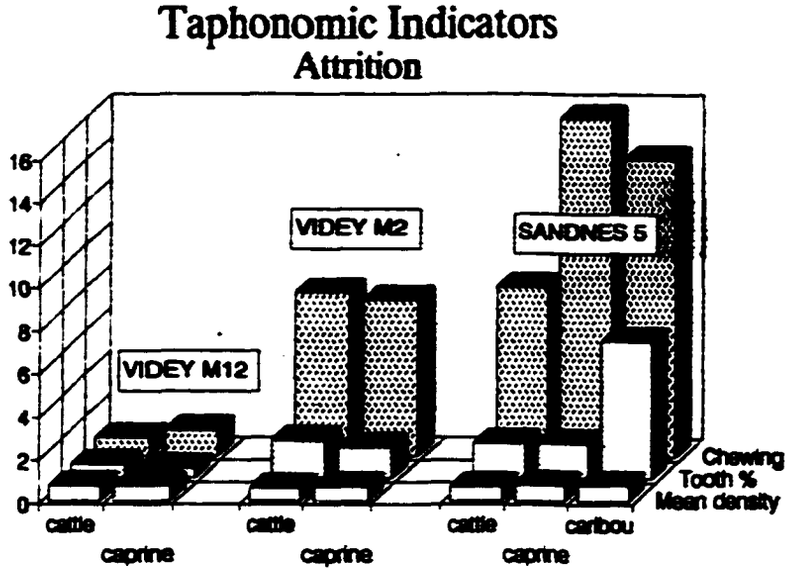
Figure 10.5 - Both the attritional factors and meat values listed in Table 10.12 graphed for the bovid sub-sample taken from the M2 and M12 site contexts at Videy. The M2 sub-sample is dated to the Early Modern phases and M12 is dated to the Medieval phases. Both the Videy contexts are compared to the West Greenlandic Norse site of Sandnes (data was kindly made available by T.H. McGovern).



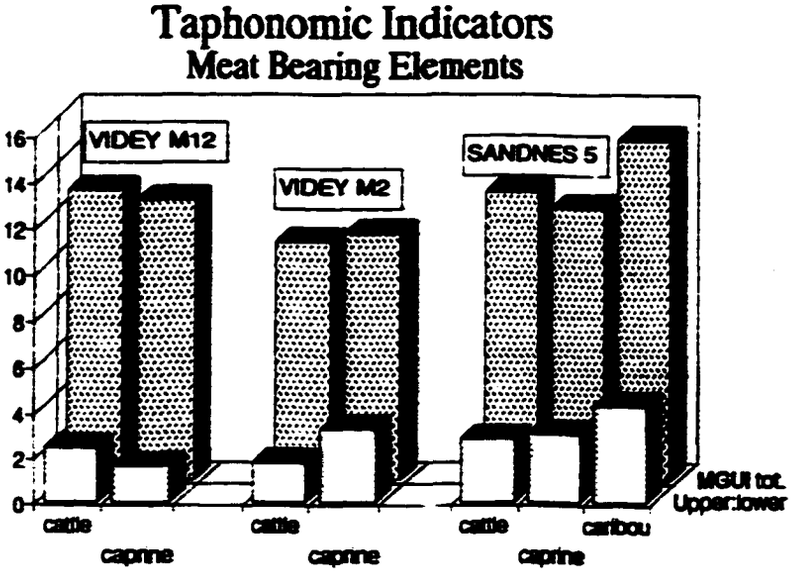


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Figure 10.6 - The cattle skeletal element distribution charted for the M2 sub-sample dated to the Early Modern phases at Videy.

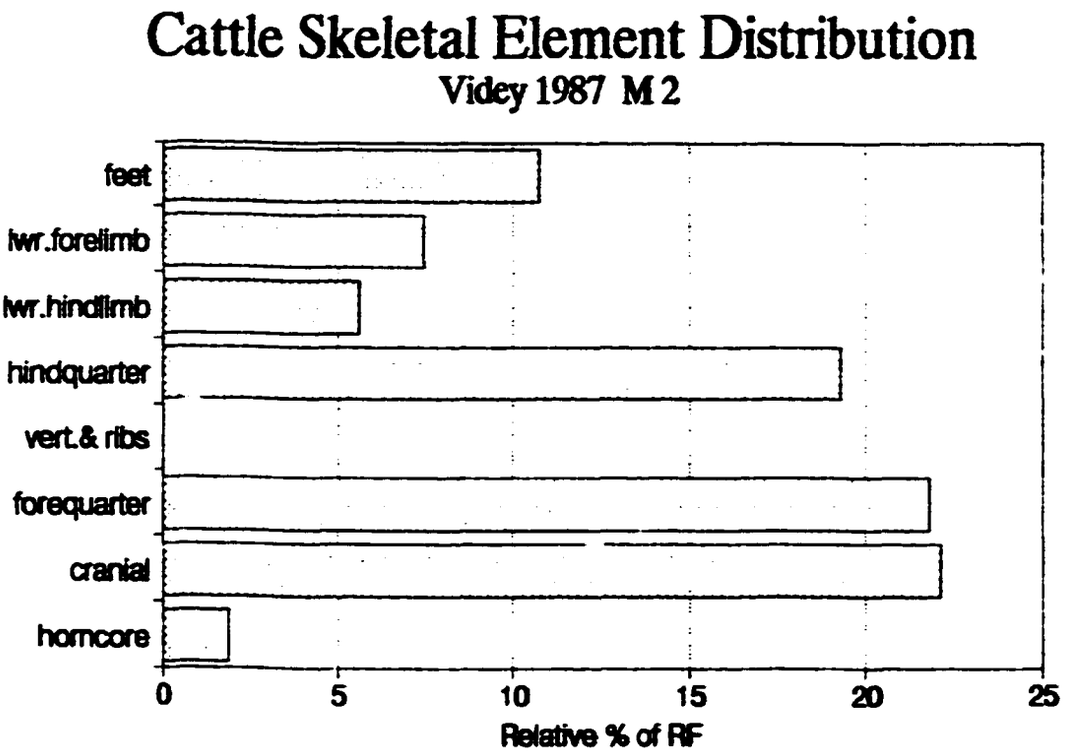

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Figure 10.7 - The caprine skeletal element distributions charted for the M2 sub-sample dated to the Early Modern phases at Videy.

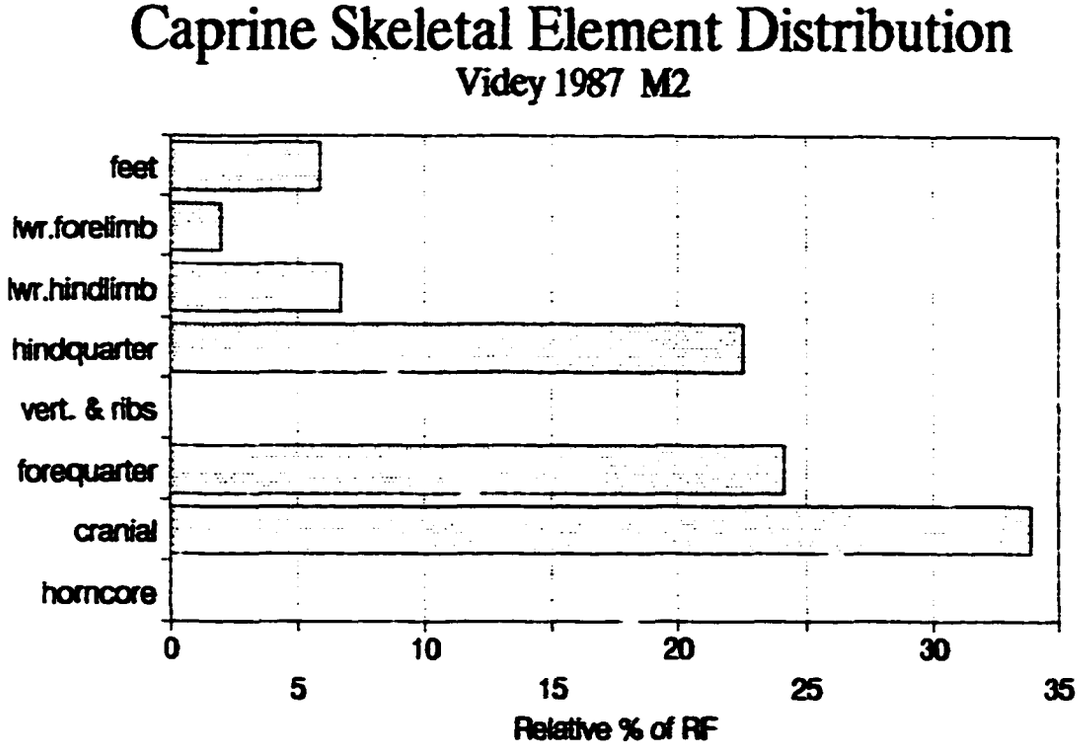

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Figure 10.8 - The cattle skeletal element distribution charted for the M12 sub-sample dated to the Medieval phases at Videy.

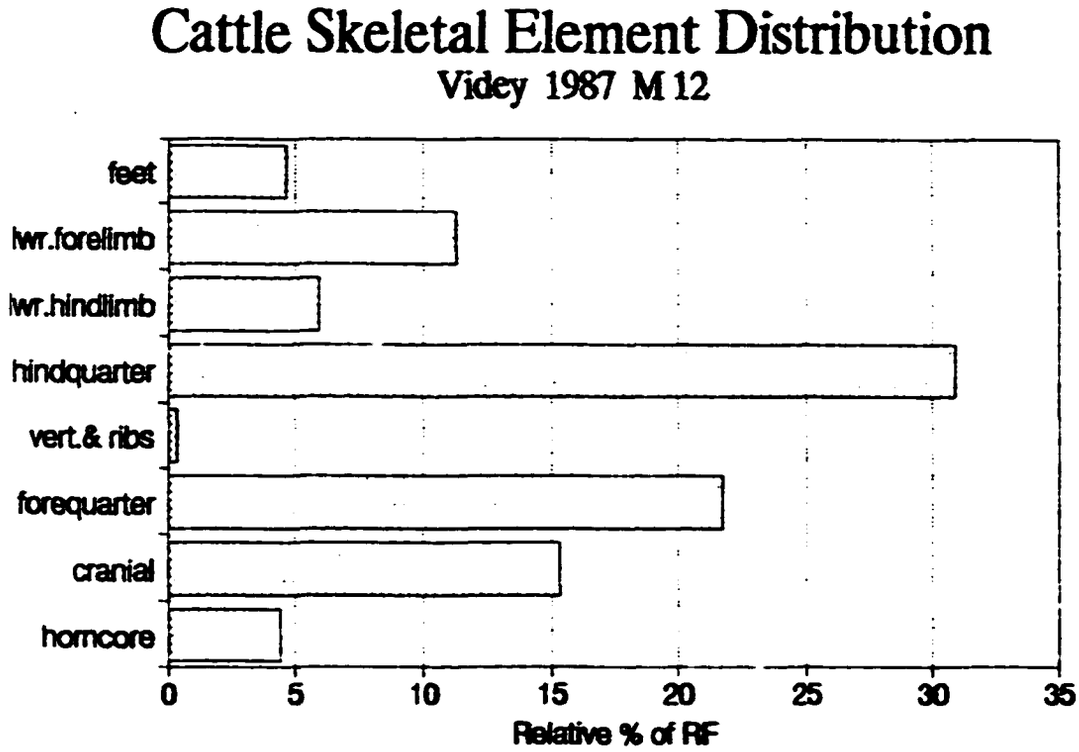

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Figure 10.9 - The caprine skeletal element distribution charted for the M12 sub-sample dated to the Medieval phases at Videy.

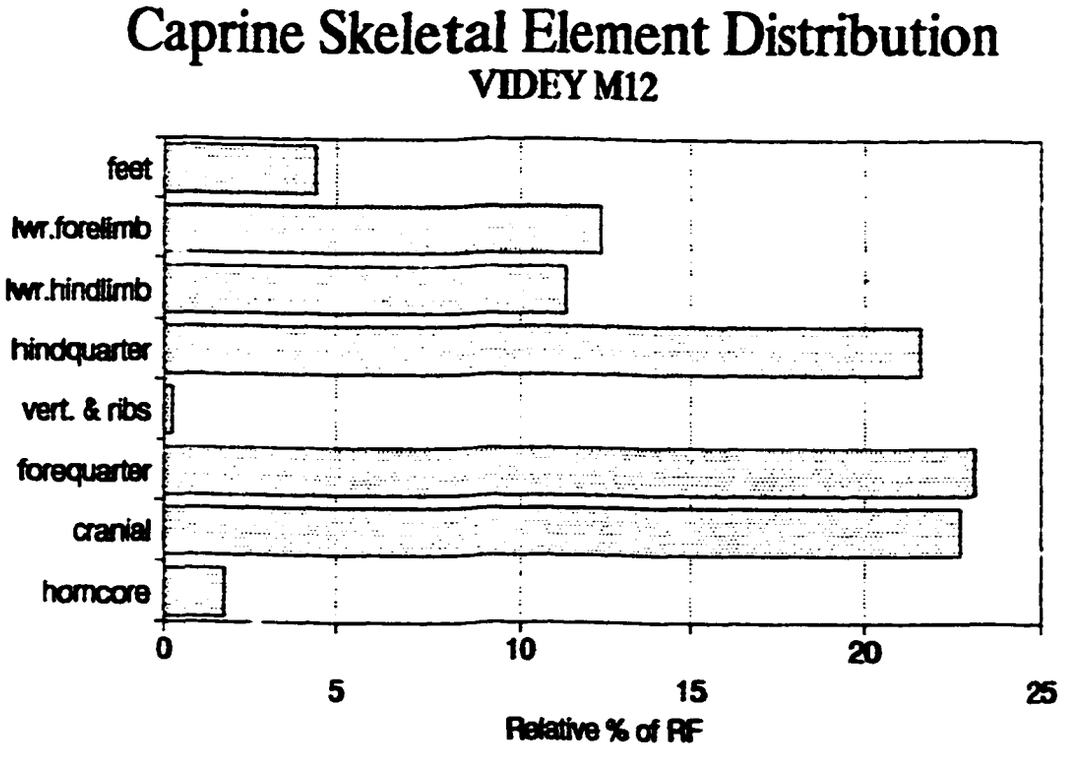

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Figure 10.10 - The Medieval phased faunal sub-sample distribution by site context.

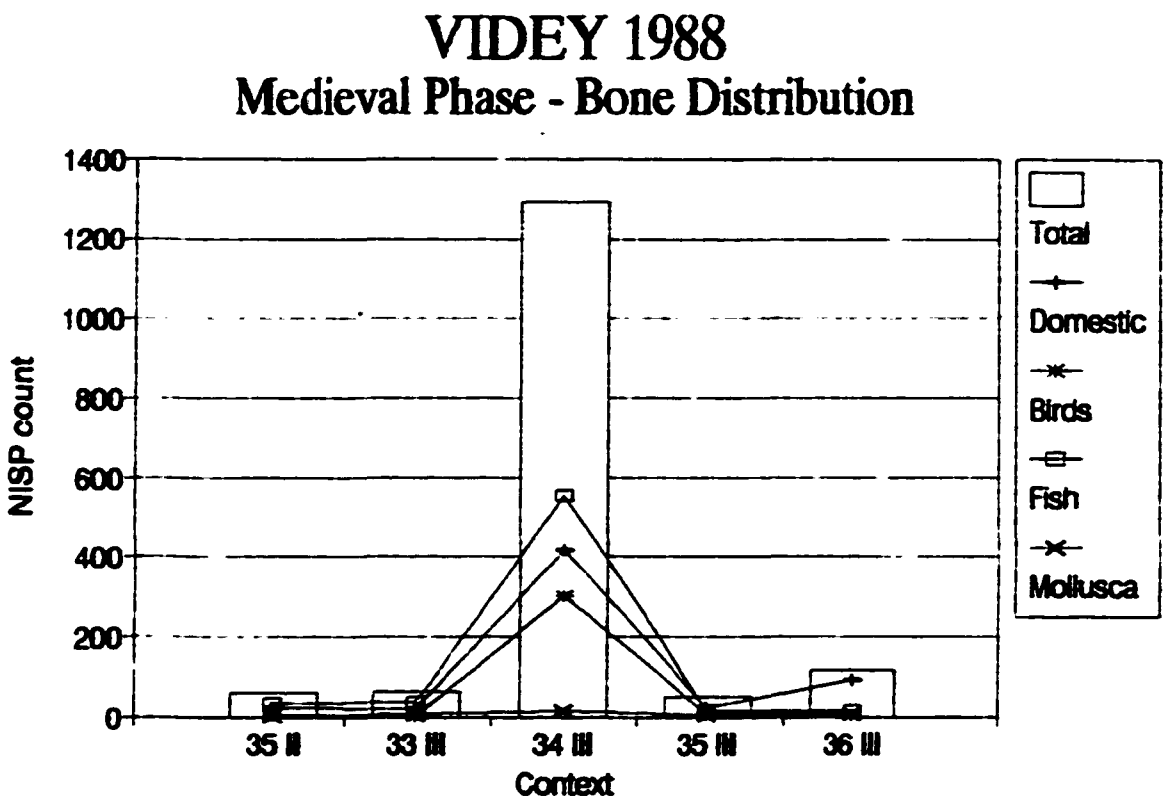

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Figure 10.11 - The 18th century faunal sub-sample distribution by site context.

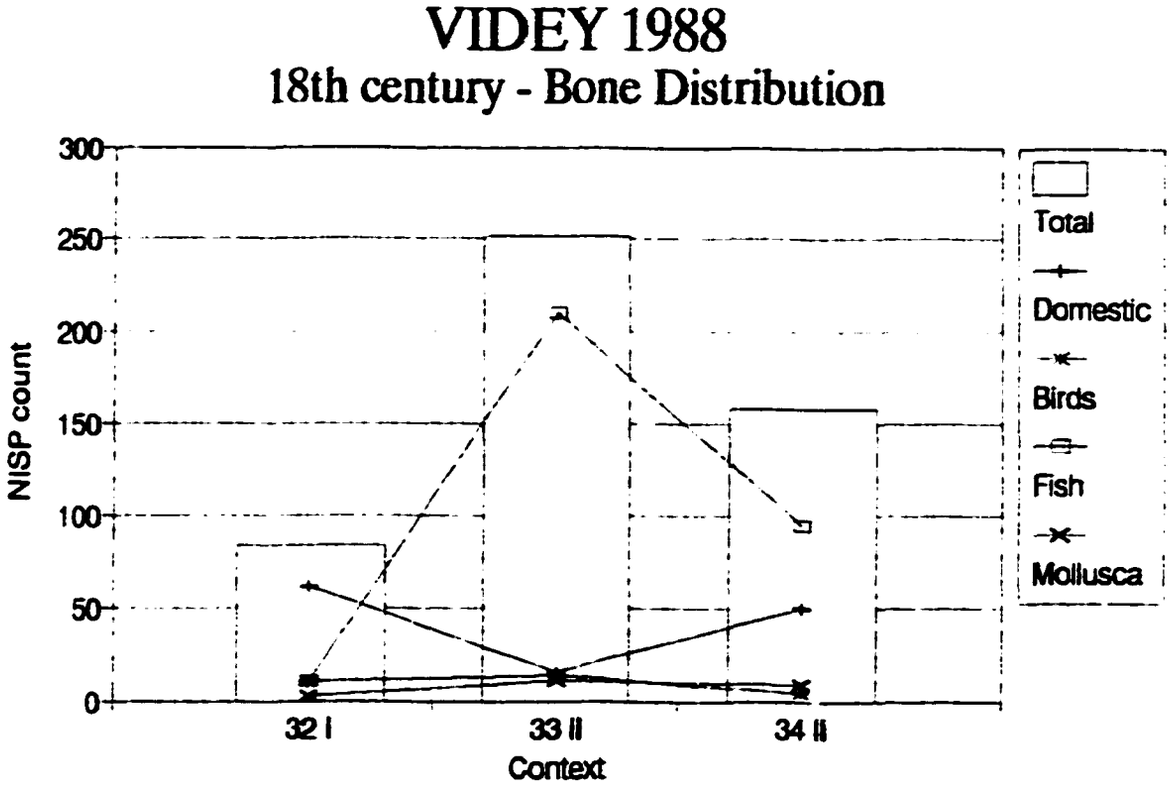

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Figure 10.12 - The 18th and 19th century sub-samples distribution by site context.

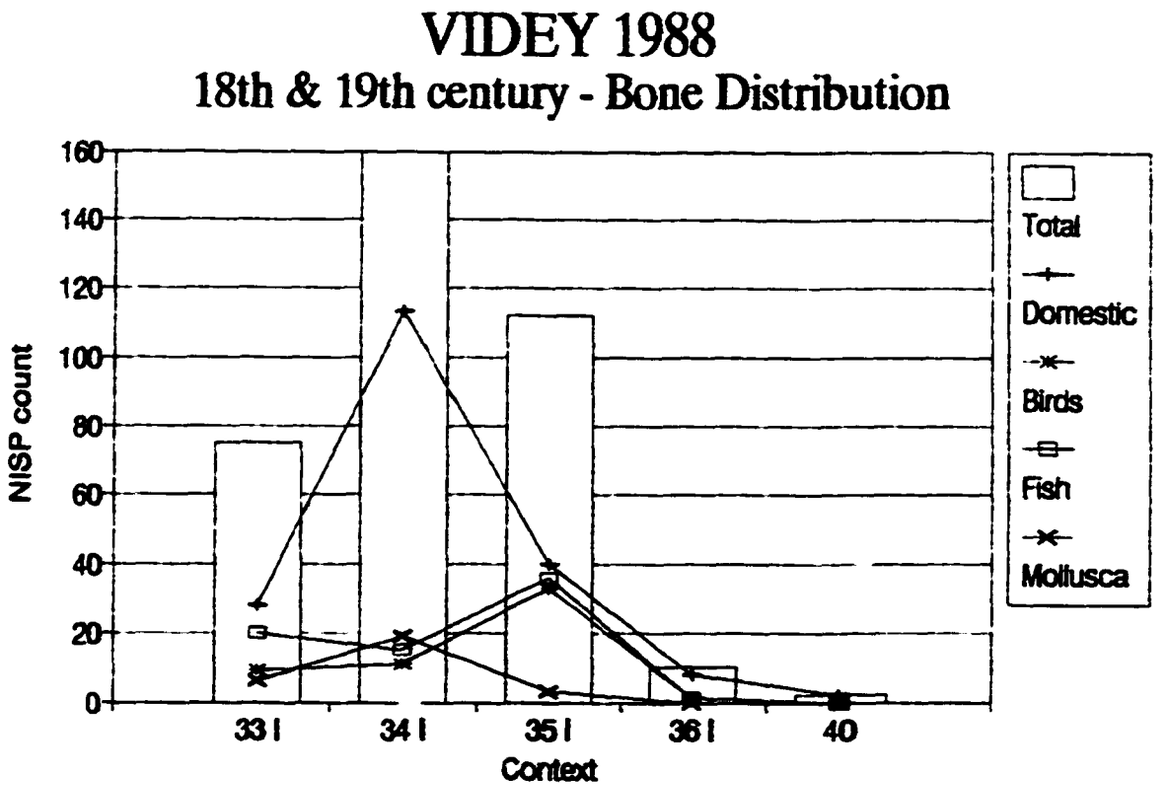

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Figure 10.13 - The cattle proximal phalanx I measurement (Bp) charted for the Videy 1987-1988 Videy faunal samples.

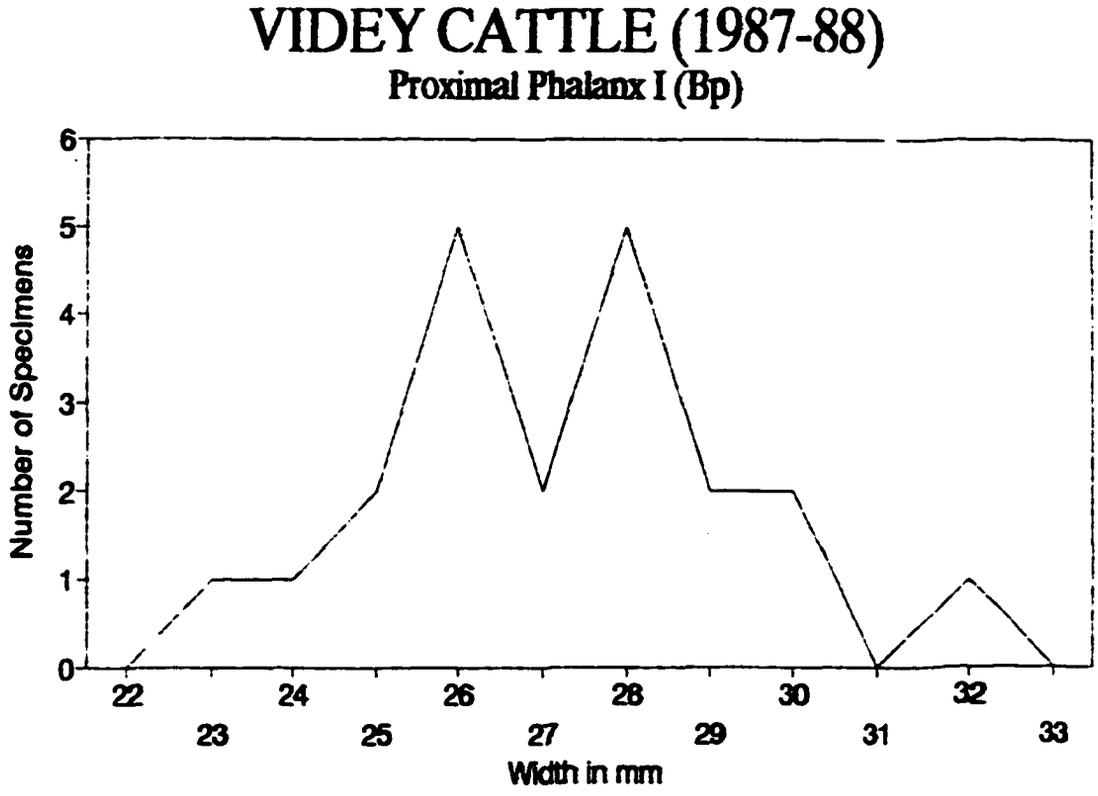

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Figure 10.14 - The cattle phalanx I greatest length measurement (GL) charted for the Videy 1987-1988 Videy faunal samples.

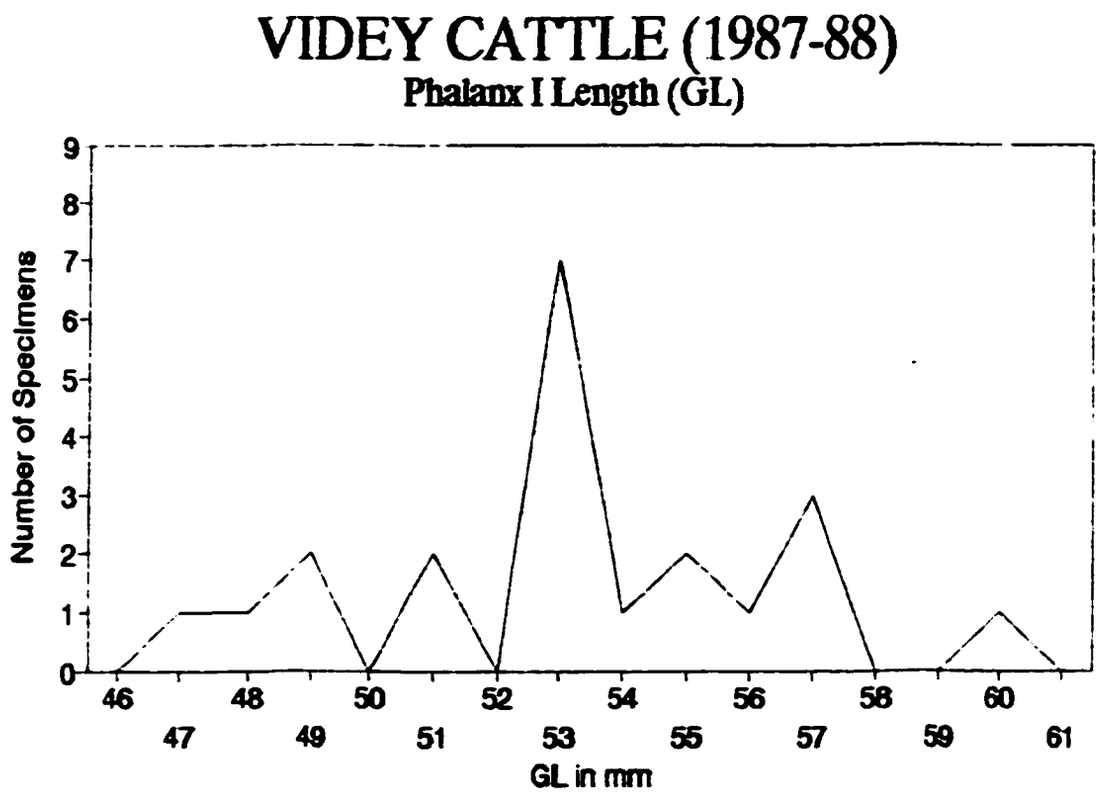

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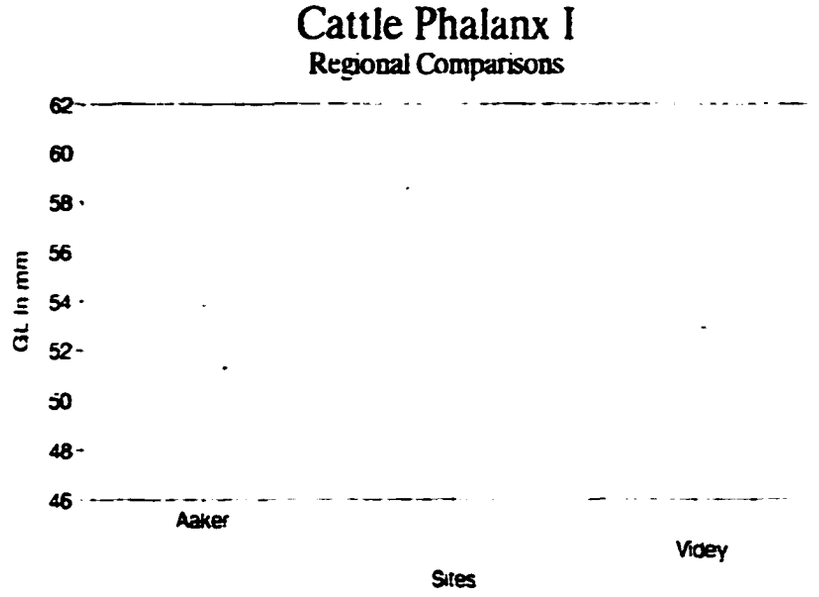
Figure 10.15 - A comparison of the Videy cattle measurements (GL and Bp) with an Iron Age faunal sample from Aaker, southwestern Norway (data was kindly made available by S. Perdikaris, also see Perdikaris 1990).



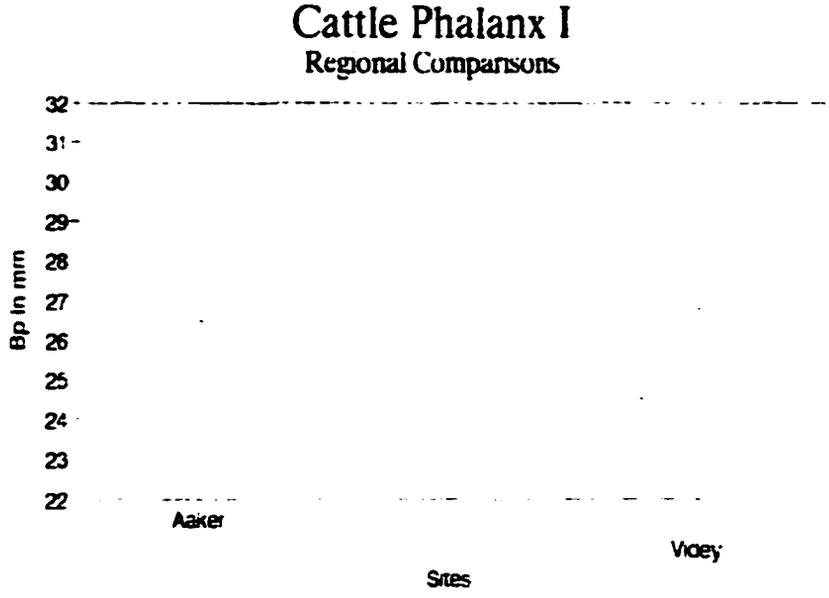


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Figure 10.16 - The caprine proximal phalanx I measurements (Bp) charted for the Videy 1987-1988 Videy faunal samples.

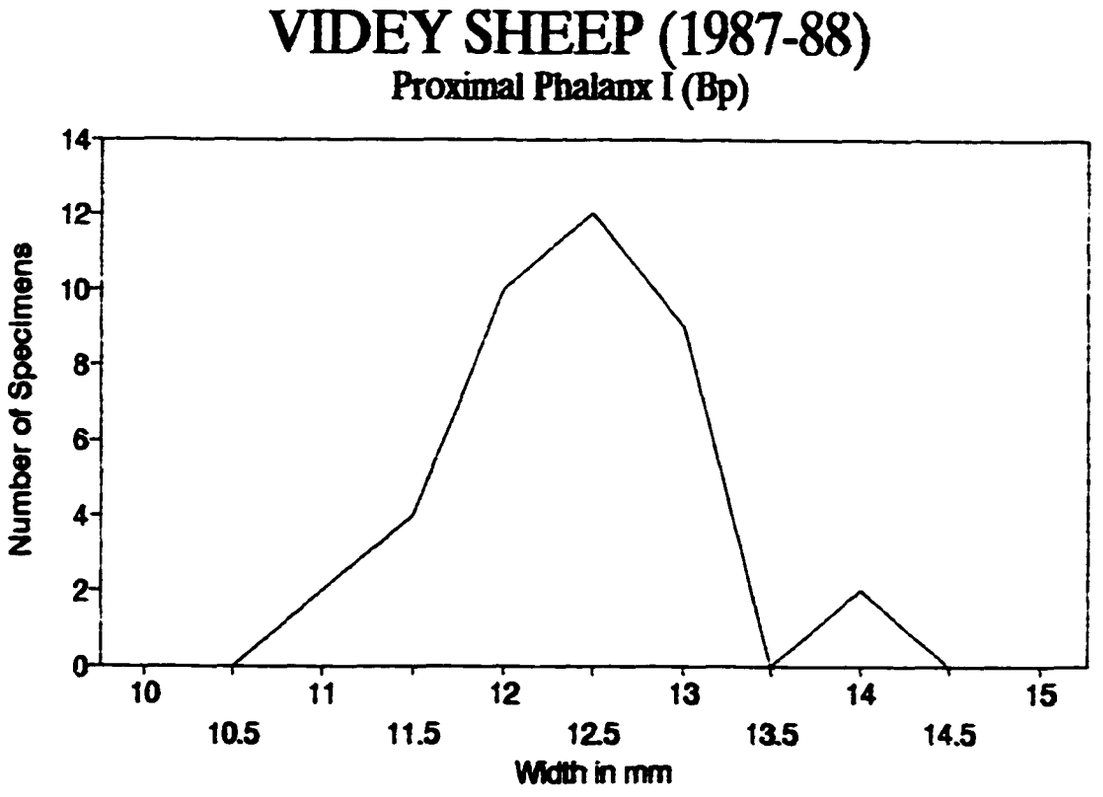

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Figure 10.17 - The caprine phalanx I greatest length measurements (GL) charted for the Videy 1987-1988 Videy faunal samples.

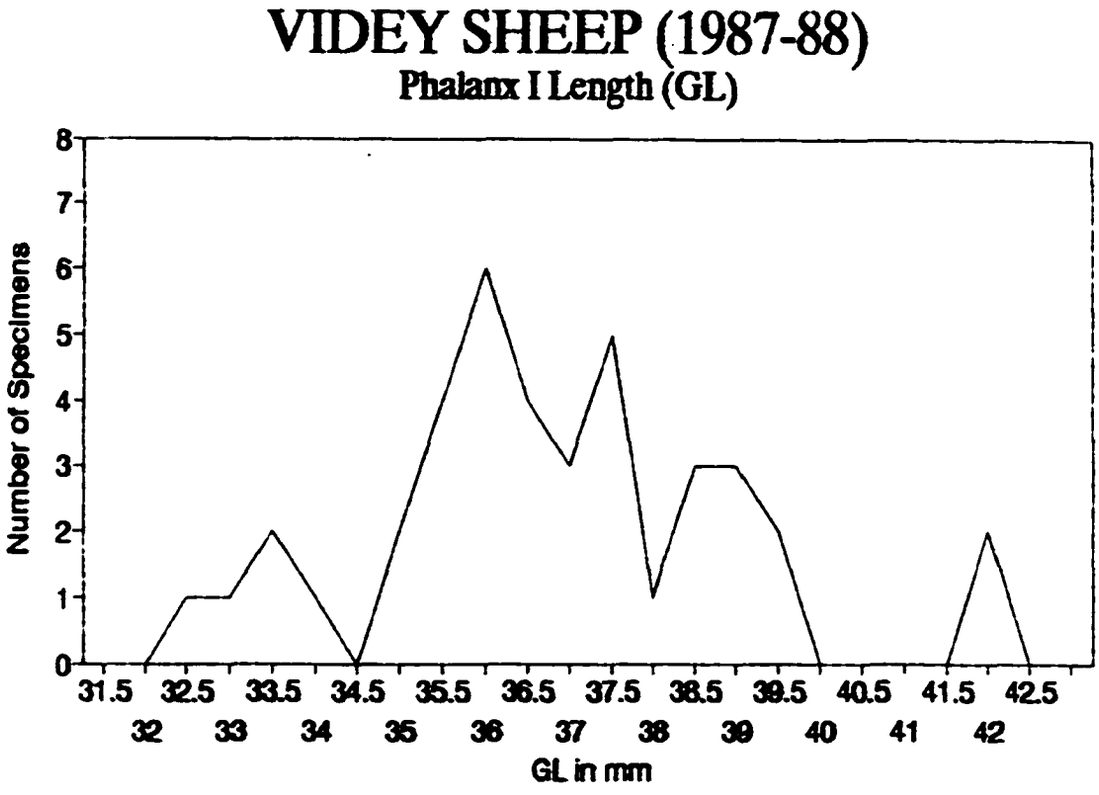

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Figure 10.18 - The caprine calcaneus greatest length measurements (GL) charted for the Videy 1987-1988 faunal samples.

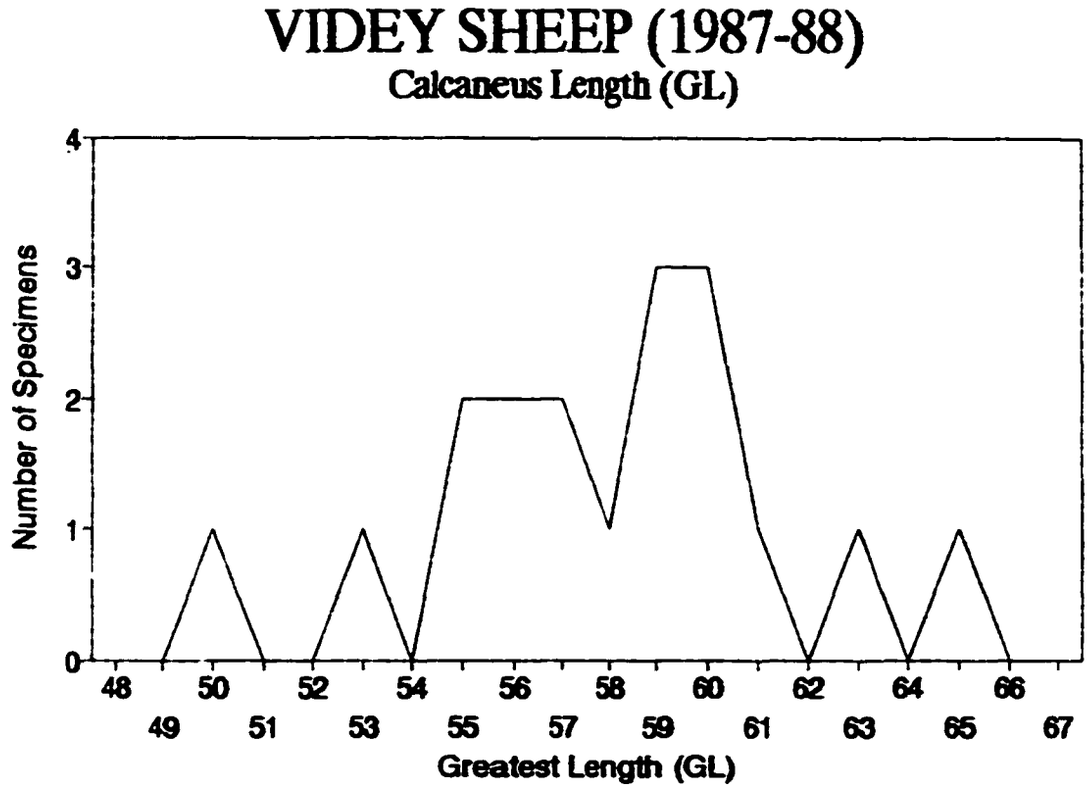

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Figure 10.19 - The caprine distal tibia measurements (Bd) charted for the Videy 1987-1988 faunal samples.

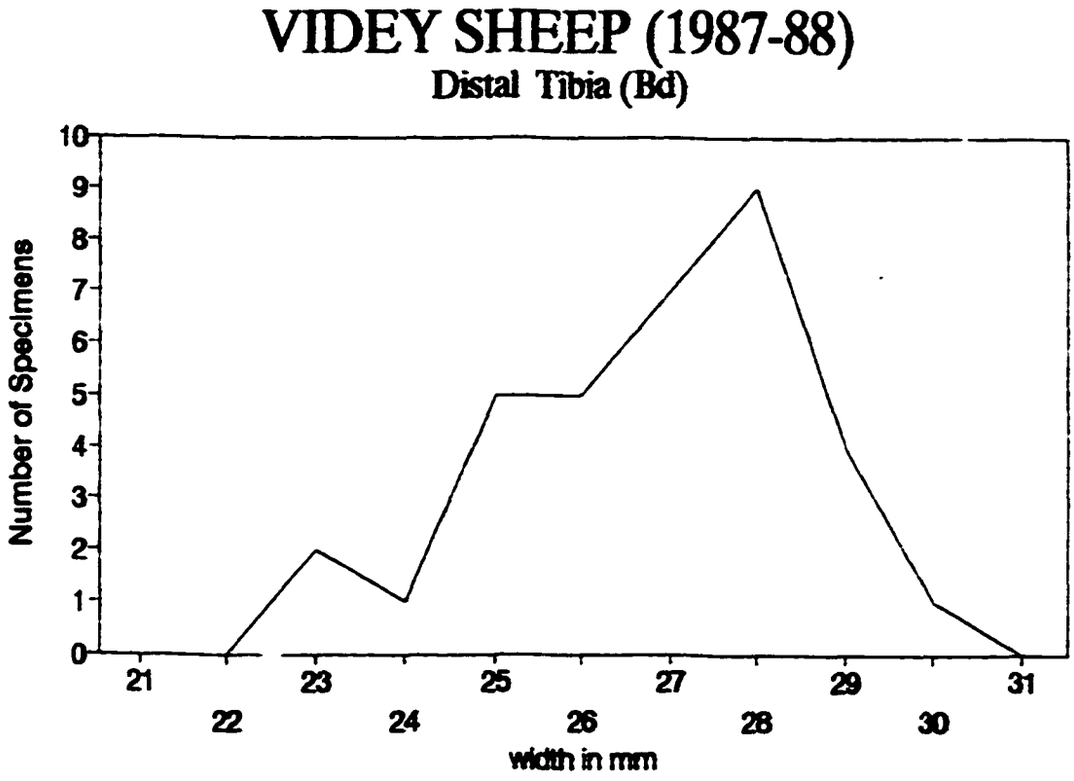

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Figure 10.20 - The caprine distal humerus measurements (Bd) charted for the Videy 1987-1988 faunal samples.

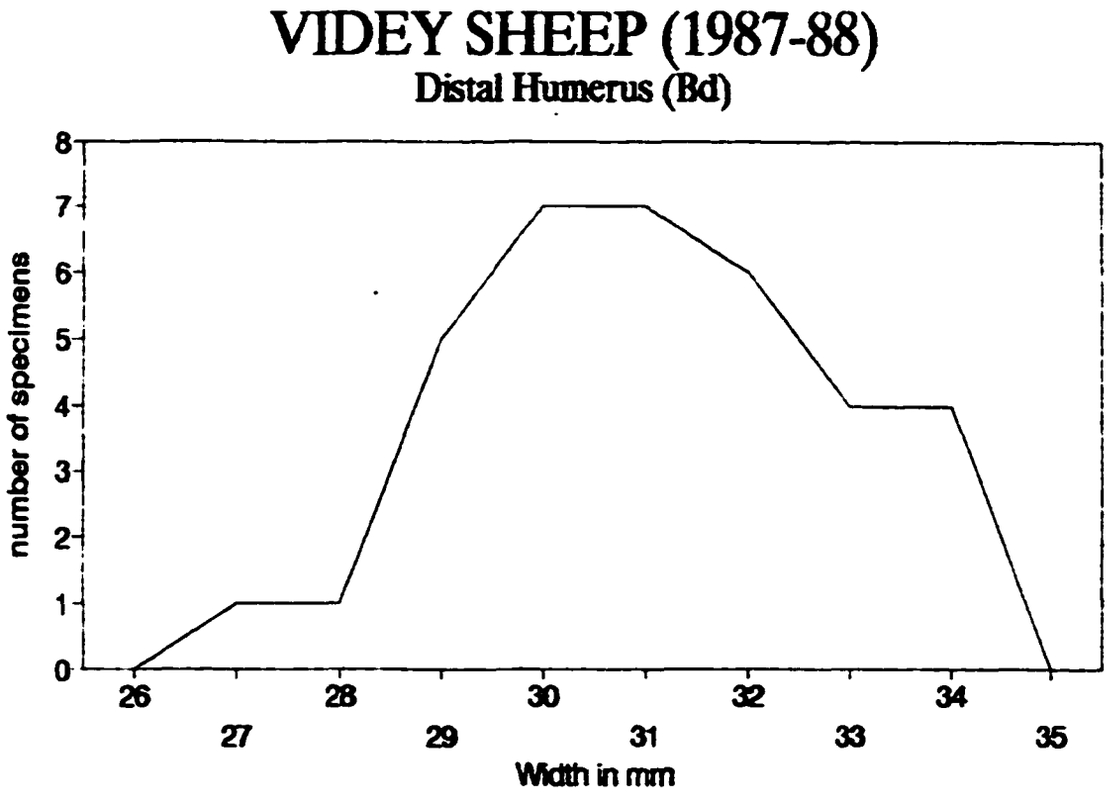

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Figure 10.21 - A comparison of caprine humeral distal breadth (Bd) from Iceland archaeofauna, Norse Greenland archaeofauna (data was kindly provided by T.H. McGovern) and English archaeofauna, from the Medieval site of Exter (Maltby 1979).

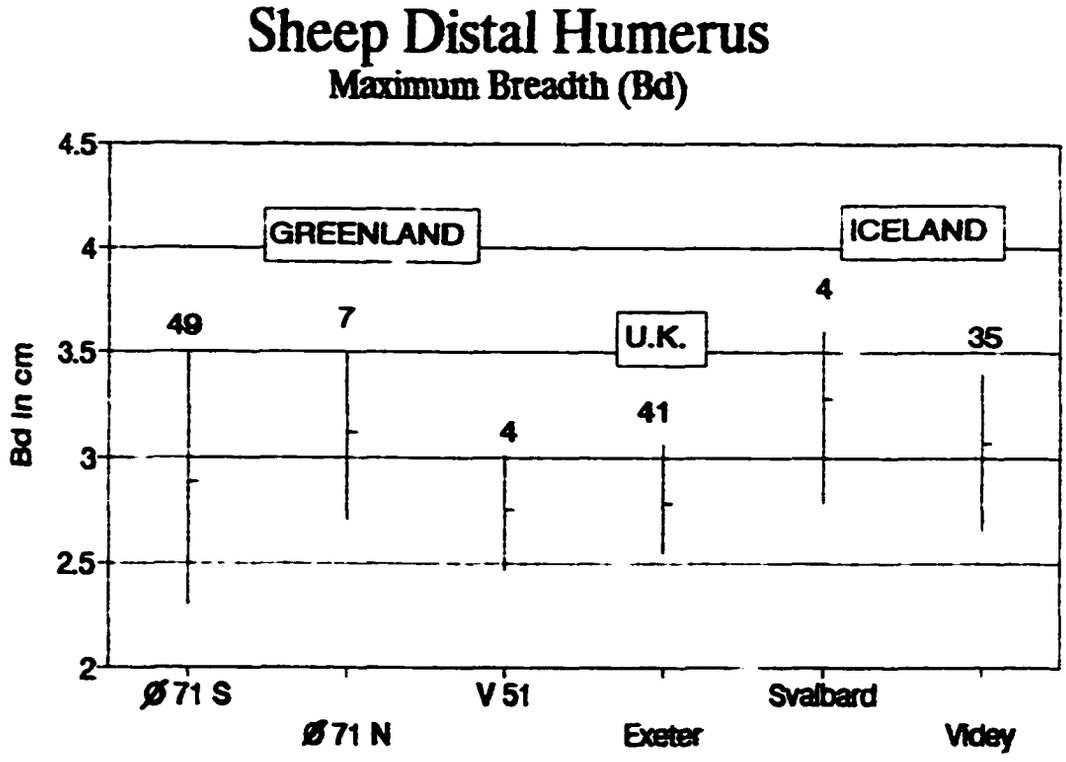

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Figure 10.22 - A comparison of caprine metcarpi distal breath (Bd) from Icelandic archaeofauna, Norse Greenlandic archaeofauna (data was kindly provided by T.H. McGovern) and English archaeofauna, from the Medieval site of Exter (Maltby 1979).

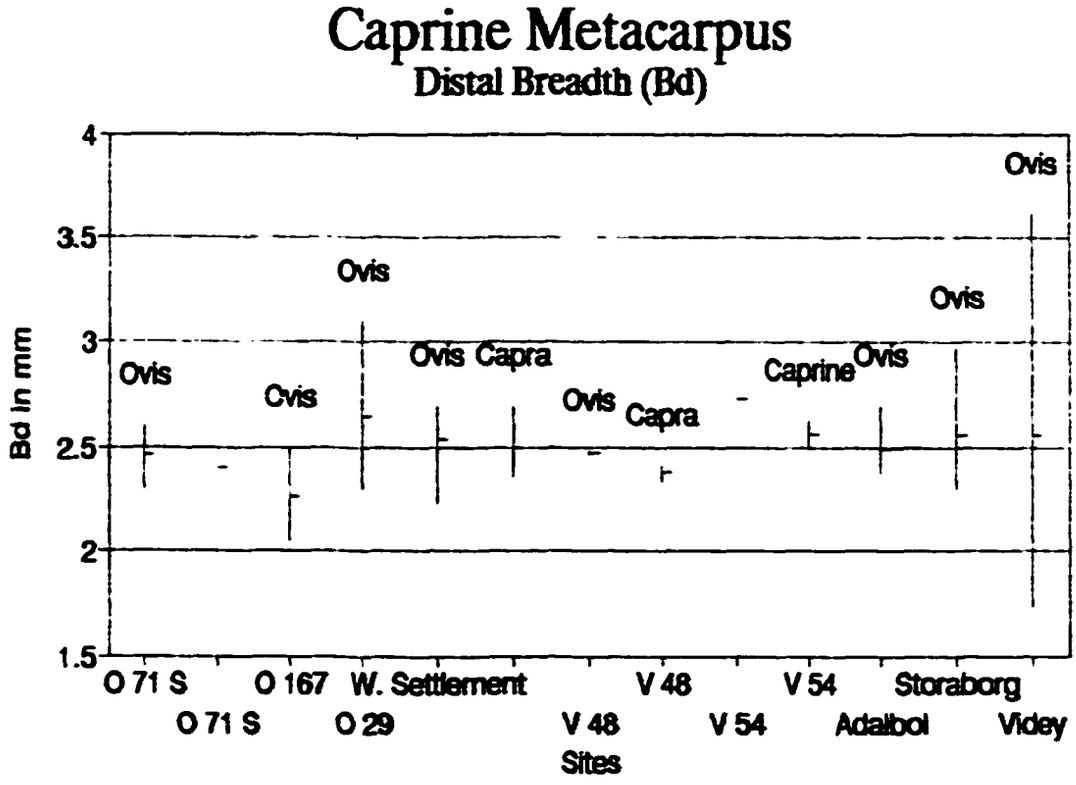

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Figure 10.23 - A comparison of caprine metatarsi distal breadth (Bd) from Icelandic arhaeofauna and Norse Greenlandic archaeofauna (data was kindly provided by T.H. McGovern).

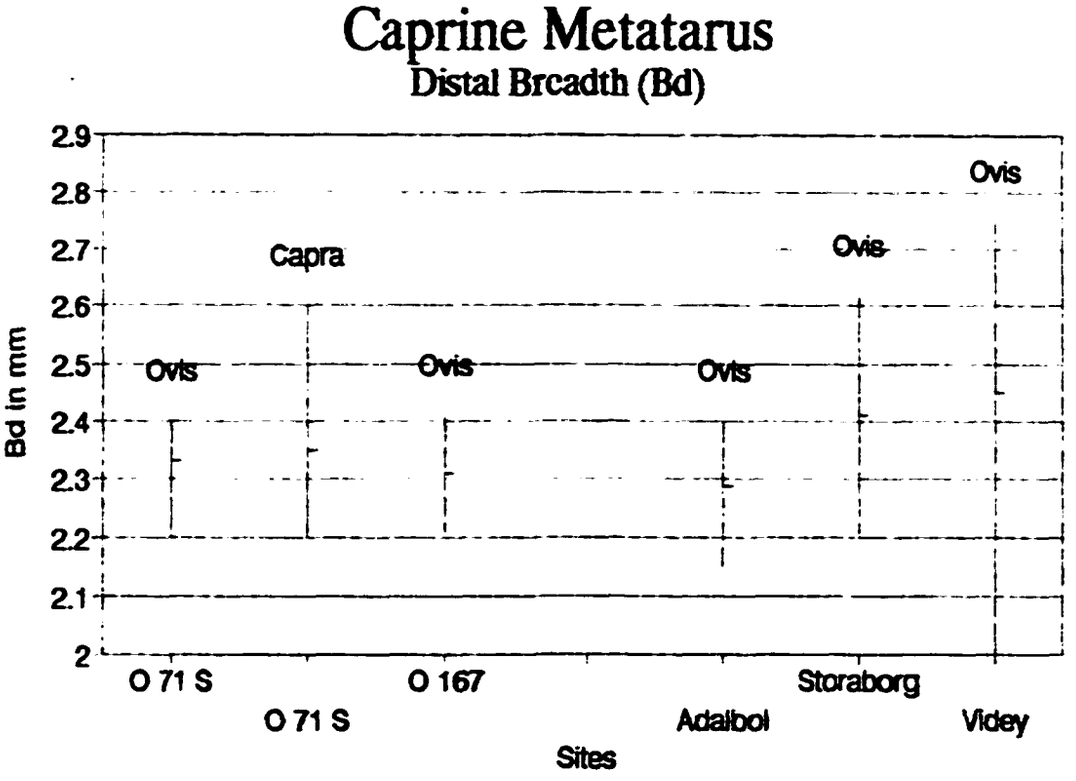

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Figure 10.24 - The reconstructed length of the Atlantic cod, ***Gadus morhua***, from the 1987-1988 Videy archaeofauna. The length data is based upon measurements taken from premaxillary and dentary.

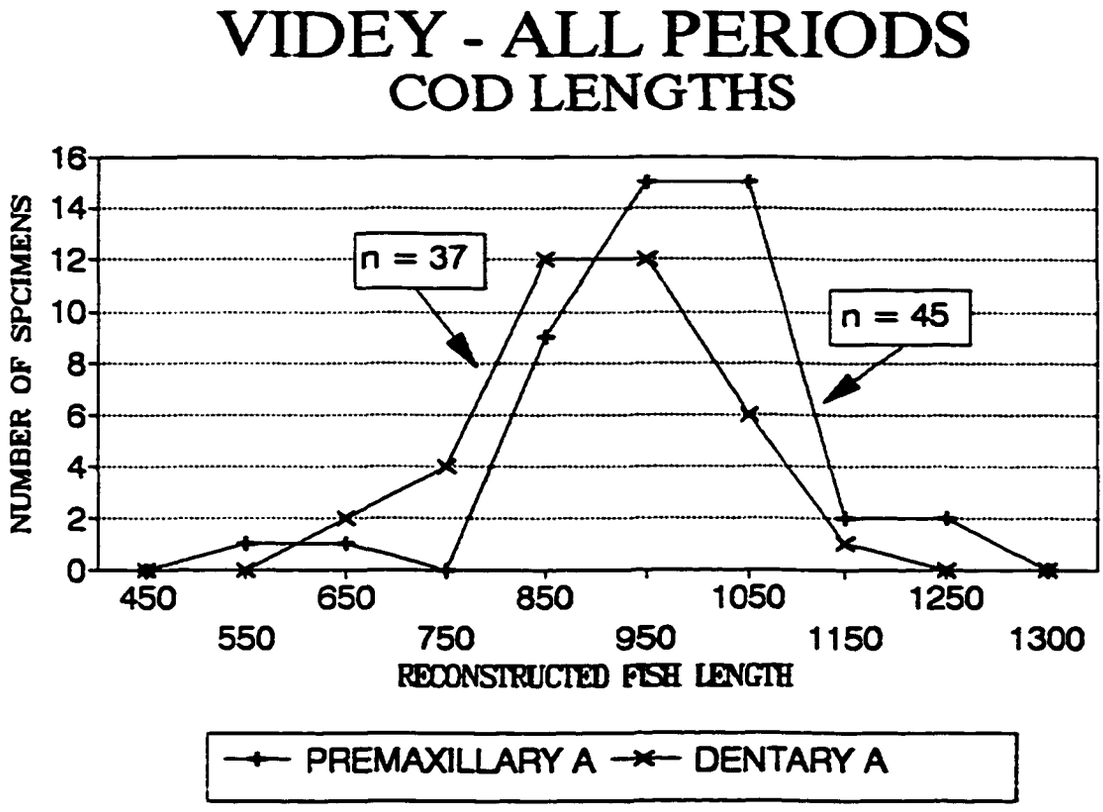

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Figure 10.25 - The reconstructed length of the Atlantic cod from the Medieval phased materials from the Videy 1987-1988 faunal samples.

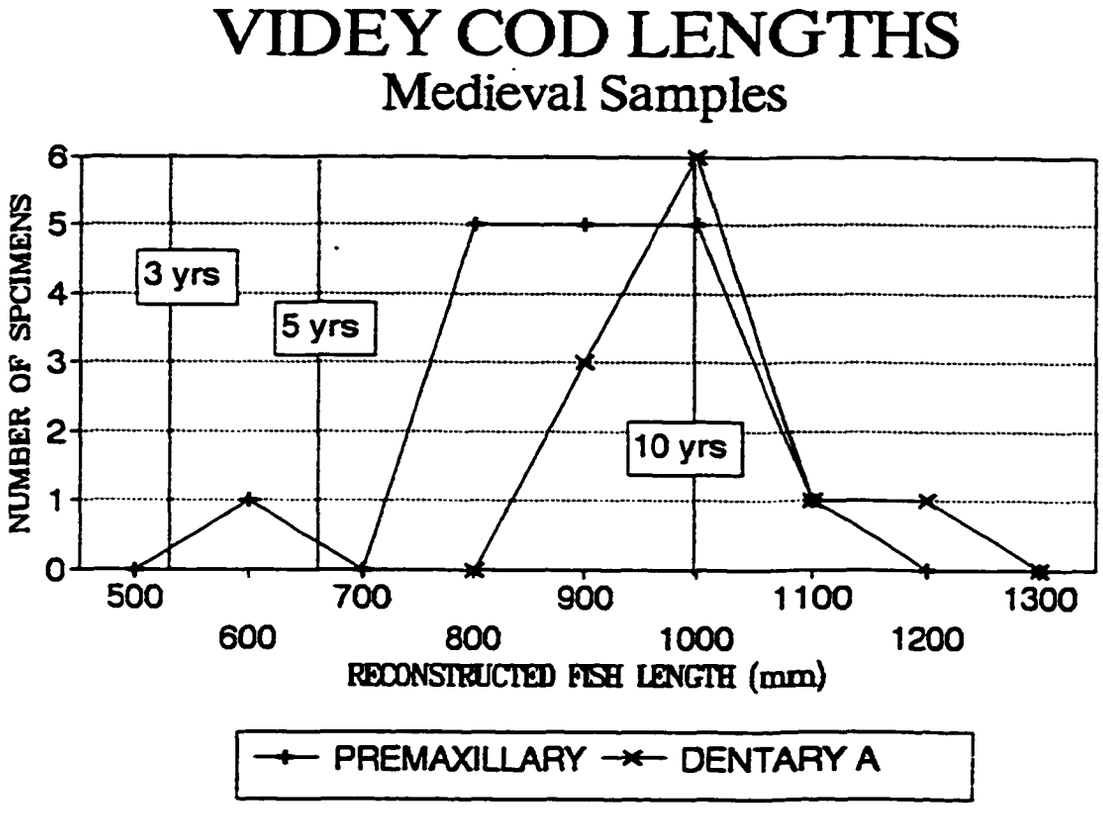

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Figure 10.26 - The reconstructed length of the Atlantic cod from the Early Modern phased materials from the Videy 1987-1988 faunal samples.

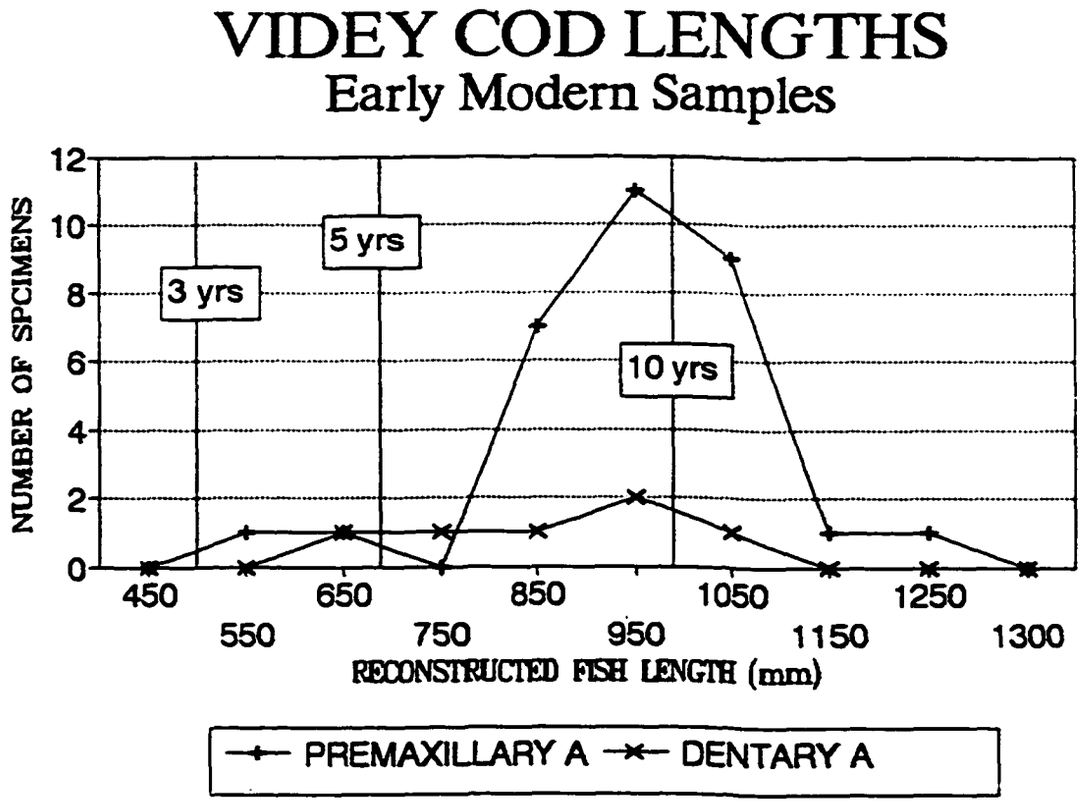

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Figure 10.27 - A comparison of the cattle to caprine ratio for western (Midbaer) and southwestern Icelandic archaeofauna.

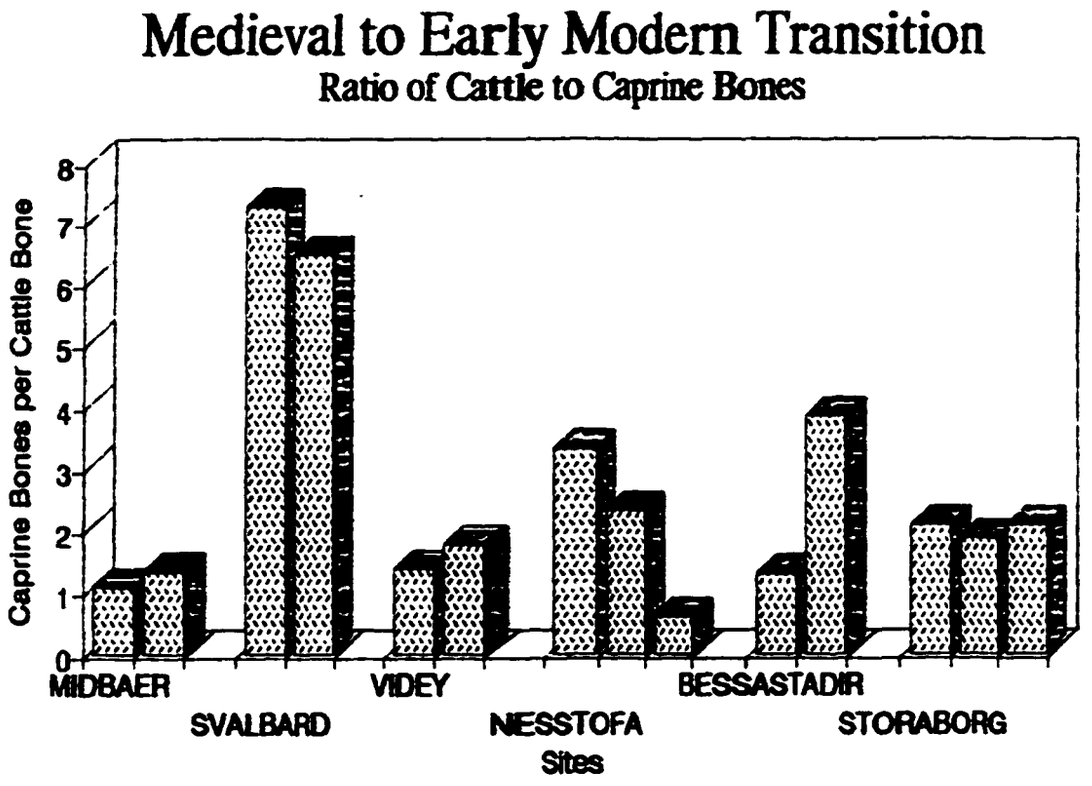

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Figure 10.28 - A comparison of the cattle to caprine ratio for southwestern Icelandic archaeofauna.

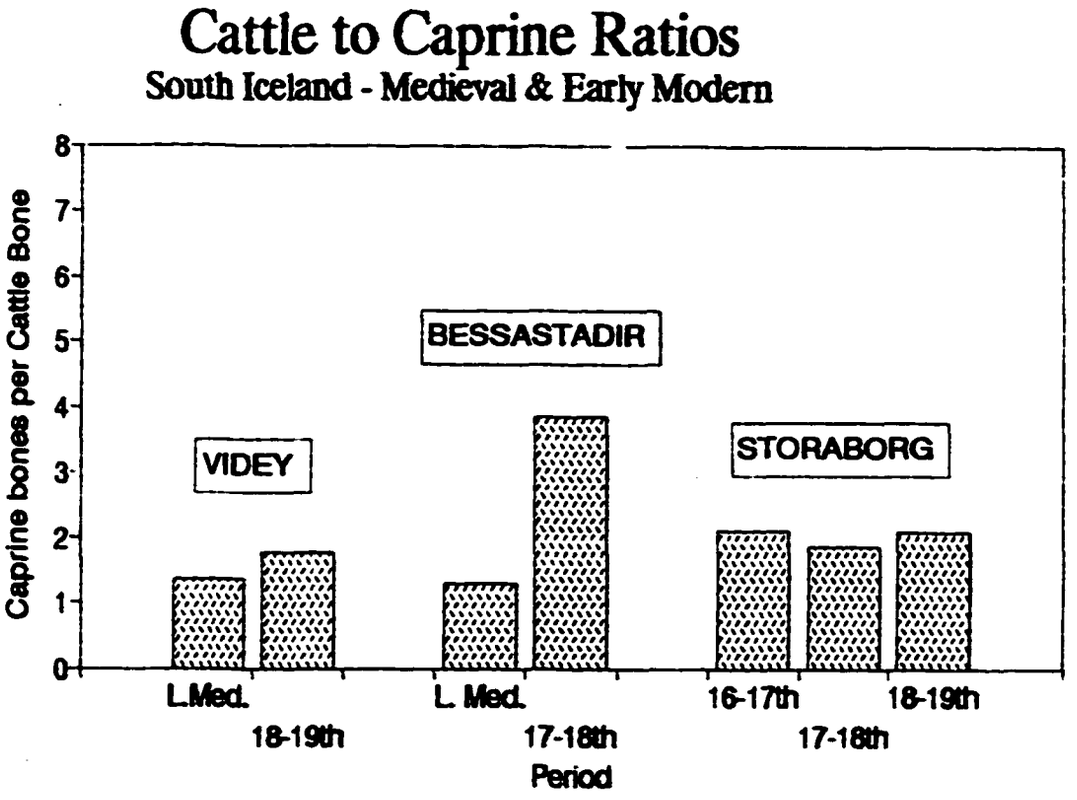

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Figure 10.29 - A comparison of the cattle to fish ratio for western (Midbaer) and southwestern Icelandic archaeofauna.

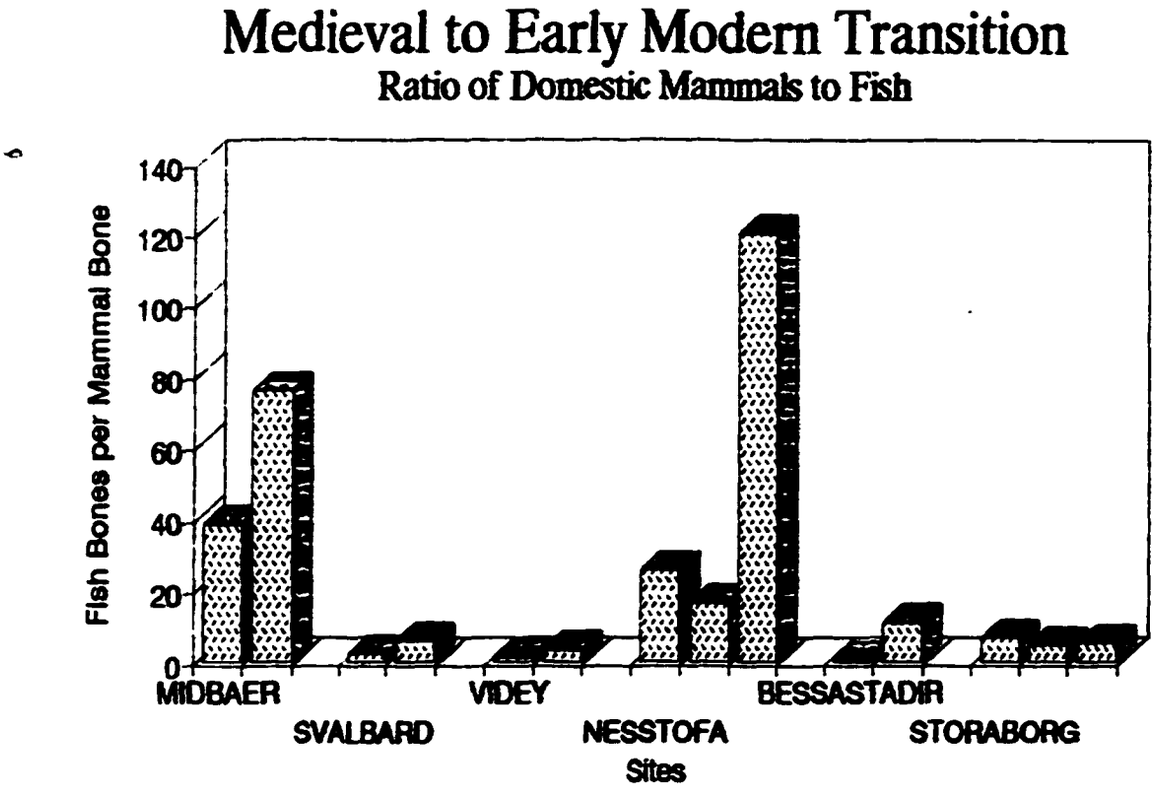

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Figure 10.30 - A comparison of the domestic mammal to fish ratio for southwestern Icelandic archaeofauna.

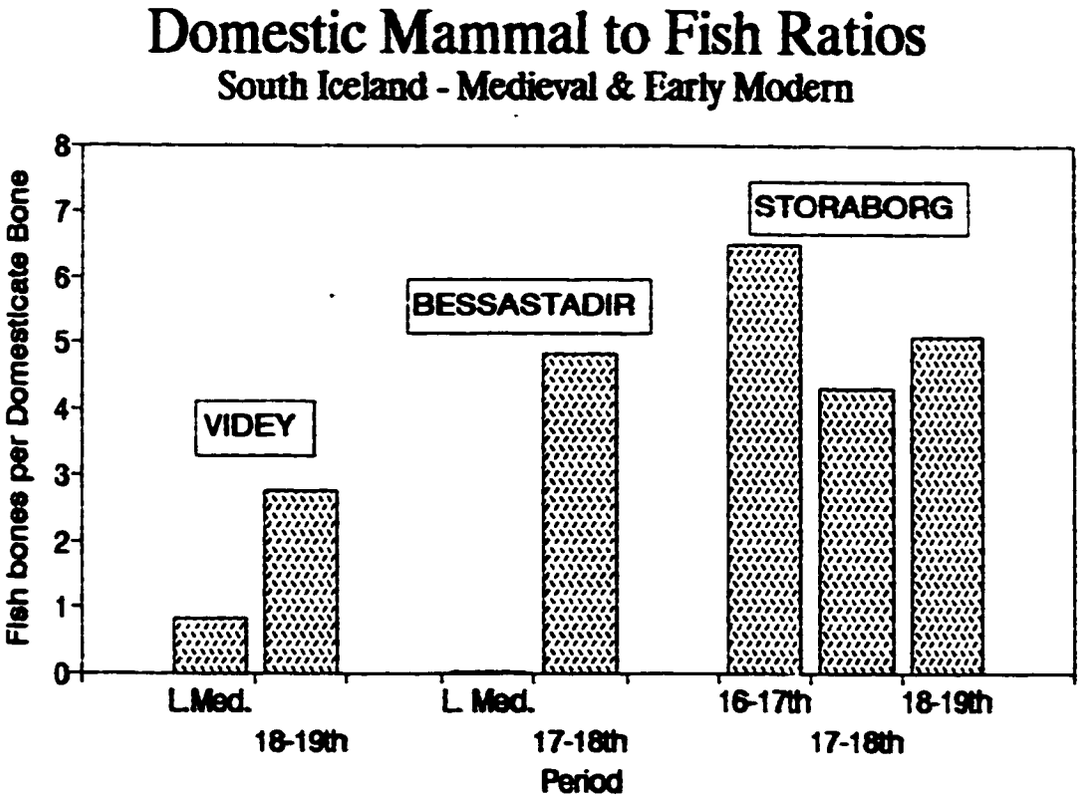

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Figure 10.31 - A comparison of the relative percentage of NISP for seals recovered from western (Midbaer) and southwestern Icelandic archaeofauna.

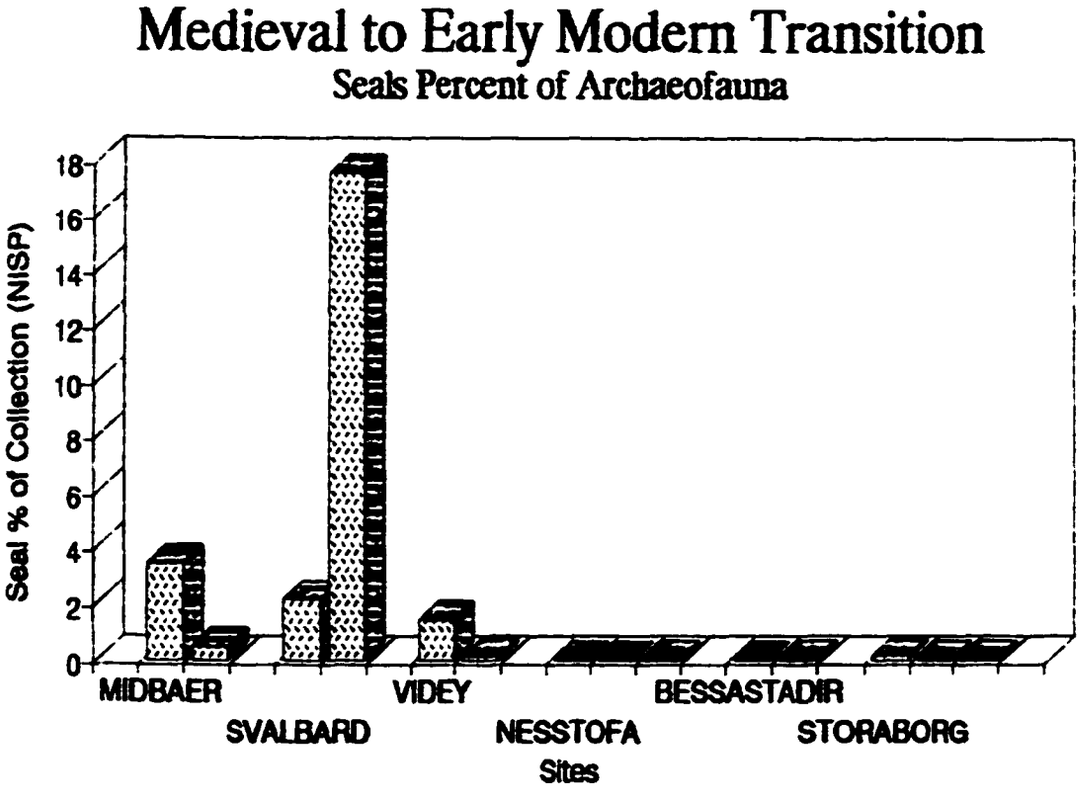

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Figure 10.32 - A comparison of the relative percentage of NISP for birds recovered from western (Midbaer) and southwestern Icelandic archaeofauna.

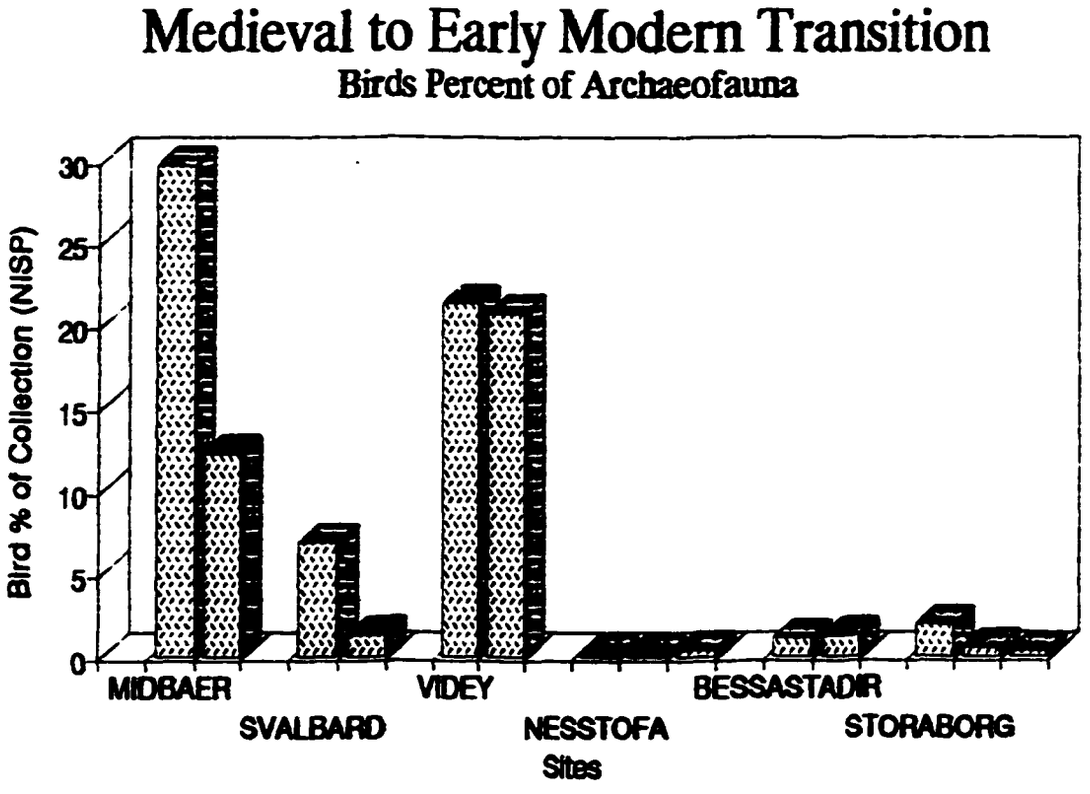

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Figure 10.33 - The major trends in the Videy 1987-1988 faunal sample.

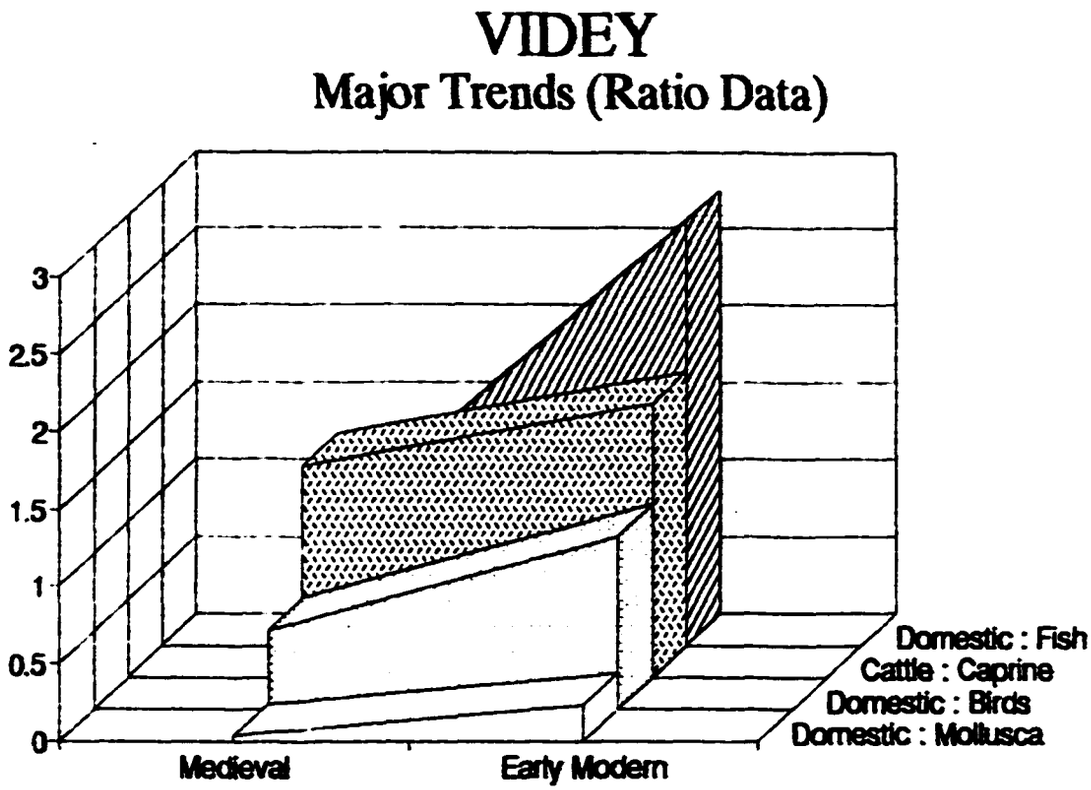

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Figure 11.1 - The taphonomic comparisons for cattle using NISP/MNI. The Norse Greenlandic data was kindly made available to the author by T.H. McGovern. Site codes are SV=Svalbard, V=Videy, TJR=Tjarnargata 4, GST=Granastadir and V51=Sandnes in west Greenland.

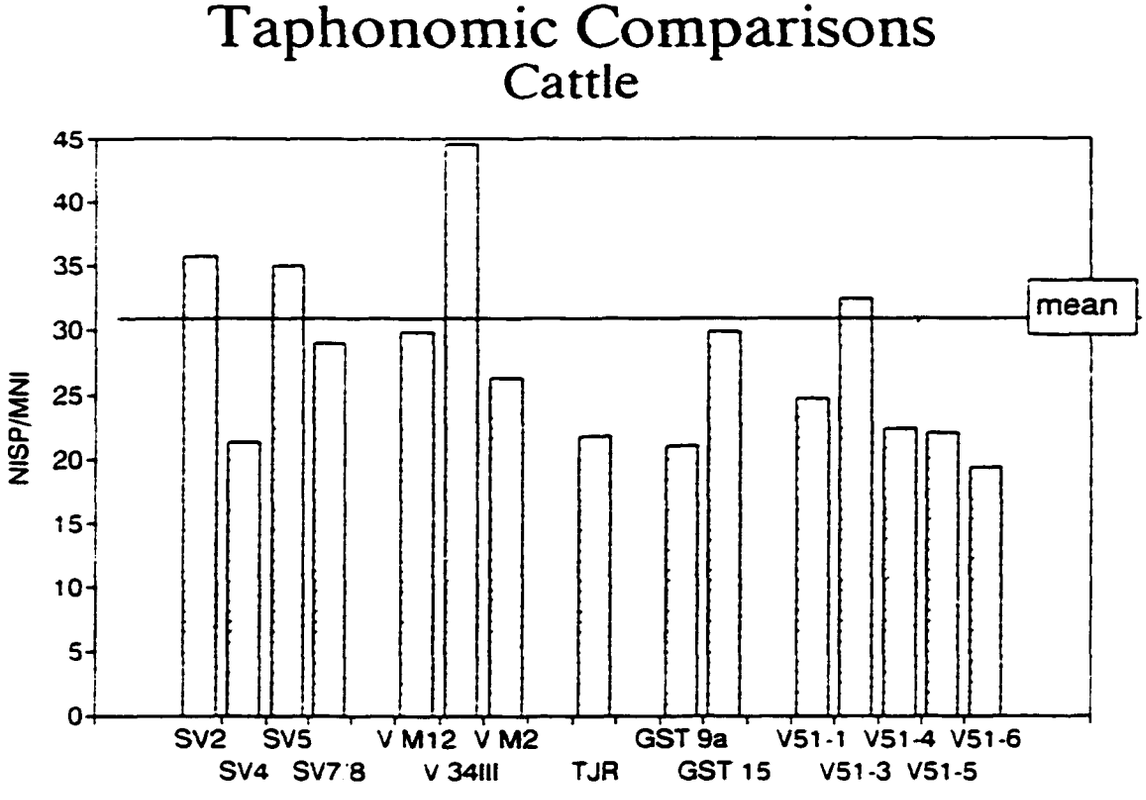

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Figure 11.2 - The taphonomic comparisons for caprines using NISP/MNI.

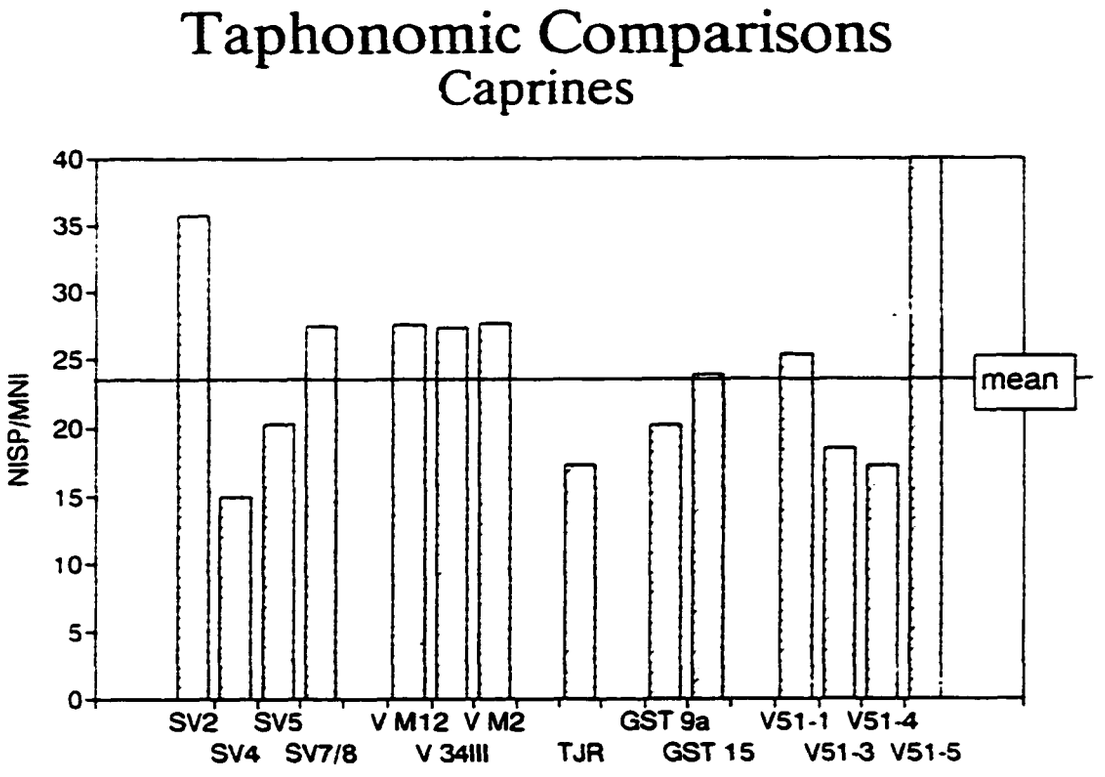

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Figure 11.3 - The taphonomic comparisons for cattle using RF*Density/NISP.

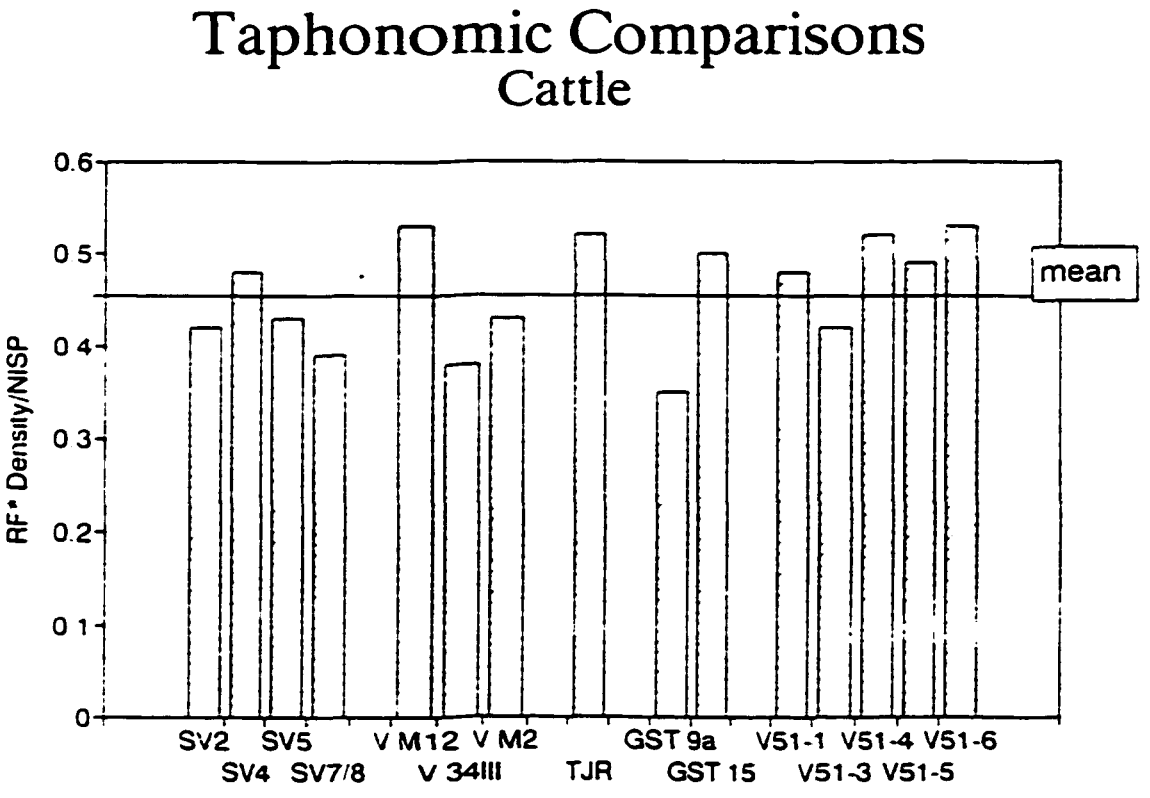

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Figure 11.4 - The taphonomic comparisons for caprines using RF*Density/NISP.

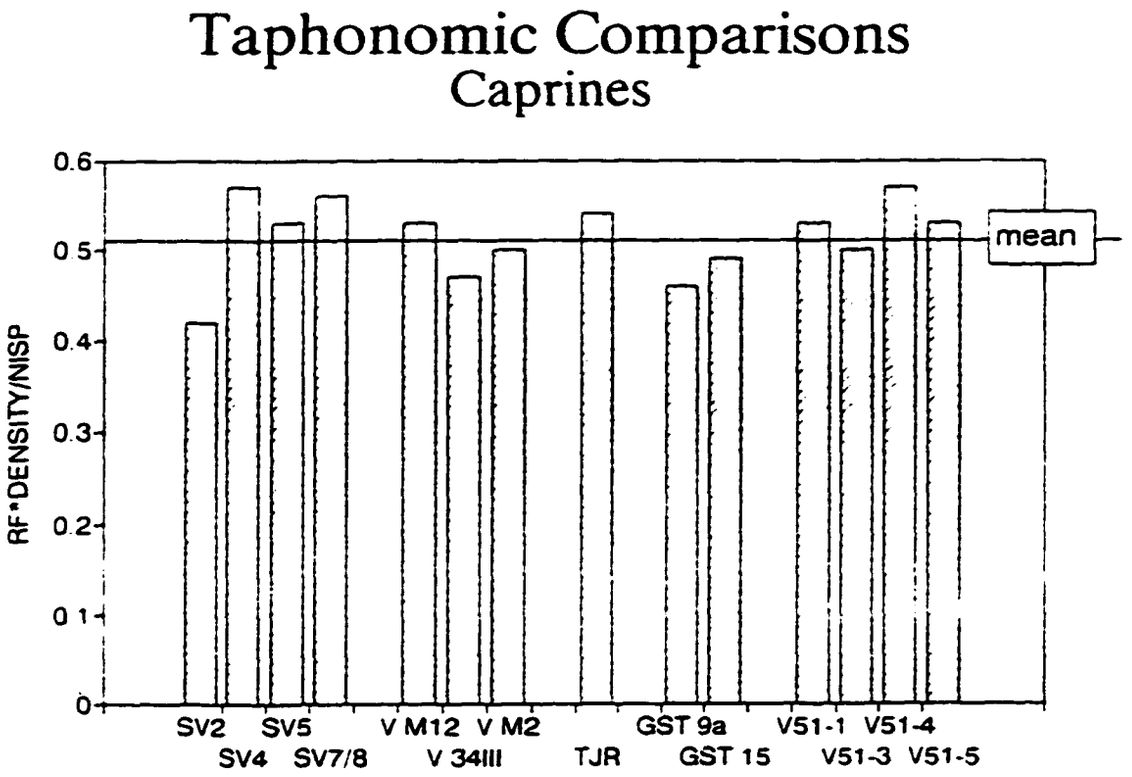

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Figure 11.5 - The taphonomic comparisons for cattle using RF*MGUI/NISP.

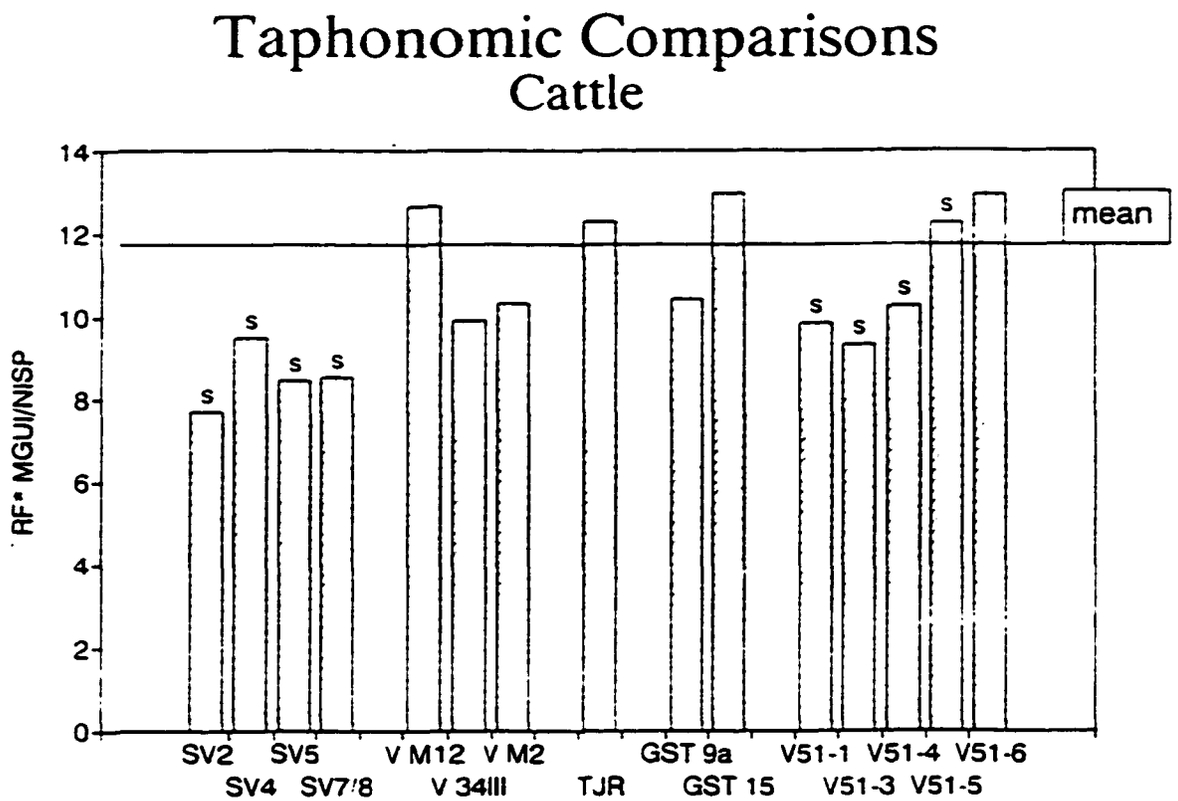

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Figure 11.6 - The taphonomic comparisons for caprine using RF*MGUI/NISP.

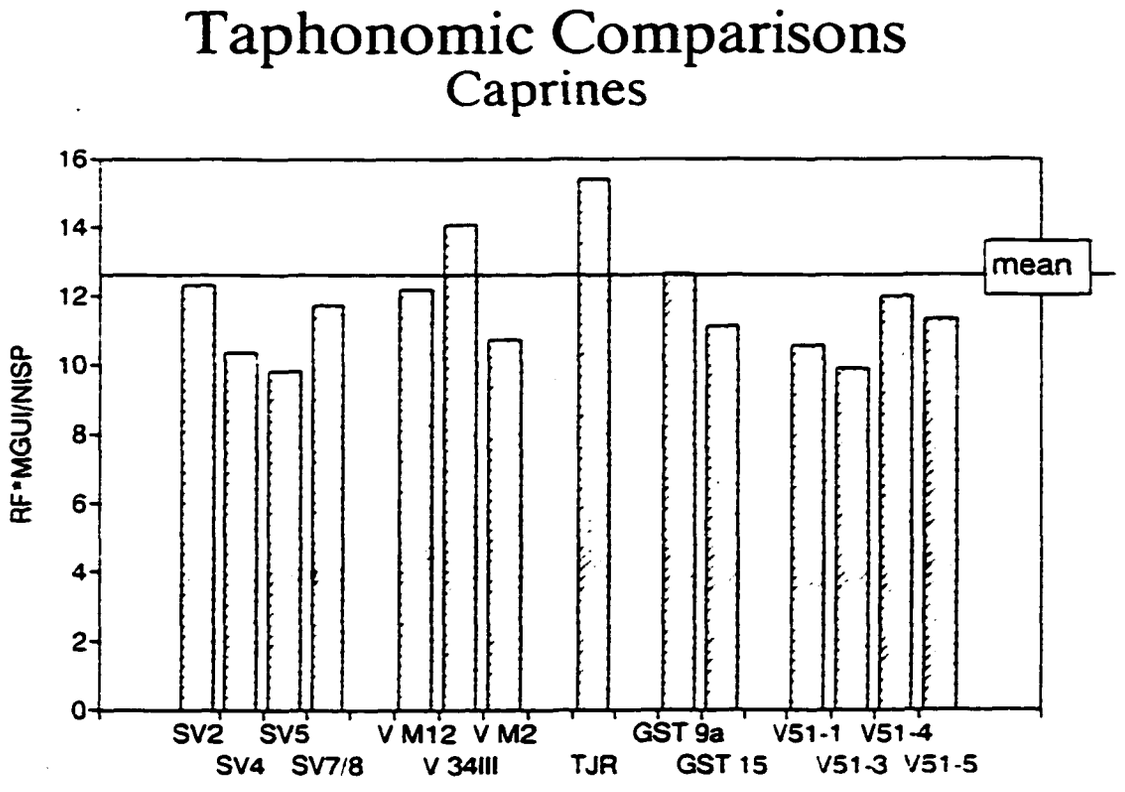

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Figure 11.7 - A comparison of cattle data done by plotting archaeological data against the "dummy" data trials by using RF*MGUI/NISP by RF*MGUI/NISP.

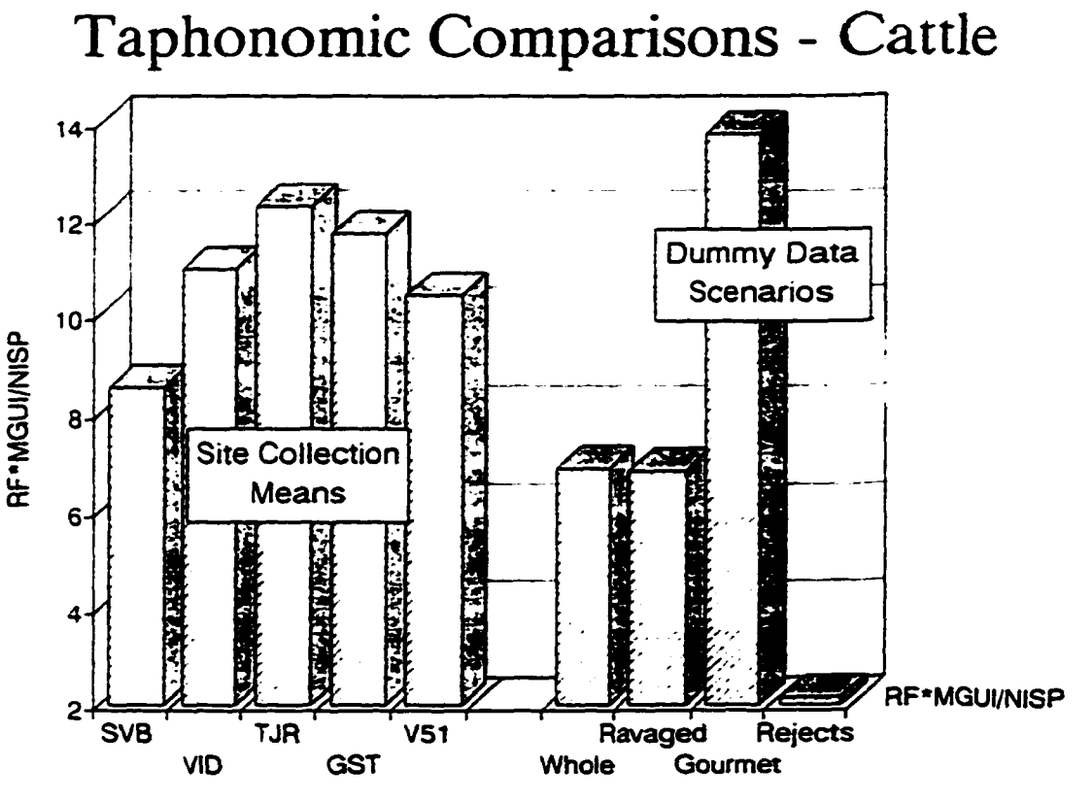

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Figure 11.8 - A comparison of caprine data done by plotting archaeological data against the "dummy" data trials by using RF*MGUI/NISP by RF*MGUI/NISP.

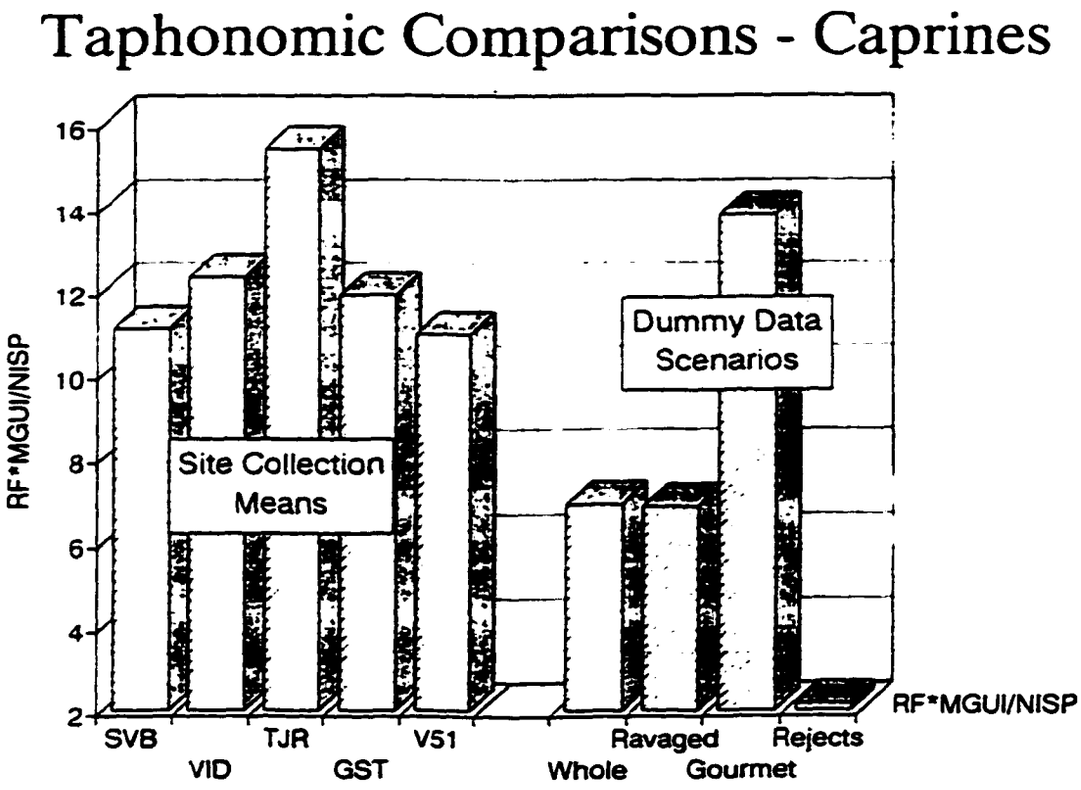

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Figure 11.9 - A comparison of cattle data done by plotting archaeological data against the "dummy" data trials by using RF*Density/NISP by RF*Density/NISP.

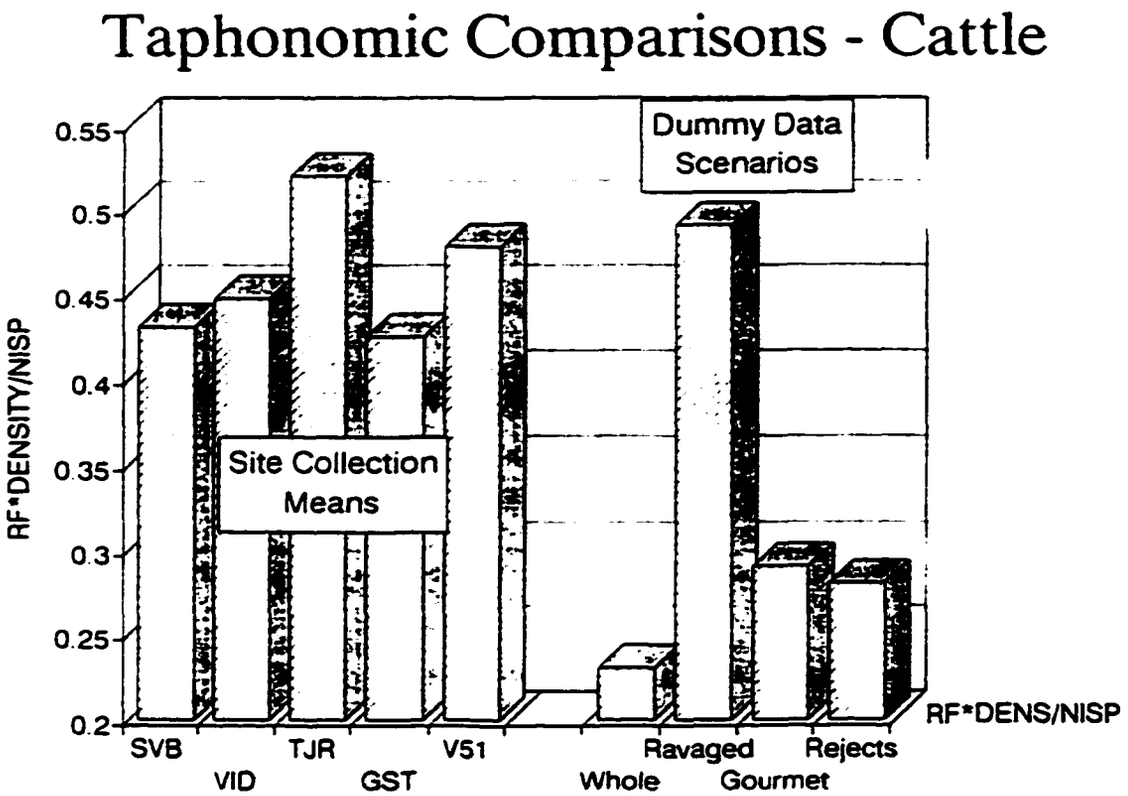

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Figure 11.10 - A comparison of caprine data done by plotting archaeological data against the "dummy" data trials by using RF*Density/NISP by RF*Density/NISP.

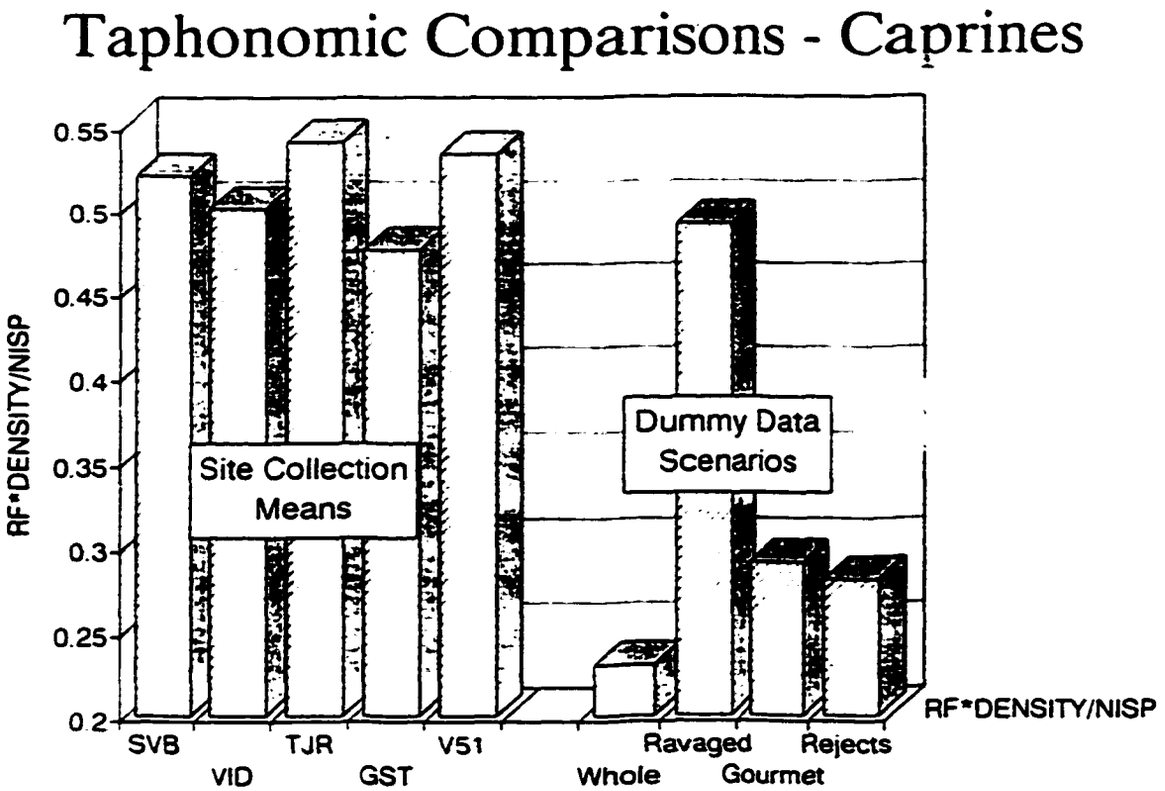

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Figure 11.11 - A comparison of skeletal element distributions by site and taxon to the "dummy" data trials.

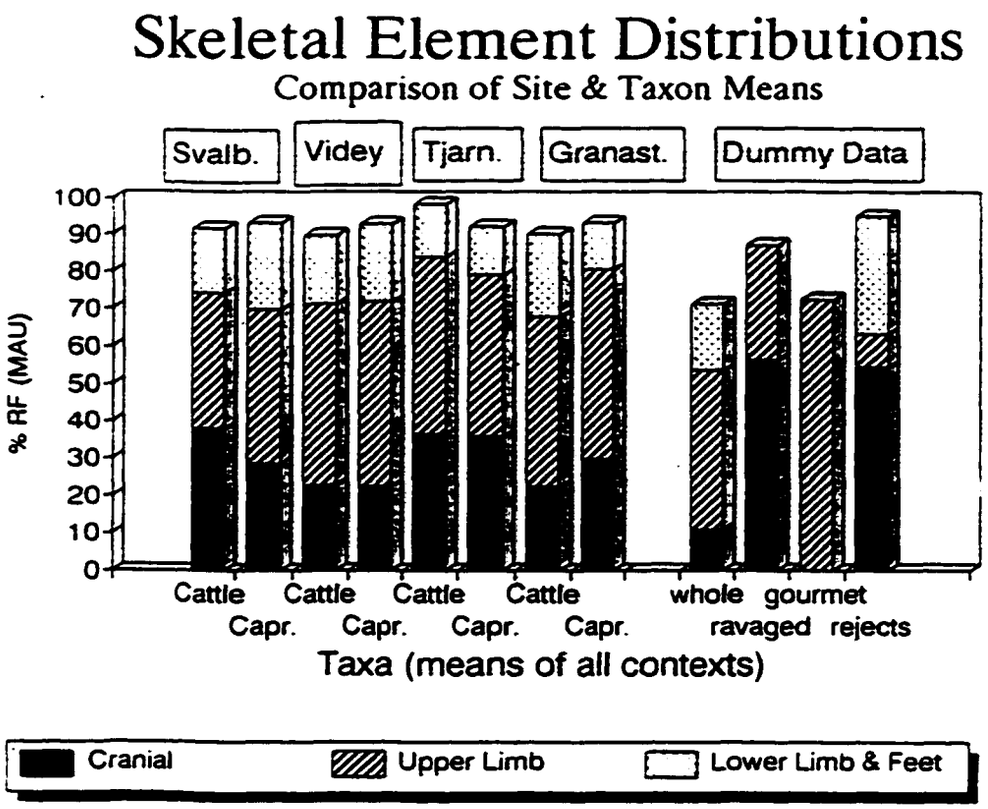

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Figure 12.1 - The Settlement period archaeofauna from Iceland (ca. AD. 870s-930a). The high percentage of cattle to caprines in these two early archaeofauna correspond to contemporary Norse collections in the eastern North Atlantic. The high percentage of birds is more unusual and may be an indicator of the initial impact of humans on previously unharvested colonies.

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Figure 12.1 (cont.) - The Settlement period archaeofauna fro Iceland.

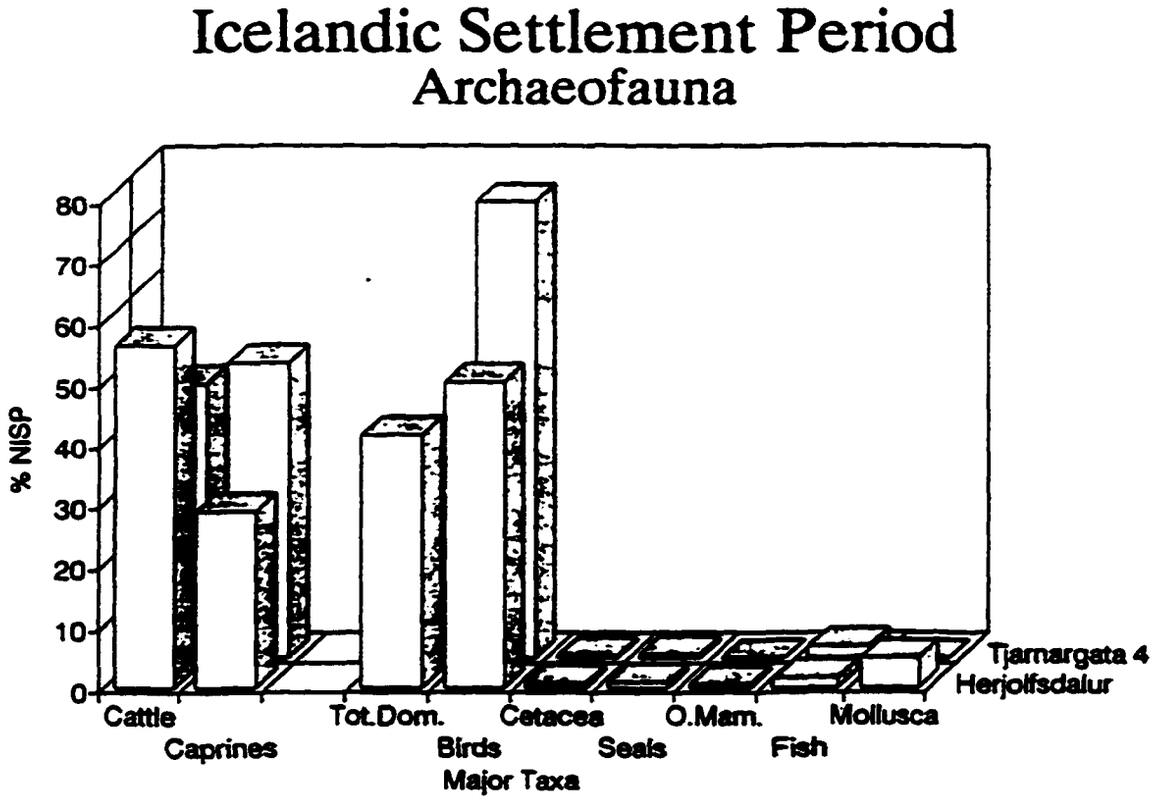

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Figure 12.2 - The Commonwealth period archaeofauna from Iceland (ca. AD. 930s-1260s). These assemblages reflect increasing diversity in both the mix of domestic species and in the use of wild resources. Note the general pattern of increase in caprines and the variable use of marine resources. The regional diversity in subsistence economy revealed by the bone collections is only hinted at in the Saga literature and as yet has little recognized by historians.

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Figure 12.2 (cont.) - The Commonwealth period archaeofauna from Iceland.

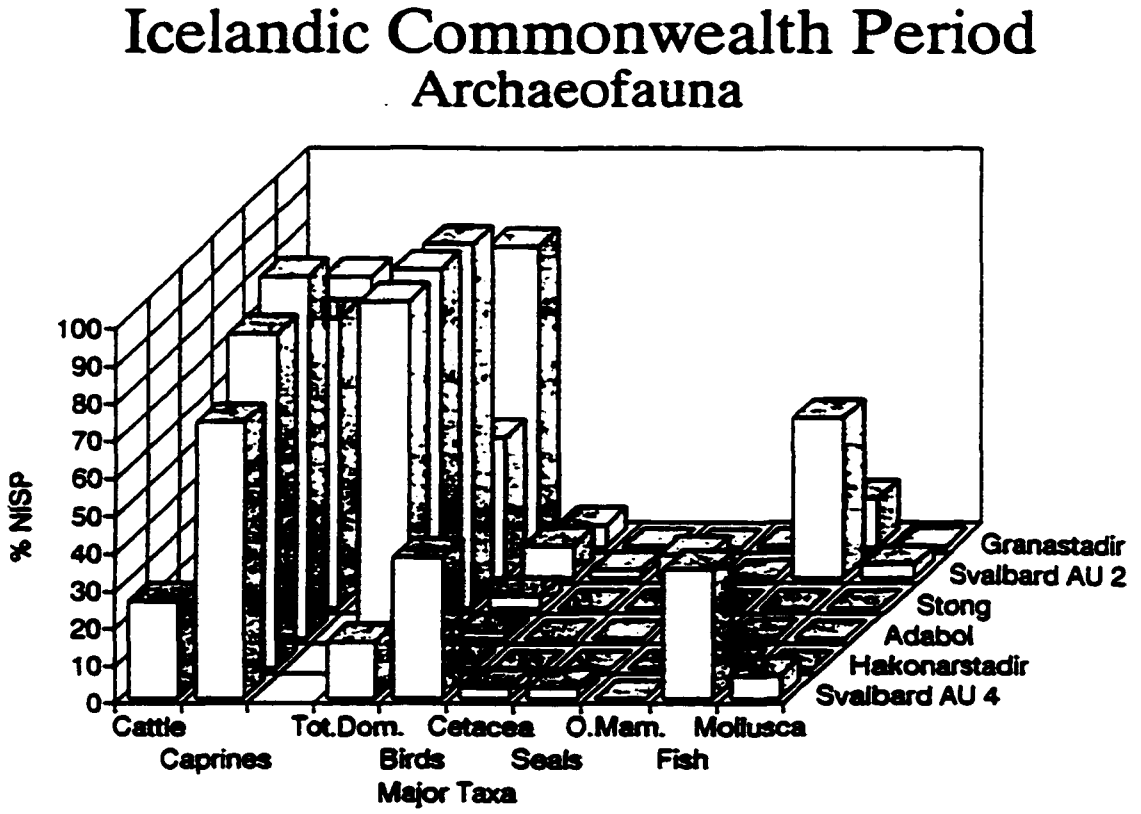

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Figure 12.3 - The later Medieval archaeofauna from Iceland (ca. AD. 1260s-1500s). These collections continue to reflect considerable regional diversity in economy with some indications of increasing importance of cod fishing in some localities.

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Figure 12.3 (cont.) - The later Medieval archaeofauna from Iceland.

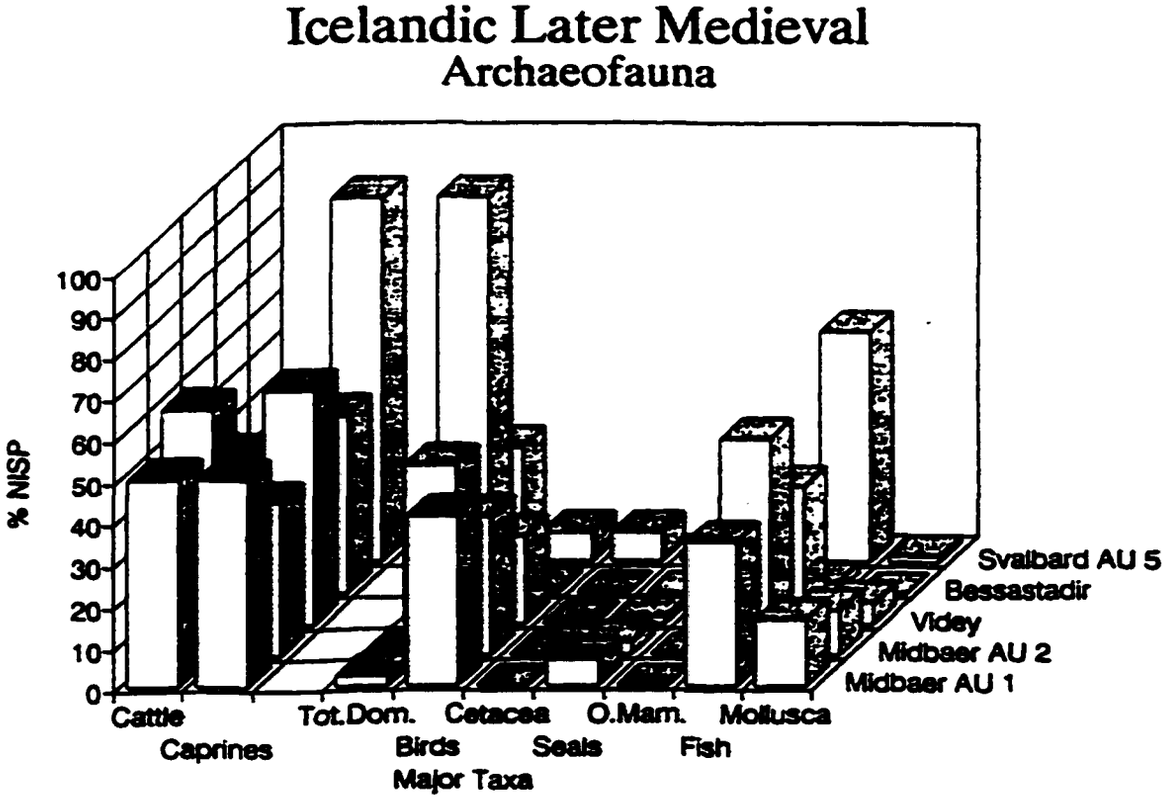

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Figure 12.4 - The Early Modern archaeofauna from Iceland. The Early Modern archaeofauna continue to exhibit variability in subsistence patterns but the most striking trend is the dominance of fish bones (almost all Atlantic cod) in all the assemblages. This would appear to be an archaeological signature for the integration of the Icelandic economy into the European commercial fisheries of the Early Modern period.

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Figure 12.4 (cont.) - The Early Modern archaeofauna from Iceland.

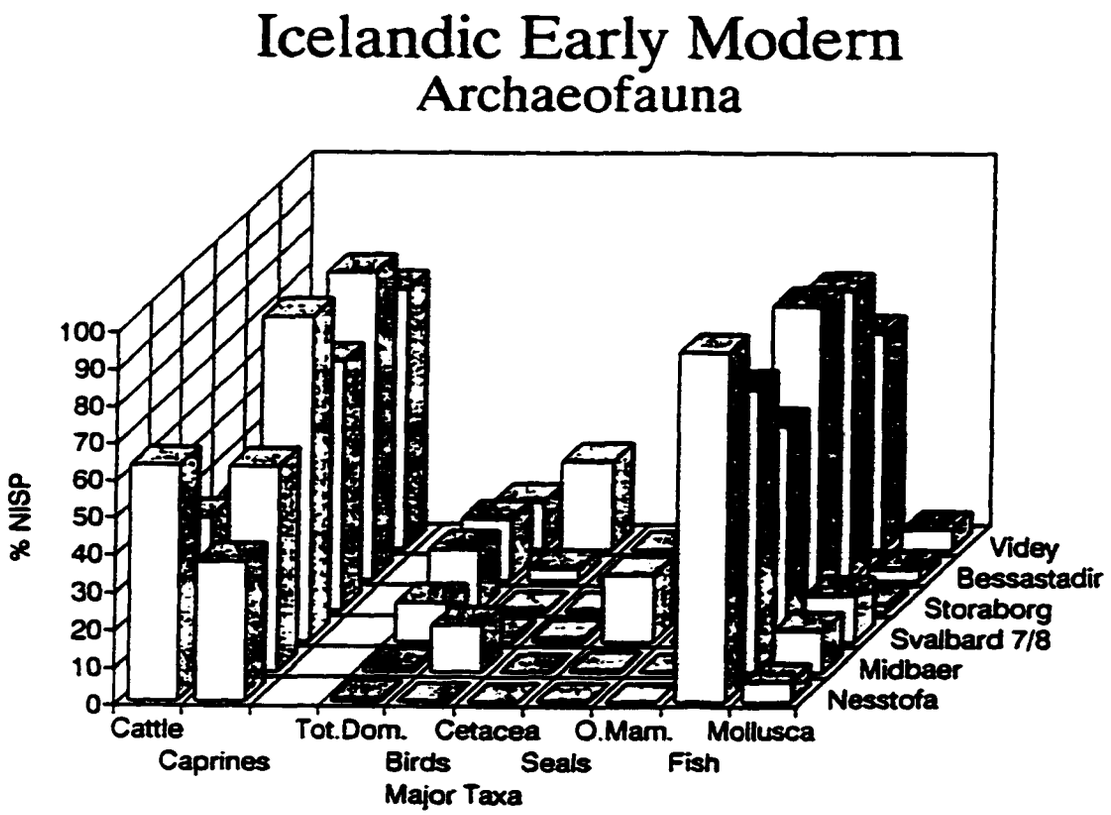

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Figure 12.5 - Comparison of modern and archaeological cod length distributions. Distribution of reconstructed cod length from Storaborg is compared to modern fisheries trawls from NE, NW, E and S Iceland. These trawls were conducted from a period of 1976-1979 (Palsson 1983). The archaeological collections lack cod smaller than 40 cm. and contain many specimens 100 cm. and longer. This pattern is strongly shaped by the Medieval fishing methods (usually hand lines are used but lack multiple hooks) and does not directly reflect the actual distribution of Medieval cod populations (see Table 12.1 and Figure 12.6, graph is from Amorosi, McGovern and Perdikaris 1994:43).

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Figure 12.5 (cont.) - Comparison of modern and archaeological cod length distributions.

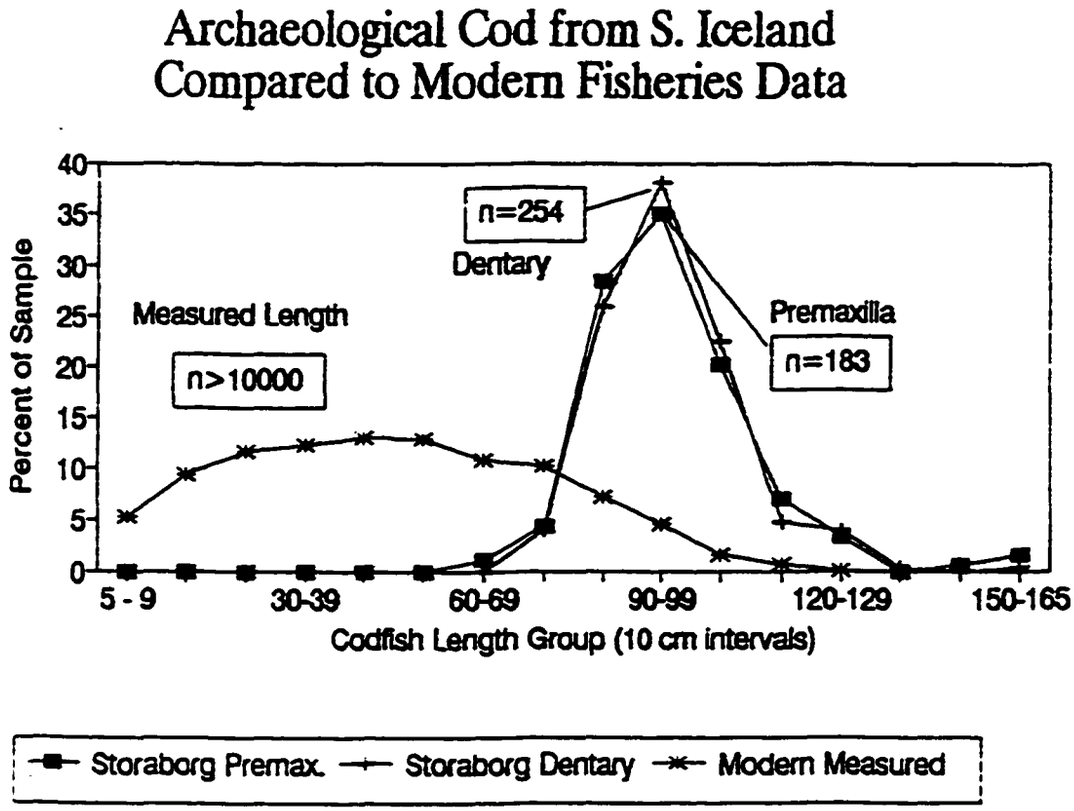

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Figure 12.6 - Comparison of counts of modern and archaeological cod larger than 100 cm.. Although differences in collection method make direct comparison of modern and Medieval/Early Modern length distributions questionable, the absolute number of modern cod recovered in research trawls from 1976-1979 show the 100 cm. or larger size class is smaller than the absolute number of similarly large sized cod bones recovered from archaeological sites. Cod 100 cm. and larger are now comparatively rare (Schopka 1994) in the waters around Iceland. It appears that such large cod were not uncommon in Medieval/Early Modern times. Also see Figure 11.16 and Table 11.12 (graph is from Amorosi, McGovern and Perdikaris 1994:43).

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Figure 12.6 (cont.) - Comparison of counts of modern and archaeological cod larger than 100 cm..

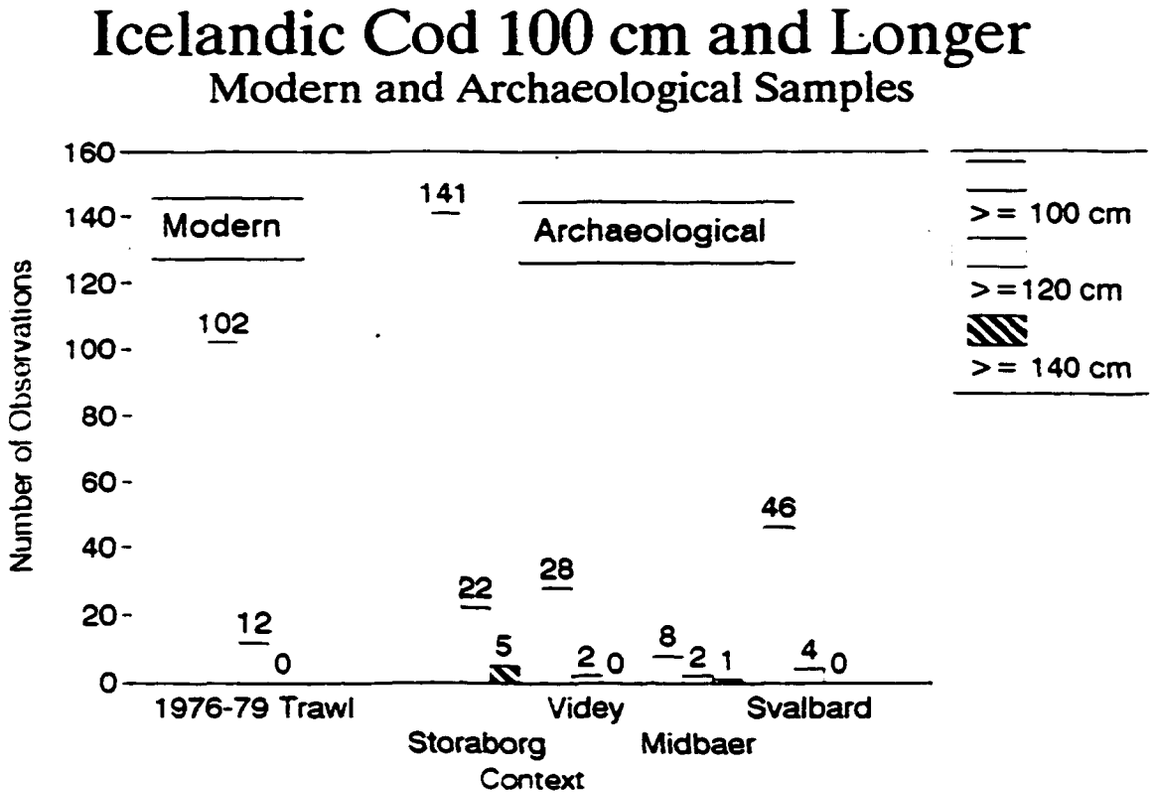

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Figure 12.7 - The Iceland cod stock biomass since 1925. The graph uses an estimated size of total fishable stock biomass (the upper line on the graph) and the biomass of 10+ year old age classes (the lower line). These data are drawn from Schopka (1994:184).

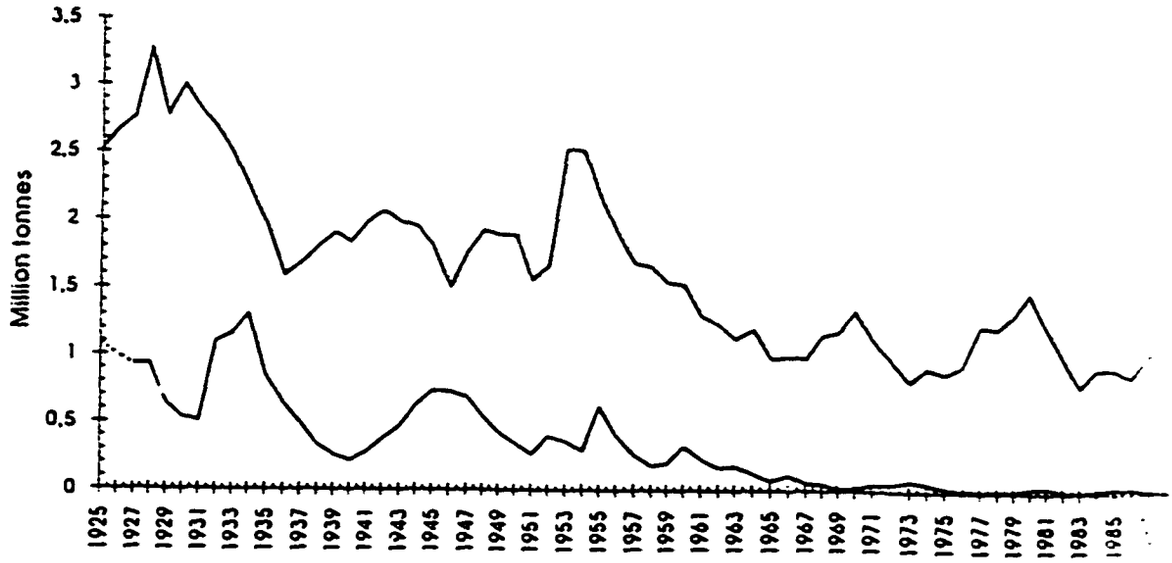

Figure 6 Cod at Iceland. Estimated size of total fishable stock biomass (upper line) and the biomass of 10 years (lower line) during the period 1925–1992

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Figure 12.8 - A comparison of modern and archaeological North Atlantic cod greater than 50 cm. in length. The 1976-1979 data was drawn from Palsson (1983).

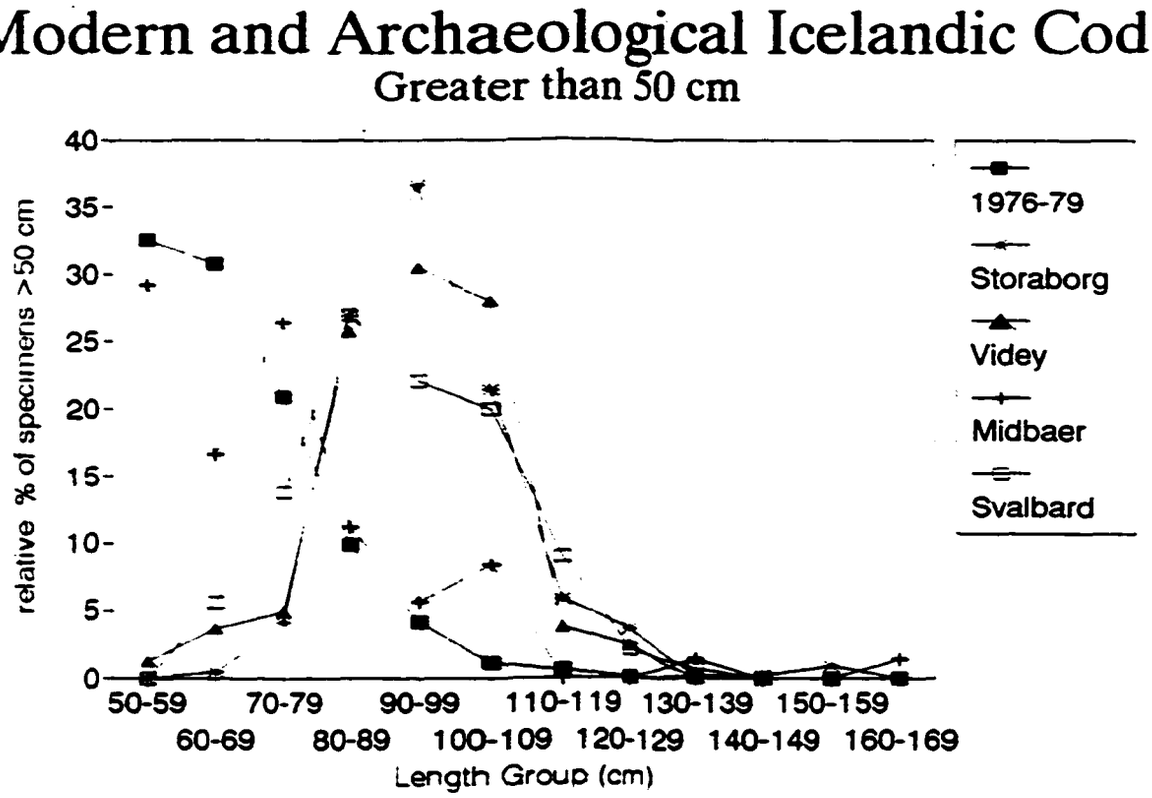

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Figure 12.9 - The reconstructed length of archaeological specimens of North Atlantic cod. The reconstruction is based upon the dentary, see Amorosi, McGovern and Perdikaris (1994) for a further discussion on methodology.

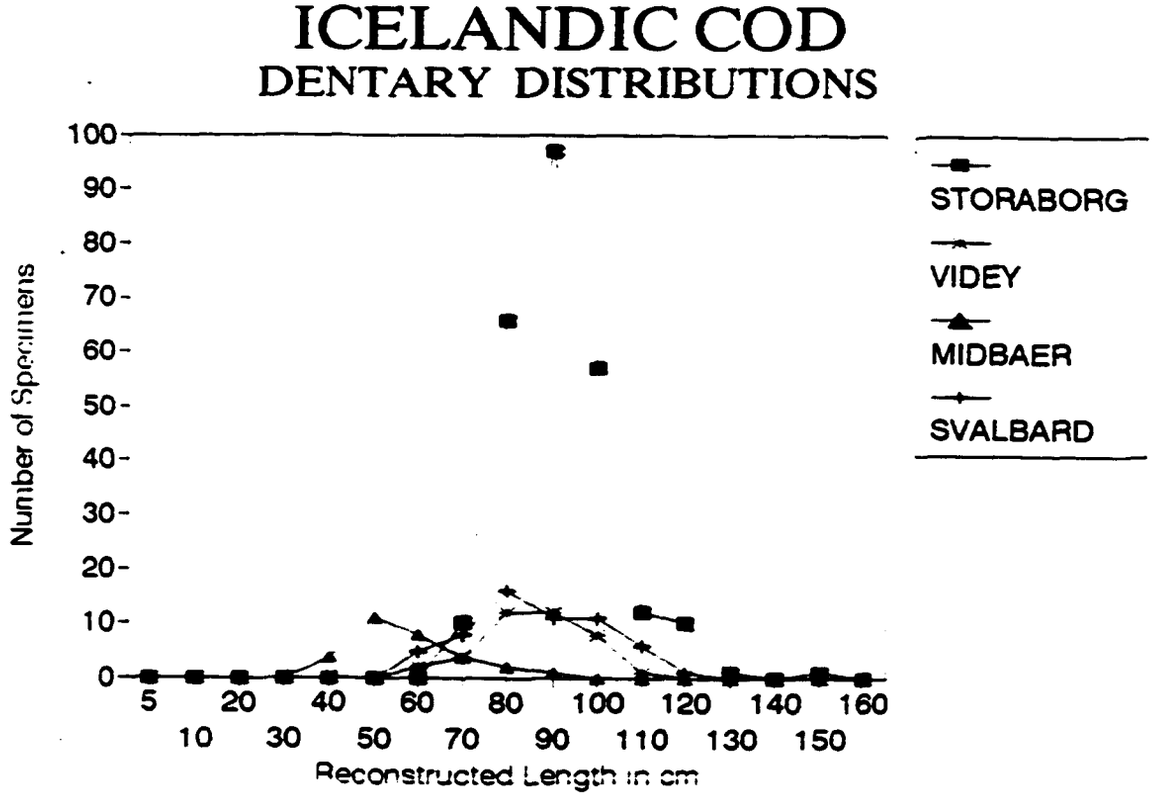

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Figure 12.10 - The reconstructed length of archaeological specimens of North Atlantic cod. The reconstruction is based upon the premaxillary, see Amorosi, McGovern and Perdikaris (1994) for a further dicussion on methodology.

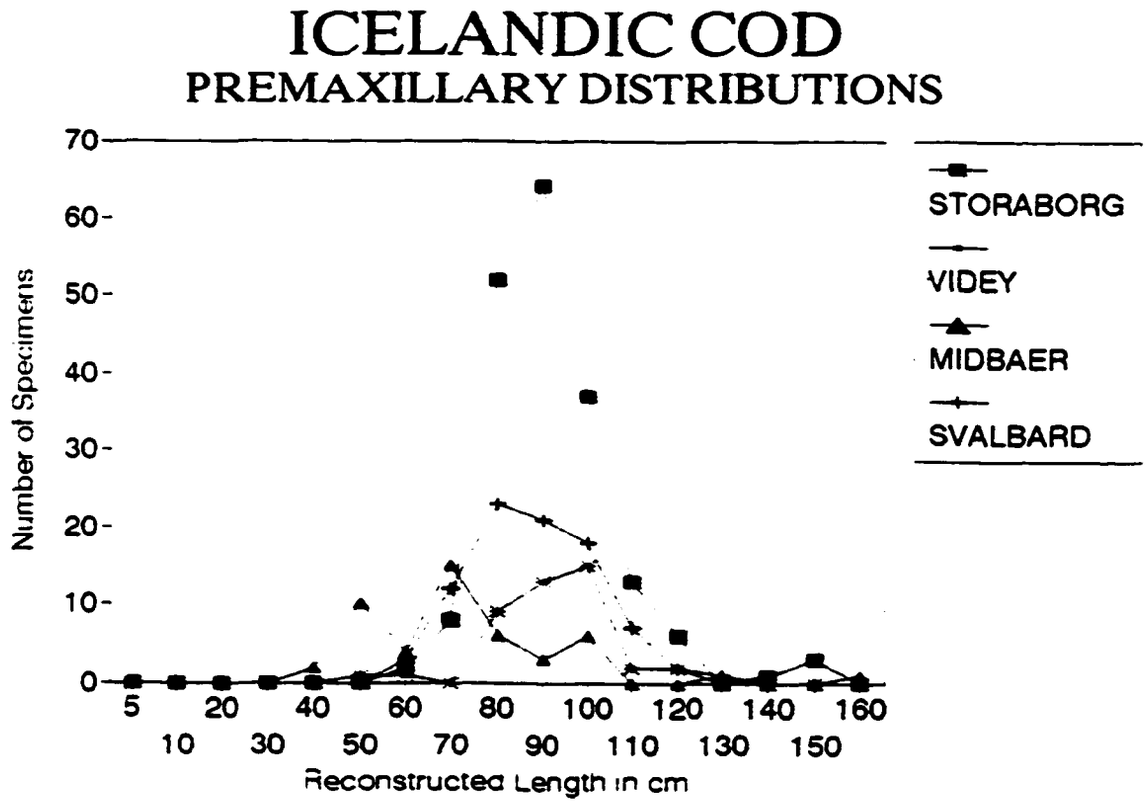

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Figure 12.11 - The reconstructed length of archaeological specimens of North Atlantic cod. These are the same data portrayed in Figure 12.9.

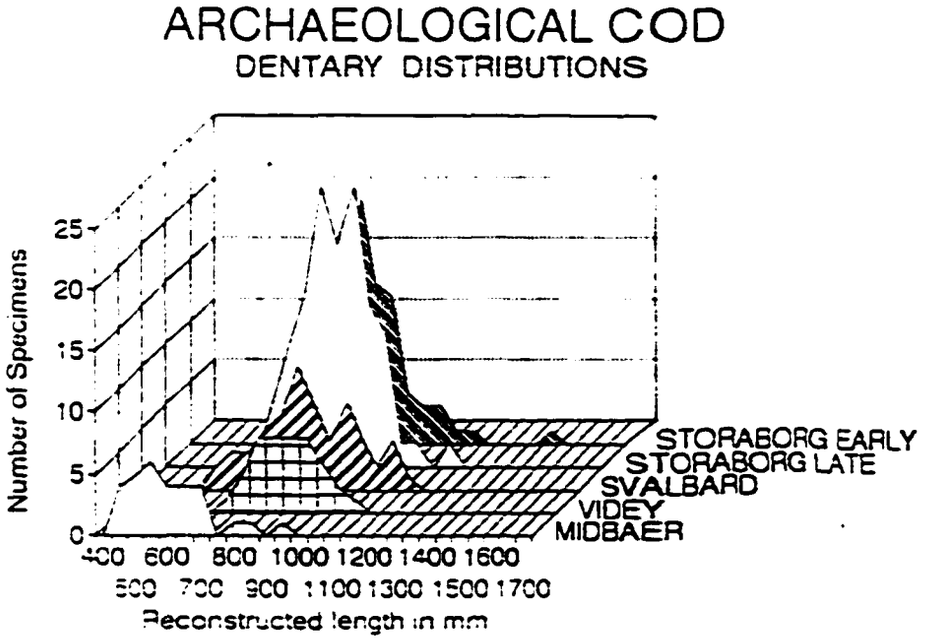

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Figure 12.12 - The reconstructed length of archaeological; specimens of North Atlantic cod. These are the same data portrayed in Figure 12.10.

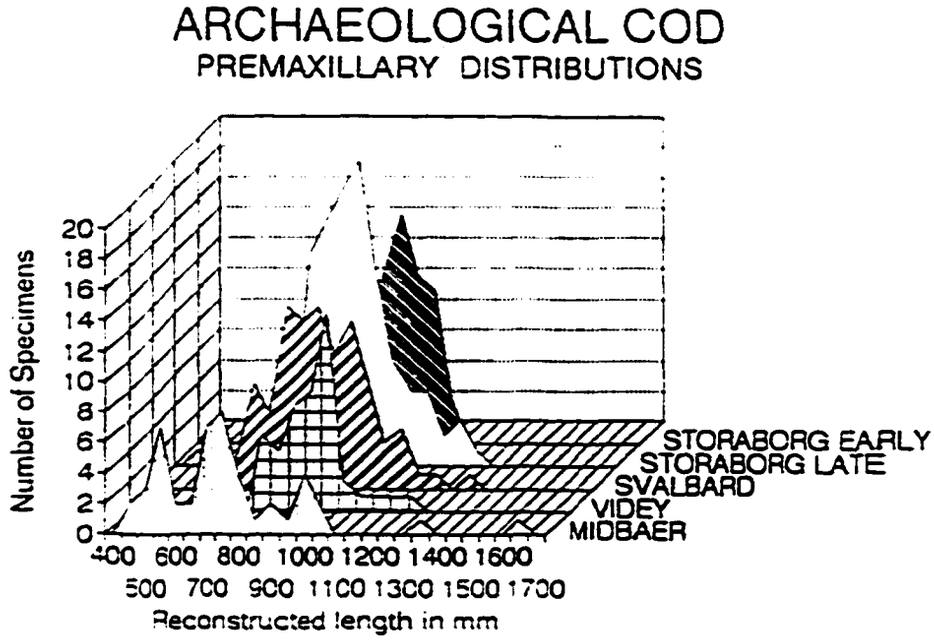

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Figure 12.13 - The reconstructed lengths of North Atlantic cod from the Midbaer archaeofauna. Lengths are based upon the dentary and premaxillary bone elements. The mean size of size is smaller (mean size range of 600-800 mm.) than the other Icelandic archaeofauna (mean size range of 900-1,000 mm.). This size differential might be related to the ecology of Breidafjord's many islands, rip-tides and shallow, sandy shoals.

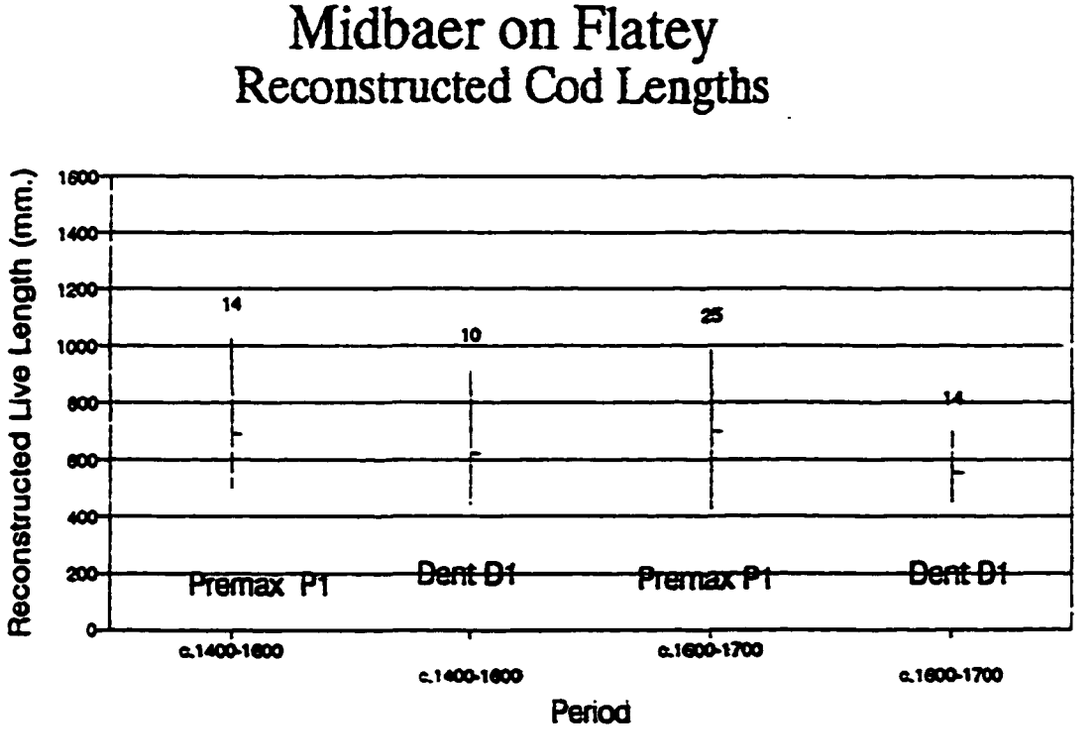

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Figure 12.14 - The reconstructed lengths of North Atlantic cod from the Storaborg archaeofauna. The reconstructed lengths are based upon the premaxillary specimens.

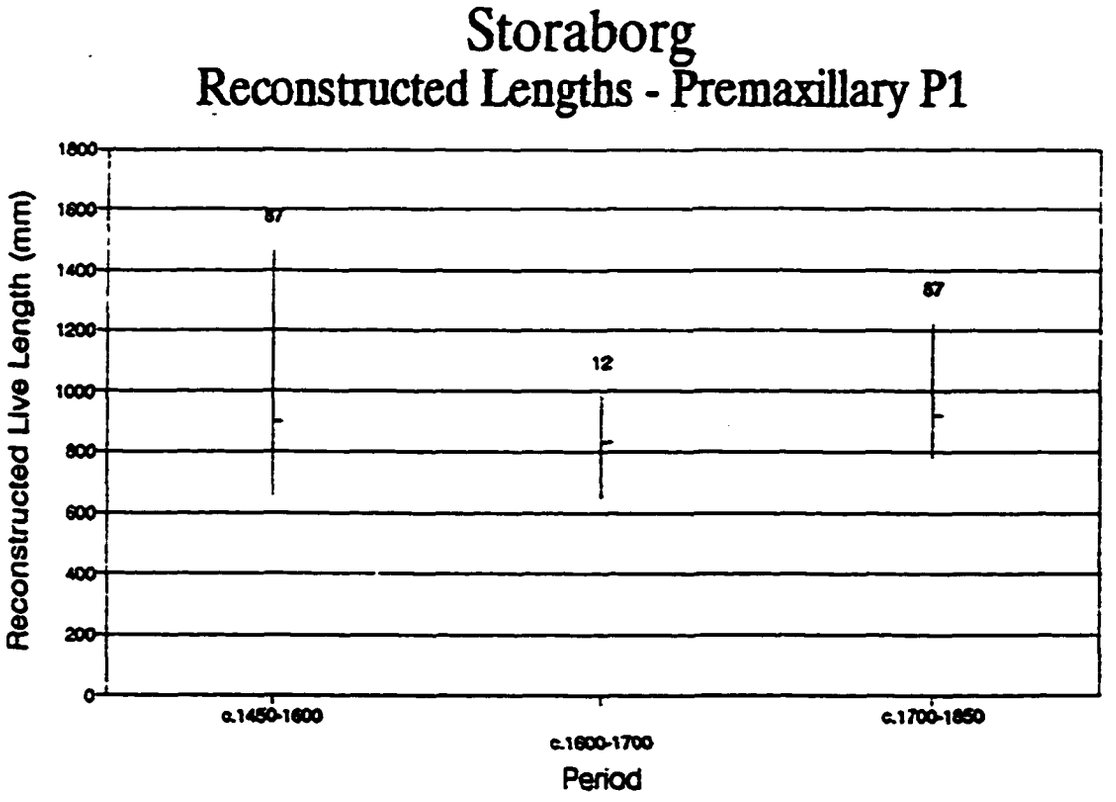

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Figure 12.15 - The reconstructed lengths of North Atlantic cod from the Storaborg archaeofauna. The reconstructed lengths are based upon the dentary specimens.

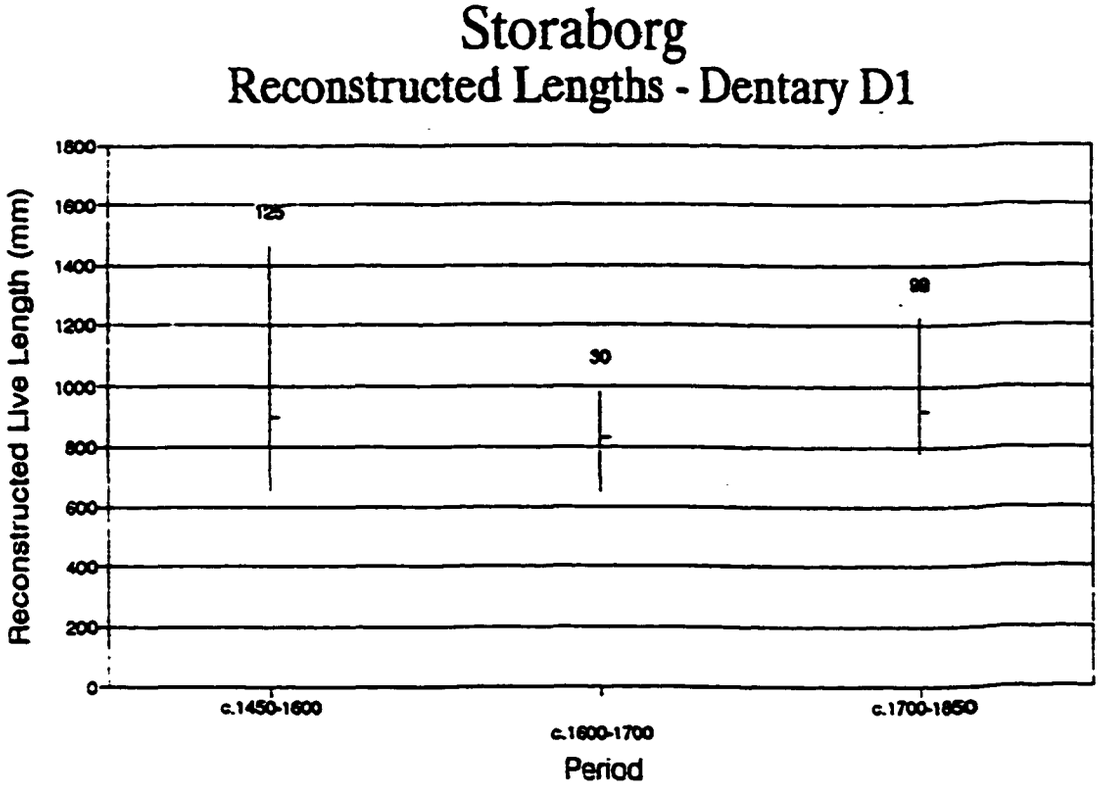

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Figure 12.16 - The reconstructed lengths of North Atlantic cod from the Svalbard archaeofauna. The reconstructed lengths are based upon the premaxillary specimens.

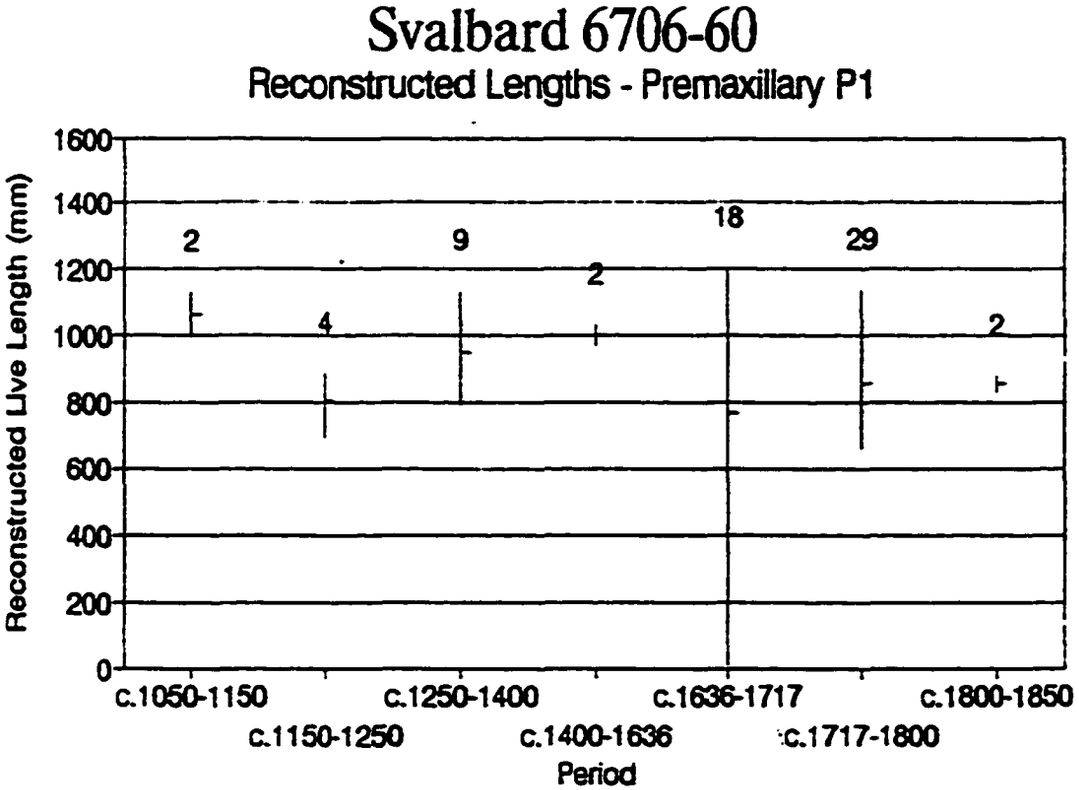

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Figure 12.17 - The reconstructed lengths of North Atlantic cod from the Svalbard archaeofauna. The reconstructed lengths are based upon the dentary specimens.

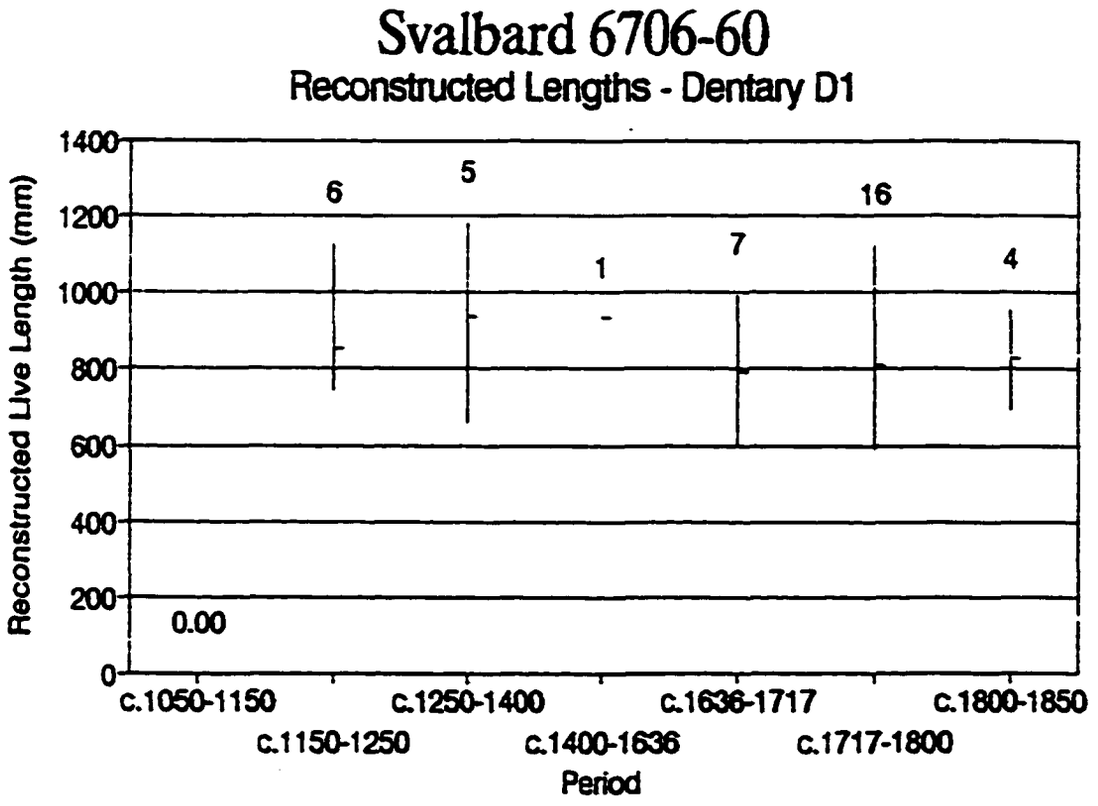

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Figure 12.18 - The reconstructed lengths of North Atlantic cod from the Videy archaeofauna. The reconstructed lengths are based upon the premaxillary specimens.

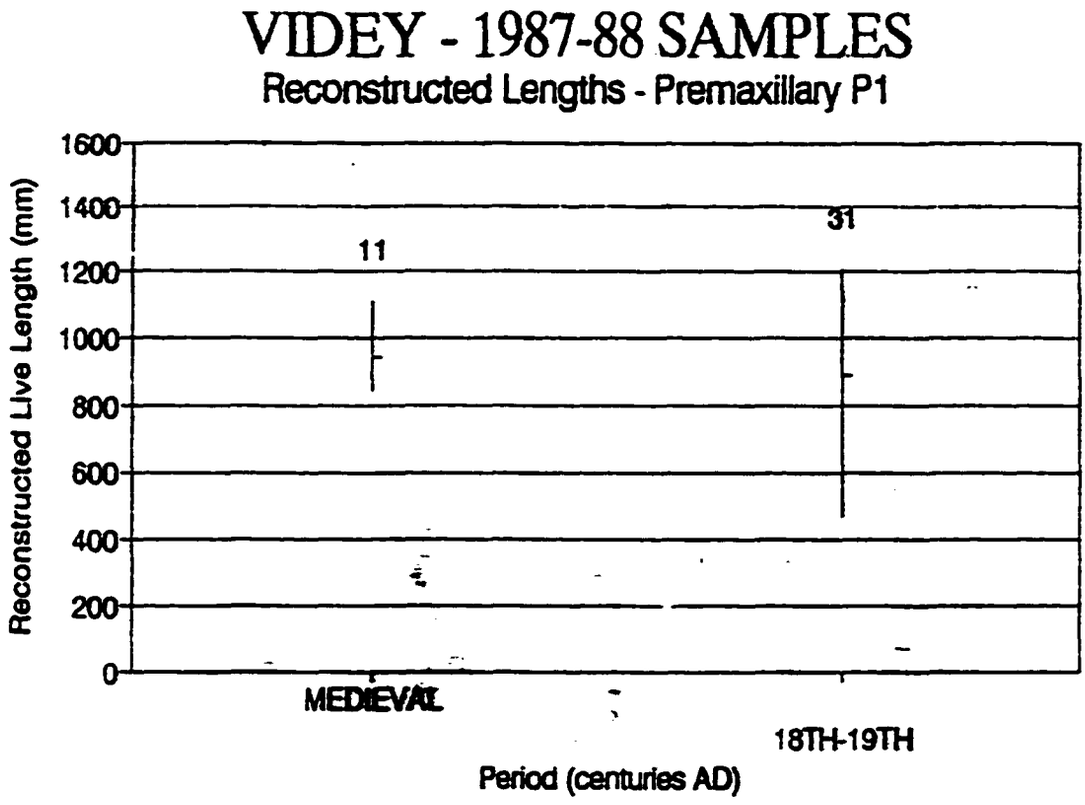

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Figure 12.19 - The reconstructed lengths of North Atlantic cod from the Videy archaeofauna. The reconstructed lengths are based upon the dentary specimens.

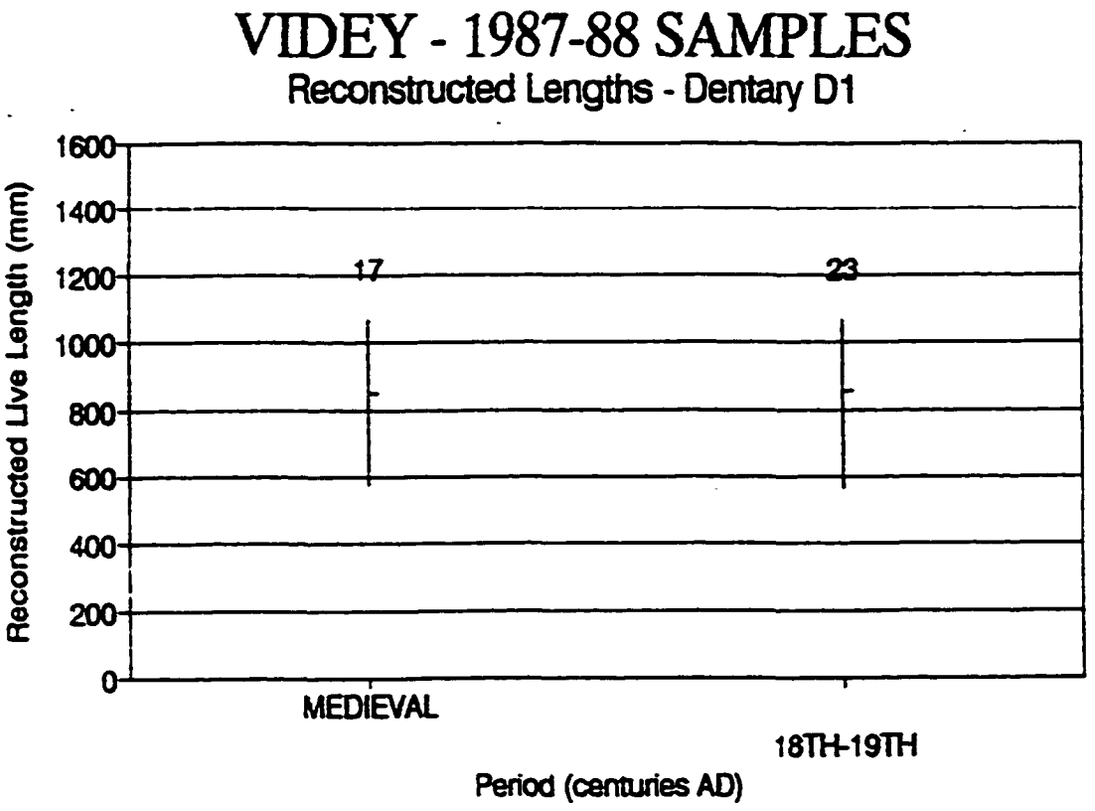

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Figure 12.20 - The species diversity of fish in the Icelandic archaeofauna, also refer to Table 12.2.

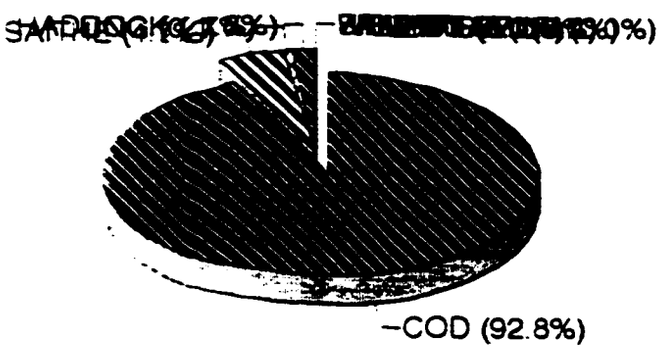

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Figure 12.21 - The species diversity of fish in the Kodiak Island, Alaska archaeofauna, also refer to Table 12.2.

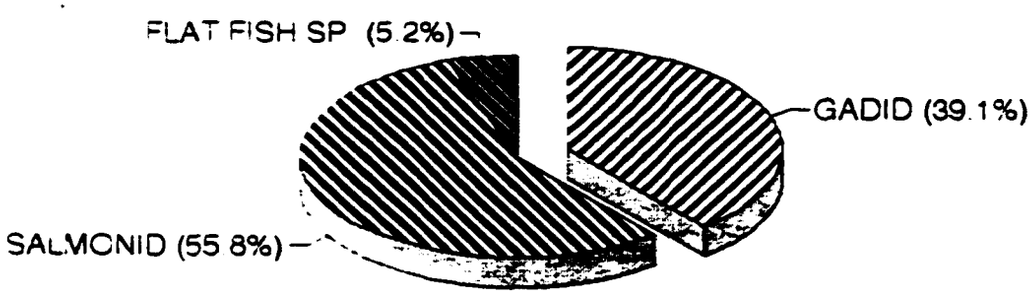

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Figure 12.22 - The cranial age/growth swelling of the 10-?+ year old age classes of North Atlantic cod, ***Gadus morhua***. Illustrated are the preoppercular (top left), parasphenoid (top right), postcleithrum (lower right) and (lower left) branichial-radial spines.

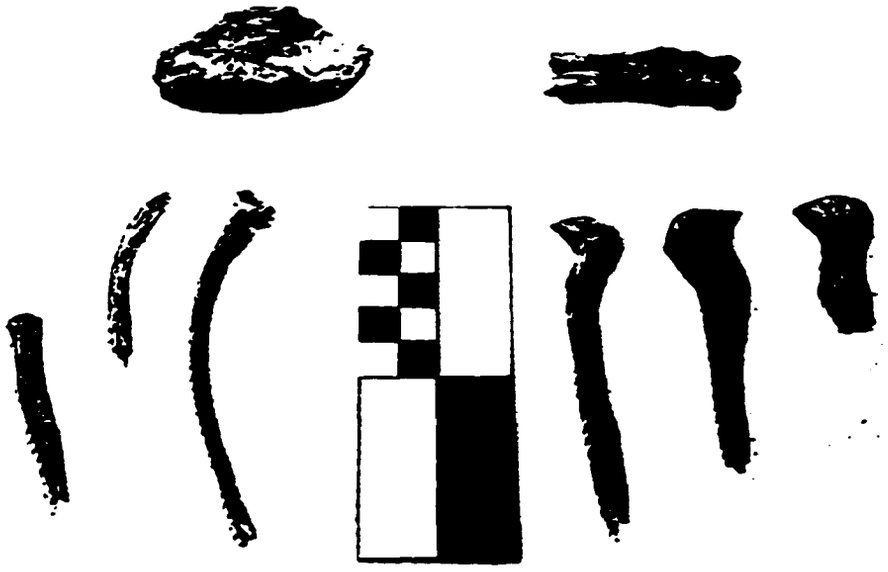

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Figure 12.23 - The age/growth progression of the "swollen" condition in the North Atlantic cod, (*Gadus morhua*), cleithrum for the 10-?+ year old age classes.

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APPENDICES

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APPENDIX I

QUATTROBONE 3.0

Quattro[1]
Templates for Zooarchaeology

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&
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September 16, 1996

Please DO duplicate and disseminate this manual and software! If you have problems, bugs to report, or ideas for upgrades, please contact the authors at the address above. If you do make use of these templates in published analyses, the correct citation is:

McGovern, T.H., & Thos. Amorosi
1990 Quattrobone 3.0, template software on file, Dept. of Anthropology. Hunter College, New York.

Quatbone.man

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Summmary & Disclaimer

This paper and associated software present one route to the integration of a popular spreadsheet program into zooarchaeology. QUATTRO and its upgrade QUATTRO PRO[2] offer significant improvements (especially in graphics) over the Lotus 123 version 2.01 or the newer 123 version 3.0. Both Borland products can run on older 8088 based IBM clones (with at least 640 K) likely to be available to the average archaeological user. An older version of these templates designed for Lotus 123 (Lotusbone versions 1.5-2.0) is available from the authors, but we strongly advise making the switch to Quattro. Both versions of QUATTRO can read and write Lotus 123 files, though the reverse is not true. The original version of QUATTRO will run without a hard (fixed) drive, has most of the advantages of the upgraded QUATTRO PRO, *and* it currently retails for less than US$100, so we have designed the current set of templates for the *original* QUATTRO. Additional bells & whistles usable only by QUATTRO PRO may appear in future versions.

NOTE WELL: we are distributing our templates, not the spreadsheet program itself. These templates are shareware, and become yours after the payment of a nominal sum to cover our production costs (or in trade for your own programming efforts). You are freely *encouraged* to make copies of our templates and pass them around as widely as you like- we are not trying to make a living at this and we are glad to see anybody use our *work*. However, QUATTRO is a commercial program whose copyright is owned by Borland, and its unauthorized duplication constitues piracy- which does steal money from professional programmers. Check with your local software merchant for a legal (and quite inexpensive) copy of the real program- you get a nice manual and technical support too.

This template set has been developed at the Hunter Bioarchaeology Facility over the past five years, and has been used extensively for manipulation of basic data on

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collections from West Greenland, Iceland, and Kodiak Island, Alaska. The major purpose of the Quattrobone package is to aid in the many tedious calculations necessary for the conversion of raw zooarchaeological data into a final report, and to allow for pattern-recognition searching (with graphics aids) previously impeded by the sheer volume of numbers involved. In short, we offer an advanced, special purpose calculator with some graphics and data-storage capacity added.

Quattrobone 3.0 is a revised version of the original set, and incorporates some fixes and improvements made since 1985. If you are one of the lucky(?) souls who has the original version, you can upgrade without losing comparability, but we suggest you contact us directly for advice. We assume that you own QUATTRO, Lotus 123 or a clone and are familiar with Lotus 123 command structure, or have access to a manual. Our own (outmoded) hardware configuration is IBM PC, dual 360K floppy with 640K RAM, connected to a Toshiba P321 dot matrix printer (capable of condensed print mode). A hard drive will (as ever) ease operations, but you can make do with something as primitive as our set up.

We do not claim that the system described here will meet all your needs (won't identify bones worth spit), nor that it will compete with a database program for database functions. Statistical functions included are ***NOT*** intended for spurious hypothesis testing, but are descriptive pattern-recognition tools only. Archaeofauna rape the assumptions of most statistical tests even more brutally than the average archaeological data set. We strongly encourage you *to try out* the spreadsheets with the dummy data sets loaded before entrusting your real data to them, and that you carefully think through the assumptions behind the system we are using: they may *not* be yours. As ever, ***do make back ups*** of templates and any entered data before trying any modifications, data sorts, or similar manipulations. We will be very grateful for notice of any glitches, bugs, or problems, and suggestions for improvements are particularly welcome.

PLEASE NOTE: While we have done our best to check and correct these templates, we ***assume no responsibility*** for crashed data sets or any other user-specific problems. Contact Borland, Lotus or your clone vendor for spreadsheet-related questions.

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Background

Like many others of his generation, the senior author made use of a special-purpose mainframe-based computer program to manipulate his bone data for his doctoral thesis work in the mid-late 1970's. Like many contemporaries, he devised and memorized a 4 cm thick coding manual (and still wakes up at night with the chilling certainty that an 023541233123 is a left proximal humerus, fused, canine chewed, lightly weathered,unburnished, unburned, and belonging to a harp seal). Like so many, he also had the experience of shredded punchcards, jammed readers, long lines at terminals, crashing systems (only when your data is running, yes?) and bully nerds everywhere. Like many, he also asked himself if the time/trouble investment was worth the output, especially for smaller archaeofauna or those whose conditions of collection did not encourage attempts at great precision in data manipulation.

Most practicing zooarchaeologists will recall these pre-PC days without nostalgia, and few are now unfamiliar with the delights of either specially written or off the shelf microcomputer software. Most of us now have our own pet programs and recording systems, and it is clear that there are many computer aided routes to a solid & professional bones report, and there is currently no single shining path all should adopt at risk of unfashionable obsolescence.

However, we have noted a tendency for zooarchaeologists to make most use of data base programs (which are most similar to the old mainframe set ups we started on), downplaying the spreadsheets so popular with business users. We feel that spreadsheets do have many applications in zooarchaeology, and we have had some good luck with ours. Much of the least fun and least productive time we spend as zooarchaeologists is in basic numbers manipulation, and a spreadsheet can be very helpful in cutting this drudgery short. We make no grand claims for this approach, but if you like it, please use it and share it. If you hate it, just erase your disks and take comfort in the memory of how little you paid for it.

The Hunter Bioarchaeology Recording System

Our recording system begins with a set of paper forms (attached) which have space for recording basic zooarchaeological data and act to aggregate single bone

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fragments by taxon and by archaeological provenience unit. As the attached forms manual indicates, we tend to use these form-based records for the most common taxa, relegating low frequency species and extensive comments (on articulation, burning, burnishing, tool-modifications, general observations) to a separate analysis notebook (which also records unidentifiable scrap, and such mushy taxonomic catagories as "Large Terrestrial Mammal" "Medium Terrestrial Mammal", etc.). In practice, the paper forms and the notebook are used in one room (where bone bags are opened, collections washed, coffee is consumed, and rate of sedimentation is high) and the completed data sheets are entered into the Quattrobone format in a different, significantly cleaner room. Paper forms thus serve as an ultimate hard-copy backup, though we also regularly make floppy backups and store at least two copies of the data panel printout.[3].

Note that we are thus *not* doing a bone-by-bone entry in random order (for later multiple-key sorts), but are instead recording on a bag-by-bag provenience based system. If you want to manipulate individual fragments disassociated from their provenience information for any reason[4] then you will find our system clumsy and we suggest a database approach instead. If you are interested in rapid calculation of major zooarchaeological frequency measures (NISP,RF, crude MNI) and some investigation of element frequency and distribution, ***and*** you are willing to use lowest order archaeological provenience units as your base unit of analysis, you may find this system useful.

Some Inherent Biases

Before getting to the mechanics of the templates, a few methodological/philosophical prejudices of the authors should be made explicit. In our recording system, we have

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3. We suggest you investigate the product ***Softstrip*** by Cauzin for long term curation of large data bases.

4. For example, if you want to rapidly find out how many right distal slightly weathered medium-well done femora of woodchuck there are in the site archaeofauna as a whole, or how many right elements of any kind there are in the site collection.

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deliberately attempted to keep alphanumeric codes to the absolute minimum.

Here's why:

- Heavily coded records are visually opaque, difficult to scan rapidly for errors and nonsense entries. Fatigued recorders, beginners struggling with unfamiliar terms and taxonomy, and Murphy Law effects all combine to produce a high % (normally around 10% in experiments we've done) of error punches that have to be caught and corrected. If tedious checking (which can effectively double the recording time) is not done, then what price the apparent precision of 5 graded catagories of burning?

- The coding manual itself creates a barrier to research, forcing trained zooarchaeologists to waste time learning codes they may never use again, and greatly complicating the learning process for beginners. Given the daunting size of most analysts' backlogs, ***any*** step in the recording process that wastes time is an expensive luxury at best.

- The basic data record is normally intelligible only to the codemaster. If the material is not printed out fully, in all its permutations & combinations, there is real risk that the basic data will become a meaningless string of numbers if and when the last coding manual crumbles to dust. One hopes that our successors will still know what a proximal humerus is/was, but can we expect them to recognize a z345m/2?

We have also reduced the data per bone element to a bare minimum, cutting out the various catagories of burning, abrasion, burnishing, weathering, etc. that necessitate long coded entries for each fragment. We kept chewing (present/absent), as this has produced interesting patterns for us in the past, and have relegated other data to notes made in notebook. Low frequency observations need not be mechanically added to basic record forms. Each added observational catagory costs valuable time, and human-factors studies indicate that multiple catagory judegments (weathering catagories 1 to 5, chewing type 1 to 3) are particularly stressful & prone to systematic creeping error as the worker tires. Since we all face Herculean labors in

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getting the basic sorting and taxonomic identification done (which cannot be automated), we feel that a large, consistant, "no frills" data set is preferable to one full of bells & whistles of measurable cost but unmeasured utility. You may feel differently, and may want to add catagories to forms and spreadsheet.

We feel strongly that there is probably no *single* ideal quantitative measure for all archaeofauna. We doubt that any statistic will adequately characterize collections resulting from catastrophic bison drives, gradual accretion of many short term human (interspersed with non-human) occupations of rockshelters over many millenia and the accumulations resulting from permanent, intensive residential midden-dumping over a period of decades. Conditions of deposition, attrition, recovery, temporal and spatial scaling etc. clearly influence individual archaeofauna profoundly, and we need to be particularly careful to insure that we are not invariably comparing apples to oranges (or scavanger-ravaged kill sites to basecamps or hornworker's shop to domestic refuse). A major goal of this template package is to allow you to conveniently compare contexts and search for unit-specific strangeness. Identifying the cause(s) of said strangeness may be less easy, but you will never recognize variablity within your patterns if you don't look for it. Many of the calculated indices are designed to aid you in posing the question of within site and between site comparability. Answers are harder, and are not included.

Teaching Applications

Like many of you, the senior author teaches a zooarchaeology introductory course periodically. The Quattrobone template system can be used to generate dummy data sets (with strong patterning that needs explanation by students) for class assignments, and can be used by more advanced students for "what if" experimentation, simulation of Binfordian attritional patters, and the like. The graphics greatly aid student comprehension, and can make the whole process of comparing quantification techniques fun (or at least less painful). On disk (disk 2 if you have the 5.25 inch version) are a set of simple dummy data sets that key into a class assignment that is included in the printed hardcopy. The files are called BOSDUM1.WK1,CERDUM1.WK1 etc., and are saved in Lotus 123 -readable format for students who may not yet have Quattro. The file SUMDUM88.WKQ provides the answers for the exercise and some graphics. Your comments

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and suggestions are welcome, and I hope you have fun in Strackenz.

Installation & First-Time Use

Quattrobone Primary Templates

Follow the manufacturers' instructions for installing and starting QUATTRO. Place the Quattrobone 3.0 Primary Template disk [5] in your data drive (normally A:). Then give the file retrieve command (/FR) and examine the filenames displayed. They should include:

BOSFORM3.WKZ	CERFORM3.WKZ	SHELLFIS.WKZ	
OCFORM3.WKZ	PHOFORM3.WKZ	AVES.WKZ	BOSTEST3.WKZ

As you may suspect, BOSFORM3 is the basic record form for cattle, OCFORM3 is for caprines, CERFORM3 is for deer, and PHOFORM3 is for seals. AVES is for most birds, and SHELLFIS is for mollusca common to the North Pacific (alter as needed for your area). Templates for pigs, dogs, and horses are coming, but were not completed in time for this presentation. We suspect that inspection of the formulas will allow experienced spreadsheet users to convert BOSFORM3 for horses, and PHOFORM3 can be altered for pigs and dogs with only a few changes. The file QUATBONE.MAN is this manual in ASCII text with some FINAL WORD control codes added. Any additional file names are examples.

A Tour of the Primary Spreadsheet

For demonstration purposes, select BOSTEST3.WKZ for retrieval. When it appears on screen, you will be in cell A1 of a spreadsheet that extends to the lower right as far as cell **AH77**.

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5. In 5.25" format you have two disks, in 3.5" format you have one disk.

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Presentation Panel

The first four columns (A1...D56) comprise a data presentation panel where the archaeological context is recorded and the results of various calculations are displayed. This panel will print on a single sheet of 8 1/2 x 11 inch paper if your printer can do condensed print. The first 12 rows (A1...D12) are for ***site context*** data, and contain locational information for a dummy data set from a meter square, single layer, 5 cm level of the site. This mock-up is for illustration only, please modify this section as you see fit. Note that the site context data will automatically be echoed across the top if the next two panels to the right, so be sure to adjust this too if you make radical changes in the layout of the context panel.

Below the site context panel is a ***Summary Statistics*** panel (A13...D25) which presents a count of identified fragments (NISP)[6] followed by mean Relative Frequency (RF = element NISP/freq. of element in skeleton) and RF standard deviation (n-1 method) and RF Coefficient of Variation. RF counts (developed by the late Dr.s Perkins & Daly, see Gilbert & Singer 1982) provide a useful variation on MNI assessments, focussing on the distribution of fragments recovered over a taxon's skeleton. In this context a high RF Coeff. of Variation reflects a higher variance in element RF scores, which in turn reflects a recovered sample very different in element frequency from that produced by the deposition, survival, and recovery of whole skeletons. The larger the RF coeff. of Variance, the greater the uneveness of skeletal elements recovered and identified. This measure may priove useful as a flag of very different patterns of skeletal deposition ind different archaeological contexts. When you are ready, make a dummy data entry that would result from one single articulated skeleton and check the result on RF Coeff. Variation.[7].

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6. Terms here follow Grayson 1984

7. ***NB:All the simple descriptive measures employed here are statistically invalidated by the high probability that individual fragments are not in fact independent of each other (some probably come from the same animal).*** ALL these entries are intended to aid you in recognizing and investigating differences in particular sub-samples that

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The maximum RF score is presented as a very crude MNI (one which does not take into account left/right, fused/unfused, upper/lower distinctions). It may also serve as a direct comparative statistic for those following Payne's most common element approach. A more elaborate MNI can be derived by inspection following a Data Sort command (described below).

The template could have been arranged (through use of data function commands and macros) to extract a more complex MNI from the data entry panel, but given the wide variability evident in the way different workers calculate MNI and the advantages of keeping the current template as simple and straightforward as possible we opted not to go this route. Users seriously committed to MNI approaches should consider a very nice package developed by Dr. Richard Klein at the Department of Anthropology, Univ. of Chicago (update available from him free of charge). The NISP/crude MNI ratio is presented in B24 for those interested in Graysonesque measures.

In the lower right of this panel (C17-D25) are some additional catagories: neonatal remains (important in North Atlantic contexts if not in yours) and basic data for calculating ARF should you choose to do so. In other spreadsheets, these panels may contain other information we find useful, take a look.

Element Distribution

The panel section A26...D37 presents the distribution of elements across a generalized skeleton, with relative % of RF, raw RF score. To see this data graphically, press F10 now. Should you care to see the same data displayed as a pie chart, select Graph Name Display (/GND), move pointer down (to filename ELDISTPIE), and press enter. This section can give you a quick view of the concentration of elements, and may highlight particularly interesting or strange features (horncores??). Elements included in each catagory:

Horncore horncore

---

may result from factors of taxonomy, recovery, or identification. If you use these numbers in significance tests, you do so at your peril: YOU HAVE BEEN WARNED!!!!

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cranial	Calarium Centeral, Bilateral: Premaxilla: Maxilla, central, bilateral: Mandible: Hyoid: all teeth: atlas: axis
Forequarter	Scapula,humerus,radius,ulna,carples
Vertebrae & Ribs	Other cervical,thoracic, lumbar, sacral, caudal,ribs, sternum
Hindquarter	innominate, femora,tibia,patella, astragalus, calcaneus, nav.cub., other tars.
Lower Hindlimb	Metatarsus
Lower Forelimb	Metacarpus
Feet	Phalanges I,II,III, any acessory MP & Ph.

This division of the bovine carcass may not suit you, if so feel free to change it (select Block Advanced Create [/BAC] to see where block limits have been set). **NB: this table WILL be affected by any data sort you conduct: please return elements to original order before printing table or graph based on this panel!**

Taphonomic Measures

Versions of Binford & Bertram's bone density measure and *M*odified *G*eneral *U*tility *I*ndex (MGUI) have been included in the calculations panel (see below). Section A38...D42 presents some summaries derived from these measures (RF x MGUI score and RF x Density). If the maximum and total density score is very high, then only elements most resistant to attrition are included. If maximum and total MGUI scores are very high, then one might assume that meat & marrow-bearing elements predominate. These numbers mean very little in themselves, but their behavior across different contexts is sometimes quite interesting. To get a visual impression of the element distribution relative to these two factors, select Graph Name Display (/GND) and move the

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pointer to the graph names PERCMNI & PERCRF. Select each in turn to view a scatterplot of RF values against MGUI and element Density respectively.

Below these data panels are information on chewing, burning (where recorded), number and % of whole long bones, percent of taxa represented by teeth only, and two ratios between the dense distal end and the softer proximal end of tibia and humerus. These are all intended as taphonomic indicators: add your favorites if you like.

Finally, there is a non-printing panel (A63...D77) which presents useful data on macros and the appropriate reference should you use this software in publication.

Data Recording Panel

To the left of the Presentation Panel is the Data Recording Panel which effectively mirrors the printed paper form filled out in the dirty lab area. This will probably be self-explanitory, see the form manual for help. Entry of data may be eased by freezing vertical & horizontal titles at H3 (put pointer at H3, call up /Layout Titles Both). In the caprine and phocid templates, species-level designations are included for use when possible.

Calculations Panel

The calculations panel (S1....Z76 in BOSFORM3) is the site for most of the formulae that make the spreadsheet work. The element code column provides graphics shorthand. The Relative Frequency column (RF) houses formulae that divide the number entered in the NISP column of the Data Recording panel by the number of times that particular element occurrs in the skeleton of the taxon in question (for example: 4 scapulae/2 per skeleton= 2). The RF scores are thus normalized for natural skeletal abundance and make a useful basic data set for further analysis. To change taxon, alter this column. The Density column borrows figures from Binford & Bertram (1977), with some estimations included to fill gaps. MGUI column is derived from the same source, also with some gaps closed by estimation. Bone density and potential meat/marrow utility have been proposed as major factors affecting archaeofauna, and these columns allow for some tracking of these variables.

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The next four columns are attempts to identify element frequency patterns. Percent of MNI presents each element as a percent of the most frequent element (which scores 100%, next most frequent might score 98%, etc.). Consider the difference between a % of MNI pattern of "100%,99,98,95,94..." and "100%,45,10,5,4.5,4.5,3...." in its implications for the distribution of skeletal elements and possible depositional patterns (consider some graphic displays here). Percent of RF sum presents each element as a percent of the total RF score, approximating a traditional percent of whole score with normalization for natural skeletal frequency. Here the largest % belongs to the most frequent element, but the *total* for the column will equal 100%. The next columns present RF multiplied by the bone density and MGUI, with high scores reflecting elements that are both numerous relative to their frequency in the animal's skeleton and very dense or very high in meat/marrow utility. A heavily scavanged deposit might be high only in dense bone, while a kill site might be high only in low-MGUI elements. Again, patterns in the real world will seldom be clear cut, but these columns (especially when sorted, see below) may help in basic pattern detection. Try out some extreme cases to see how it works for you.

Some Mechanics

Using Quattrobone Primary Templates

The Primary Template disk comes with both blank templates and sample templates loaded with data to provide a set of illustrative examples. In use, follow these steps:

1. make a backup of the original disk you copied from our master, and put this away in a safe place to ward off disaster.

2. Make up a taxon-specific disk (in this example; cattle) and copy the relevant blank form onto it (in this case; BOSFORM3.WKZ).

3. Enter Quattro, then call up BOSFORM3.WKZ. Make sure that Quattro knows what drive your data disk is in (call /File Directory to check).

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4. Now enter your data & context info in the spaces provided. Press F9 and watch it CALC. When you have filled a spreadsheet for the given context, select /File Save and give your creation a distinctive name (like Vidbos.wkz ,you may need some coding here to get round the 8 character limits). Use the .WKZ file extension to activate Quattro's file compression feature. NB: we suggest you save several times before you are completely done with a spreadsheet to avoid accidents.

5. when ready to start on a new context, do a /File Retrieve and summon up the blank BOSFORM3.wkz on disk. This will give you a fresh sheet to work with, then save under a different name.

6. Repeat last two steps until done. Do make backups of all files as you work, AS YOU work.

You will note that these spreadsheets eat disk space voraciously, and you may find two steps worthwhile:

- If you are sure you want to aggregate two or more small units, simply sort the paper forms and use Lotus to add them together (if you enter 1+12+2+4 in a space in the Data Record section the result [18] will be displayed and used in calculations). Don't waste disk space on really tiny contexts: shuffle paper instead.

- Use *Quattro* with its built-in Squeeze function (just specify the .WKZ file extension) or get the add on SQZ Lotus utility: either will reduce spreadsheet sizes by 40-50% on disk.

Combining Files

You will certainly want to merge record files during your analysis, as there are few useful questions that can be addressed on the basis of a single layer from a single square. To do this, put your pointer in the upper left corner of the data entry panel (F1) and call the command /File Combine Add Blockname (/FCAB). When prompted, supply the name of the file you want combined and the range name "data". The data will be added to your base spreadsheet. Now change the context panel (A1...D12) to reflect the merged units, press F9 (CALC) and observe the changes. Continue the process until you reach the desired result or you run out of additional data to lump. Note that the F1..F77 column will

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steadily increase as you combine spreadsheets- don't fret, it will still work to restore anatomical order after a data sort (see below). It is a good practice to regularly save intermediate stages (with distinctive labels) in case you botch a transfer.

Saving Files

Remember !!!! QUATTRO Does Not Automatically Save Your Work!! If You exit without saving, you are DEAD! If power dies, ditto!!! Save Early & Often! Make Back-ups!! SAY YOUR MANTRA or computer conjuration magic of your personal preference.

Data Sort Commands

You may well find it useful (when carrying out an ARF analysis or searching for various sorts of MNI's) to sort the bone elements by frequency. Your template has a macro to carry out a Data Sort of the whole data and calculation panels with the primary sort key on the RF column (T). To activate the macro, simply press Alt and s to sort by RF. Note that an RF sort is not going to be identical to a sort on NISP, so don't be surprised if there are some differences. If you'd rather sort by NISP, just change the macro formula (AH 50..AH77).

You can now examine the top and bottom quadrants for clustered elements (are all the high MGUI scores at the top?) and get a better grasp of the element distribution generally. To restore the original order, press ALT + u to unsort.

Three cautions:

1. Recall that the Element Distribution table and the graphs derived from it will NOT work when sorted: put things back before using these for prints or PIC files.

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2. Recall that you ***cannot*** merge files if one or the other is in frequency sorted condition (well, you can if you like hashed data sets...). Be absolutely sure that you put each & every file back into original order (press ALT + u) before saving it and you will have no problem.

3. If you choose to modify the Data Sort variables, make sure you include in the Data Block not only the Data Record area but also the Calculations Panel or you will produce chaos when you CALC after sorting.

Modifications

Please feel free to alter these primary spreadsheets to fit your needs. Be aware that any changes in the ***Data Record*** panel will probably make your version incompatible with the present Hunter model. If you plan on direct data transferrs with the Hunter research group, do consult before altering the Data Record Panel (F1...Q77 in BOSFORM3). Additions on the right (AA1 .....) are harmless, and additions and changes in the Presentation panel are also fairly safe.

A Final Word

You may see a few additional files on your disk besides those mentioned in this text. These will be extra examples or late additions, just try them out and see. If you are interested in any additional archaeological spreadsheet templates, just write and we will be glad to trade.

Good luck and hope to hear from you!

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APPENDIX II

The following is reprinted from:

Morris, C.D. and D.J. Rackham, eds.
1992 Norse and Later Settlement and Subsistence in the North Atlantic. pp. 169-191. Glasgow: Archetype Publications, University of Glasgow, Department of Archaeology.

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Appendix II: (Amorosi et al. 1992:169)

Site Status and the Palaeoecological Record: A Discussion of the Results from Bessastaðir, Iceland

Thomas Amorosi, Paul C. Buckland, Guðmundur Ólafsson, Jon P. Sadler, and Peter Skidmore

Introduction

Status in a community is frequently displayed in terms of the possession of prestige items. In societies where the architectural tradition might otherwise indicate egalitarianism, the contents of the midden might imply social division not apparent elsewhere. Such simple statements lie at the back of much archaeological interpretation, yet the pathways by which artefactual material may enter the archaeological record are often complex and may bear little relationship to their primary attributes in terms of status. Items are as likely to be cascaded down through a hierarchy as curated up. Sometimes this is a reflection of fluctuating supply patterns, an aspect perhaps most evident in pottery assemblages, but perhaps equally likely to be apparent in beads and fish hooks. In situations where the artefactual record is at the best sparse, as in much of North Atlantic island archaeology, the few finds may provide little evidence of site status and what there is may be seriously misleading both because of preservational bias and taphonomic problems. There is therefore a need to look beyond the purely artefactual record and consider what contributions the palaeoecological data might be able to make to the examination of a site's regional context as well as the immediate on-site interpretation. In Iceland, where the documentary record for some sites is particularly good, the opportunity exists for examining any model of status indication from the archaeofauna with a view to the application of similar criteria in less well documented and prehistoric contexts.

From the 8th century onwards, emigrants from the Scandinavian cultural *milieu* in north west Europe exported a largely subsistence-based farming system, based primarily upon secondary products from cattle and sheep, supplemented by limited amounts of cereal production and a variety of additional protein sources. This expansion left a series of local adaptations to available resources across the North Atlantic from Shetland (Bigelow 1984; 1989) to Faroe (Arge 1991), Iceland (Amorosi 1989; 1991), Greenland (McGovern 1985; 1991) and, abortively, also North America (Wallace 1991). At the core lay a system of land division and resource partition under the control of chiefdoms (Byock 1988), whose ultimate power, from the 13th century onwards, lay in the hands of an often dis-interested Norwegian and later Danish Crown. In Iceland, this control was increasingly exercised from the Governor's residence at Bessastaðir on the Alftanes peninsula, south of Reykjavik.

Bessastaðir

In terms of its later medieval and post-medieval history, Bessastaðir holds a prime position in Iceland and the house remains the official residence of the Icelandic president. The site lies on a narrow isthmus on the Alftanes peninsula some 16km southwest of Reykjavik (Fig. 1). To the north and

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Appendix II: (Amorosi et al. 1992:170)

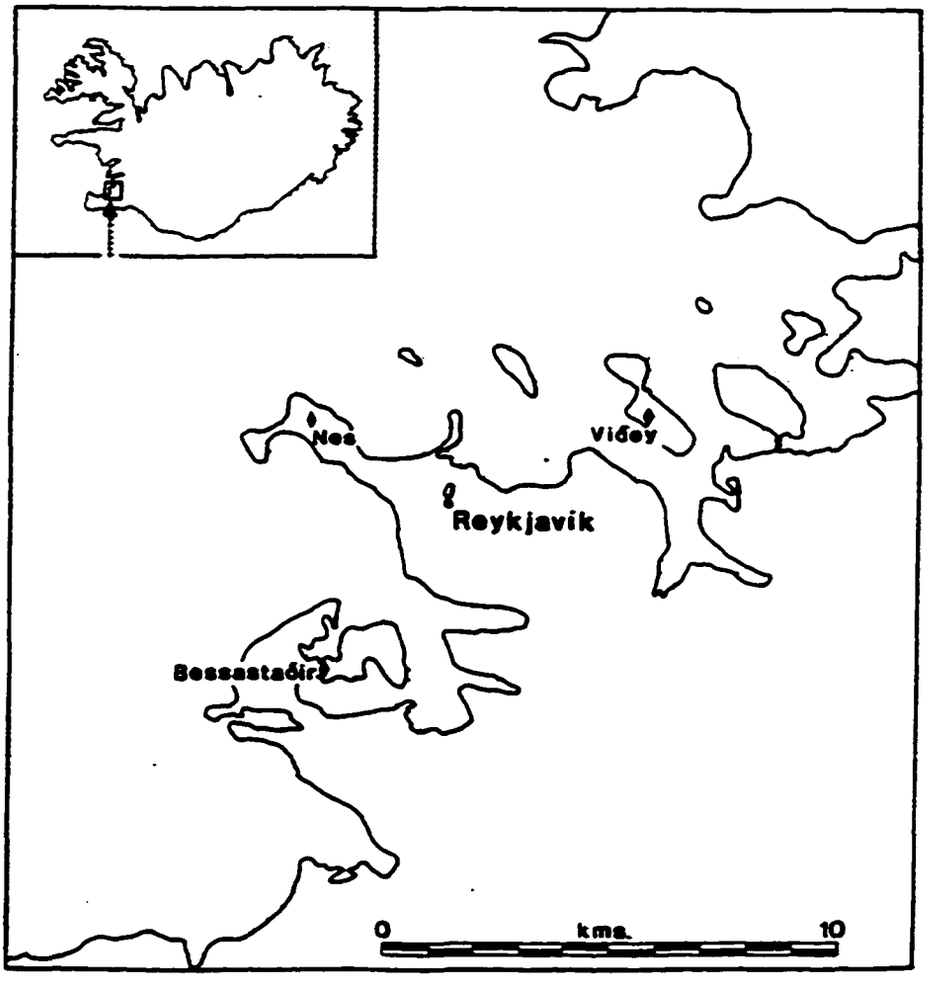

Figure 1 Location map of Bessastaðir (Source G. Ólafsson, National Museum of Iceland.)

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Appendix II: (Amorosi et al. 1992:171)

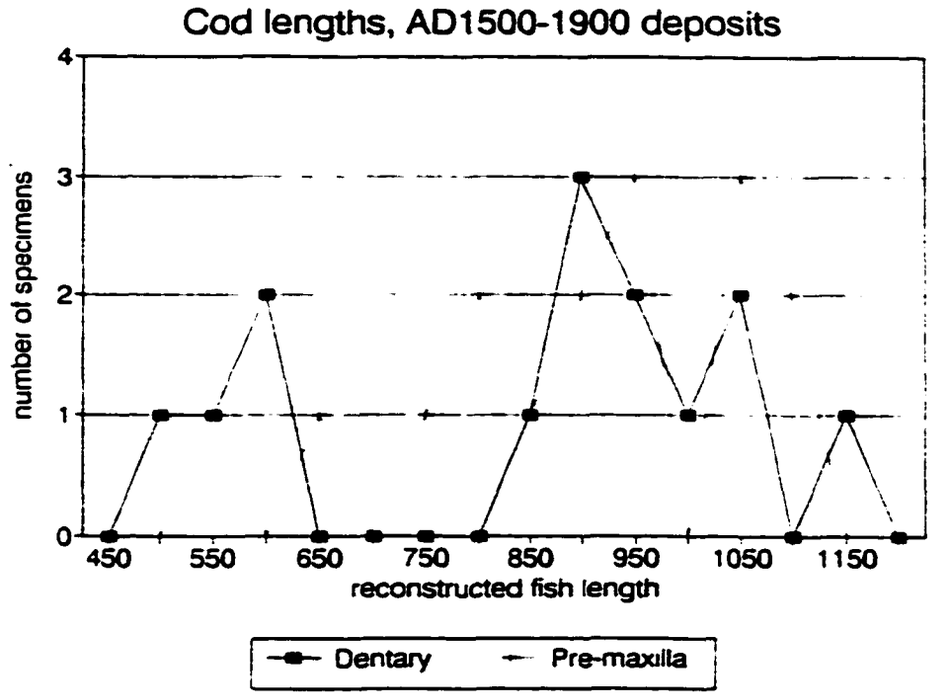

Figure 2. Distribution of reconstructed cod lengths based upon the length of dentary and pre-maxilla recovered from Early Modern (A.D. 1600–1849) deposits

south, shallow bays bring marine resources into close proximity to the site and eastwards the peninsula opens out into an extensive area of potential hayfield and grazing. First mentioned in the 13th century, the farm became part of the holdings of Snorri Sturluson and later was the seat of the Danish Governor. The existing buildings preserve a core of the 18th century stone house (Laxness 1985).

From 1986 onwards, the extensive rebuilding of the official residence has necessitated a series of rescue excavations both within the existing buildings and in the adjoining areas (G. Ólafsson 1991). The constraints which the construction work placed upon the archaeology are such that the sampling strategy can hardly be considered ideal and the diachroneity between the deposits sampled for invertebrate remains and those with usable vertebrate assemblages are largely a reflection of availability of areas for excavation: there was extensive access to the 17th and 18th century midden between the house and church (Fig. 3), where the sediments were too aerated to preserve invertebrate

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Appendix II: (Amorosi et al. 1992:172)

Norse and Later Settlement and Subsistence

Taxa		NISP	% of whole sample
Bos taurus	cattle	26	27.4
Equus caballus	horse	25	26.3
Sus scrofa	pig	1	1.0
Ovis/Capra sp.	caprine	39	41.0
Alopex lagopus	fox	1	1.0
	Bird sp.	1	1.0
Gadus morhua	cod	2	2.1

Table 1 The Late Medieval (A.D. 1450 – 1500) vertebrate and molluscan fauna at Bessastadir

remains, and only limited 'keyhole' excavation of the earlier deposits, north and west of the house, where the medieval midden and some floor surfaces provided excellent conditions for insect and plant remains but only small samples of animal bone.

Vertebrate remains

The post-medieval animal bone assemblages provide a large and diverse group, with a total of 14,992 pieces. The data from the late medieval and early modern levels are presented in Tables 1 and 2. The later elements reflect what McGovern (pers. comm. and in prep.) has termed the Georgianisation of the North Atlantic, with plate-sized cuts of meat being reflected in the nature of butchery. The image is reinforced by a number of contemporary accounts of dinner at Viðey and Bessastaðir: Holland's (in Wawn 1984) description of dinner at Viðey provides an interesting contrast with the more traditional fare described by Wright (1789, 133 in West (ed.) 1970), from which only the cod head might appear in the palaeoecological record. The presence of pig is also noteworthy in this context. Although pig bones appear on a number of medieval sites (McGovern unpubl.), Adalsteinsson (1982) has noted that this animal ceased to be kept in Iceland during the 17th century and it is tempting to see the Bessastaðir material as evidence for the importation of salt pork. It is unfortunate that similar recent assemblages have usually been neglected, but, in the extensive late bone groups from both Stóraborg in Eyjafjallasveit on the south coast and Svalbarð in Þistilfjörður on the north coast, pig is absent. The direct linkage between Bessastaðir and the world trade network is further emphasised by the presence of the brown rat (*Rattus norvegicus* (Berkenhout)) in the midden. Despite its Linnean name, the brown rat appears to have originated in northern China and to have reached Europe during the early 18th century (Óskarsson 1982). Corbet (1974) suggests that it first arrived in Britain about 1720, although it may have arrived in Denmark somewhat earlier (Óskarsson 1982). This rat also appears in New World ports such as New York by the early 1680s (Greenfield 1985; 1989). New York's brown rat populations become quickly established by the late 1680–90s (Amorosi 1984; 1991b) and started to extend into the countryside. It is likely that brown rat introductions were the result of accidental infestations of European trade commodities. In contrast with the ship or black rat (*Rattus rattus* (L.)), the brown rat is more able to exploit natural habitats away from human occupation.

The rat remains from Iceland are considerably earlier than the earliest documented occurrence in the general Reykjavík area in 1865 (Óskarsson 1982). It is also interesting to note that these bones

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Appendix II: (Amorosi et al. 1992:173)

Taxa		NISP	% of whole sample
Bos taurus	cattle	285	2.6
Equus caballus	horse	15	0.1
Canis familiaris	dog	7	0.0
Sus scrofa	pig	7	0.0
Ovis aries	sheep	146	1.3
Ovis/Capra sp.	caprine	1324	11.9
Phoca vitulina	common seal	1	0.0
Phocid sp.	seal indet.	2	0.0
Cetacean sp.	whale indet.	3	0.0
Alopex lagopus	fox	1	0.0
Ursus maritimus	polar bear	2	0.0
Odobenus rosmarus	walrus	1	0.0
Rattus sp.	rat indet.	20	0.2
Rattus norvegicus	brown rat	6	0.0
	Bird sp.	346	3.1
Gadus morhua	cod	3860	34.8
Salmo sp.	salmon family	1	0.0
	Fish sp.	4747	42.8
Mollusca sp.	shellfish	322	2.9

Table 2 The Early Modern (A.D. 1600 – 1849) vertebrate and mollusc fauna at Bessastaðir

are derived from the quasi-Danish residences at Nesstofa and Bessastaðir. The Nesstofa rats date to the mid-1700s. The Bessastaðir rats may be a bit earlier, with tentative dates of 1600–1650 based upon the associated imported pottery, although there may be a curation element in this, implying a slightly later date. The larger ships of the later and post-medieval period required unloading by small boats, where transport for the rat is less likely, or at a quay. It is tempting to relate the arrival of the brown rat to the provision of wharfage in either Reykjavik or Hafnarfjorður, since both Bessastaðir and Nesstofa have shallow water approaches, otherwise ideal for beaching boats.

As well as being the Governor's residence, Bessastaðir was also a fully functioning farm and much of the bone assemblage is as likely to reflect the exploitation of its own immediate resource as the utilisation of food materials gained by way of taxation of its hinterland. In the absence of wheeled vehicles and the limited capacity of pack horses, stock animals are more likely to have been moved on the hoof than as butchered units and would therefore be indistinguishable from the farm's own produce. Several elements, however, do imply the broader context. Neither polar bear nor walrus are

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Appendix II: (Amorosi et al. 1992:174)

likely to have occurred in southern Iceland during the 18th century and both reflect important trade items which would have accrued to the Danish trade monopoly. Recent polar bear sightings are restricted to the north west peninsula, some 250km from the site and the walrus is similarly an infrequent visitor to the north. Investment in their hunting is unlikely to have been an option for farmers with limited labour resources and their presence reinforces the site's elite status. One other wild mammal is present in the post-medieval bone groups, the arctic fox. Fox have generally been regarded as a pest by the Icelandic farming community, taking seabird and eider duck chicks and eggs, as well as being blamed for the death of lambs (H. Olafsson 1989). Bounties were paid on the animals, presenting a distinct taphonomic unit in any assemblage, encompassing the entire skull, mandible, one or two cervical vertebrae or sets of caudal vertebrae. As such units were taken to the local assembly and destroyed after payment of any bounty (Hersteinsson pers. comm.). The Bessastadir piece is an unusual find. It may, however, indicate that the fur was used, perhaps as a trading object, and that the killed foxes were skinned at home. The presence in the contemporary fish bone assemblages of Atlantic salmon seems also to support the view of high status. Although it could have been caught locally, it has only been noted in the samples from the wealthier church farms, including Videy, near Reykjavik, and Svalbard in the north east.

The smaller bone groups from the medieval deposits provide a number of less certain indicators of difference. A pit, apparently sealed by tephra from the c. 1485 eruption of Katla, contained many sawn and burnt-scored fragments of horse tibia and metapodia, debris from a bone workshop. The finds may indicate the manufacture of combs, where pieces of a high tensile strength were required (*cf.* MacGregor 1985). Whether such activities were restricted to sites where the acquisition of a sustainable surplus allowed the long term patronage of specialist activities or were the work of itinerant craftsmen is uncertain, but the only other Icelandic site with similar evidence is the church farm at Svalbard in Djúpifjordur (Amorosi this vol.). Similarly close to the house was found a deposit which was particularly rich in fish bones. These remains consist entirely of remains of the Atlantic cod (*Gadus morhua*). The size of these fish can be estimated through a regression analysis, first outlined by Casteel (1976, 93 and 123) and later detailed by Bigelow (1984). Based upon this type of analysis, the size of codfish at Bessastadir ranges between two modes, 450 to 600mm and 900mm (see Fig. 2). Although this research should be viewed cautiously, this bimodal curve is of interest. These two size classes represent two different age and seasonal classes within the Atlantic cod population. The smaller size individuals could indicate a July to September seasonal date where shallow water fishing was carried out (Kristjansson 1982– see English translation on 479–480; Bigelow 1984, 130–133). Such seasonal fishing within near shore waters would have been primarily for household consumption and done in order to avoid conflict with the harvesting of summer grasses used for winter fodder. Fall (September to December) and winter (January to May) months brought the run of larger sized fish most often used for the stockfish trade. As labour requirements eased around the farmstead during the fall and winter, large rowing boats could fish off-shore shoals for the larger 900–1000mm cod. It is also interesting to note that this size class is in excess of the modern size of Icelandic cod (Amorosi 1989, 211).

Invertebrate remains

Whilst the bulk of the animal bone came from post-medieval deposits to the east of the house, towards the church, several layers of cultural deposits were recorded to the north of Bessastadastofa the main 'old' house (Fig. 3). The samples for insect analysis were excavated from this area and can be placed into three groups on the basis of archaeological and stratigraphic data. First, samples from Profile 2 which were rich in occupational debris (Sample Nos. 10, 11, 12 and 14; see Fig. 4).

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Appendix II: (Amorosi et al. 1992:175)

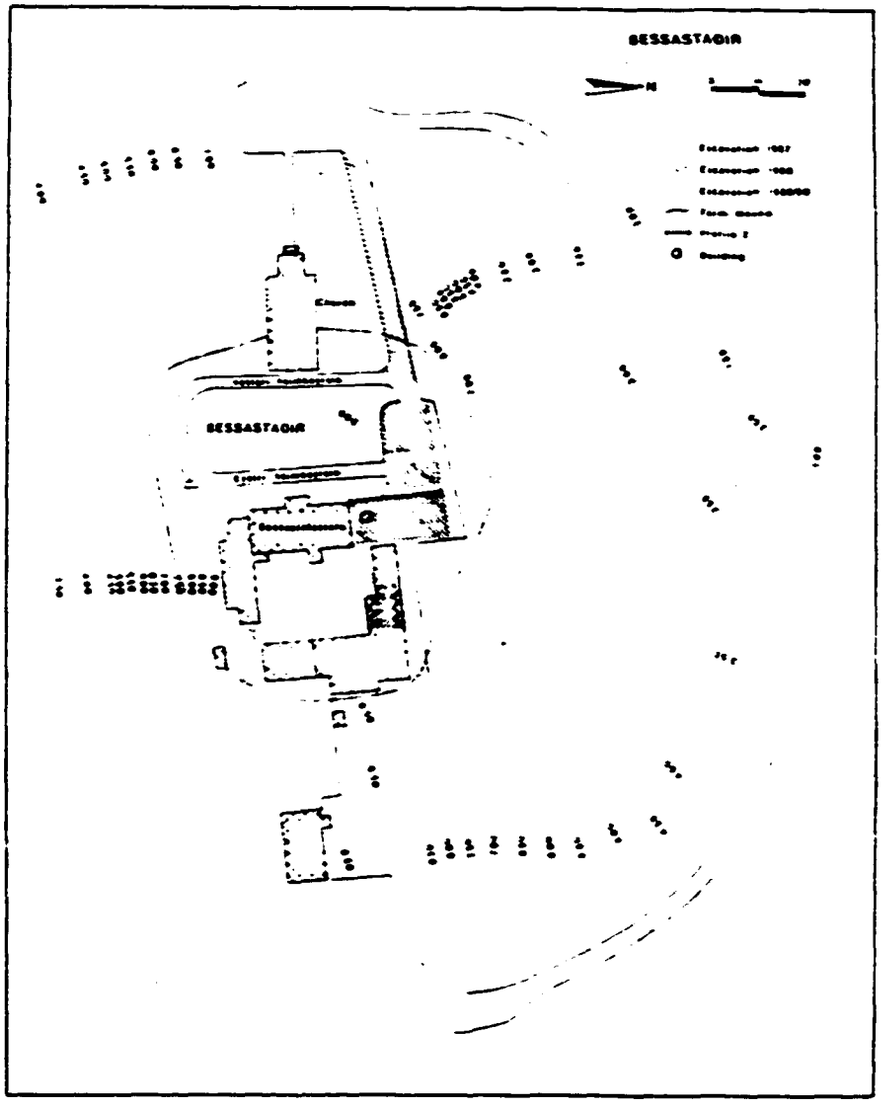

Figure 3 Plan of the excavated areas at Bessastaðir (G Ólafsson, National Museum of Iceland).

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Appendix II: (Amorosi et al. 1992:176)

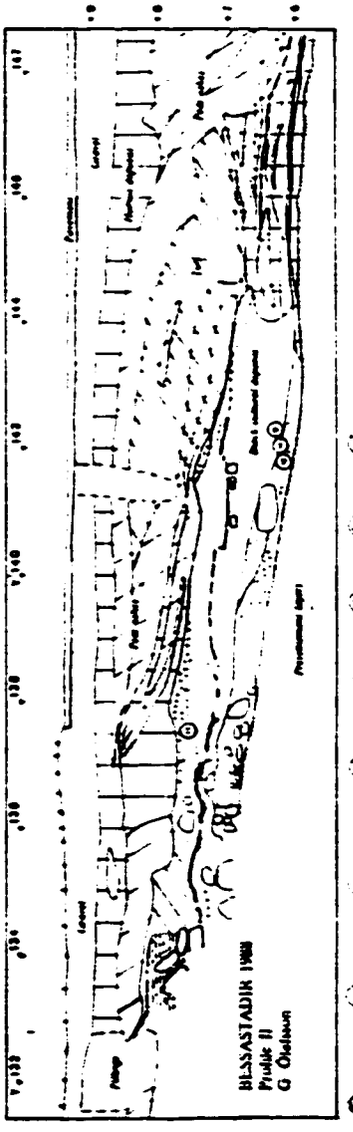

Figure 4 Profile II, Bessastadir 1988. Exact location of Samples 10 - 12 and 14 are shown (G. Olafsson, National Museum of Iceland.)

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Appendix II: (Amorosi et al. 1992:177)

Secondly, sediments within a structure and thought to represent floor layers (Sample Nos. 15 and 19) and thirdly, a small profile overlying the floor layers (Sample Nos. 17 and 18). The sediments from Profile II have been dated using tephrochronology. Sample No. 10, comes from below the 'Medieval layer', an ashfall originating from a submarine eruption off the Reykjanes peninsula and dated on historical evidence to A. D. 1226 (Johannesson and Einarsson 1988). Samples 11 and 12 lie under the tephra from Katla A. D. 1485 (Þorarinsson 1975) and probably date to the 15th and 14th centuries. Sample 14, overlies this ash and is probably of 16th century or later date (Fig. 4).

The samples from Bessastaðir have produced faunas which, in terms of their size and diversity are unprecedented in the examination of archaeological deposits in Iceland (Table 5). The majority of the species are synanthropic and it is no surprise that many make their first appearance in Iceland immediately after *Landnám* (Buckland 1988, Buckland *et al.* 1991). The human louse, *Pediculus humanus* occurs in Samples 11, 14 and 18. The preservation of the specimens is such that it is not possible to assign the lice to the subspecies, *Pediculus humanus humanus* (L.), the body louse, or *P. h. capitis* (De G.), the head louse. Where conditions are conducive to their preservation, lice are common in Norse and later deposits around the North Atlantic, occurring at Storaborg and Reykholt in Iceland (Sadler *et al.*, this vol.), and in many of the sites investigated in the former Western Settlement of Greenland (Sadler 1990). Indeed, several references (*cf.* Joseph Banks in Rauschenberg 1973, Sveinbjarnardottir and Buckland 1983) indicate that the bite of a louse was familiar to the Norse and later settlers in Iceland. The species feeds on human blood and heavy infestations can cause severe skin irritation, insomnia and anaemia (Marshall 1981). Whilst there is a tendency to associate lice with poverty and lack of hygiene, a point evident in one anonymous reviewer's comment on a short note on a body louse from Sandnes in Norse Greenland (Sveinbjarnardottir and Buckland 1983) – 'This louse could have come from an ESKIMO!' (sic) – as Sveinbjarnardottir and Buckland have discussed, they are no respecters of station and are likely to have been as at home on the Danish governor and his family as on anyone else; it took, however, an English cleric to make a virtue of inevitably. A measure of the saintliness of Archbishop Thomas a Becket was the level of infestation of his hair shirt with lice (Sveinbjarnardottir and Buckland 1983). The decline in frequency of lice, particularly the body louse, is a relatively recent event and lice were common in Iceland and elsewhere in the world until the 20th century (Busvine 1976, Overgaard 1942); head lice, less of a problem than body lice, which are the vectors in the spread of typhus, remain frequent at all levels of society, if less frequently admitted.

The sheep louse, *Damalinia ovis* (L.) and the sheep ked, *Melophagus ovinus* (L.) are present in Samples 10, 11, 12, and 14. Both species are highly specialised insects, feeding and spending their entire life cycle on their hosts (Hutson 1984, Marshall 1981). In Iceland, the earliest documentary reference appears in the 17th century (Olafsson and Palsson 1943, 143) and Thorarinsson (1939) discusses the incidence of *D. ovis*, *haltalus* and *M. ovinus*, *pertlus*, on sheep in the early part of the 20th century. Their occurrence in samples dating from the 11th and 12th centuries are the earliest records of the species in Iceland, although both species also have been recorded in 11th century midden deposits in Norse Greenland (Sadler 1990). These ectoparasites are present in low abundance and it could be argued that their occurrence reflects either the heterogeneous nature of midden accumulation or the presence of humans and domestic stock under one roof. Wool preparation, however, would have been a feature of any active farm with sheep, and the ectoparasites are best seen as a trace after such activities. High concentrations of sheep lice and keds from one sample at Storaborg have been interpreted as the result of the preliminary processing of fleeces, perhaps using urine as a cleansing agent (Buckland and Perry 1989); the fewer occurrences in the

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Appendix II: (Amorosi et al. 1992:178)

Norse and Later Settlement and Subsistence

Taxa	Sample Numbers							
	10	11	12	14	15	17	18	19
Anoplura								
Pediculidae								
Pediculus humanus (L.) / *capitis* (Deg.)		2		14			1	
Mallophaga								
Trichodectidae								
Damalinia ovis L.		1		4				
Hemiptera gen. indet.		1						
Homoptera gen. indet.		1						
Trichoptera gen. indet.	3	3	4	2				
Coleoptera								
Carabidae								
Nebria gyllenhali (Sch.)			1		1			1
Notiophilus biguttatus (F.)			1					
Bembidion bipunctatum (L.)	2	1			1	1	1	
Bembidion grapei (Gyll.)						1		
Trechus obtusus (Erich.)			1					
Patrobus septentrionis (Dej.)	1	2			1			
Trichocellus cognatus (Gyll.)					1		1	
Pterostichus diligens (Sturm)	2		1		1			
Pterostichus nigrita (Payk.)				1				
Pterostichus adstrictus (Esch.)		1						
Calathus melanocephalus (L.)	8	13	2	1	1	1	2	1
Amara quenseli (Schoen.)		2			1			
Dytiscidae								
Hydroporus nigrita (F.)	2	6	3	1	9	1		1
Agabus bipustulatus (L.)		1			1			
Hydrophilidae								
Cercyon unalis (Payk.)	1							
Cercyon littoralis (Gyll.)	2	6	2					
Cercyon spp.					1	1		
Leiodidae								
Catops fuliginosus Erich.	10	23	8	2				
Scydmaenidae								
Stenichnus collaris (Mull. & Kunze)		1						

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Appendix II: (Amorosi et al. 1992:179)

Taxa	Sample Numbers							
	10	11	12	14	15	17	18	19
Staphylinidae								
Omalium rivulare (Payk.)	5	1	5	11	2	9	4	1
Omalium excavatum Steph.	1	1	1		3	9	3	1
Omalium laevigatum (Gyll.)	1	3		1		3		
Xylodromus concinnus (Marsh.)	2	8	1	2	3	3	2	
Micralymma marinum (Strom.)		1						
Acidota crenata (F.)		2	1					
Lesteva longelytrata (Goez.)	2	4	1	1		1		
Phyllodrepa floralis (Payk.)	12	11	3		1			
Stenus spp.	3	6	2	3	10	2	2	1
Lathrobium brunnipes (F.)	1	1	1					
Othius angustus Steph.			1					
Philonthus punctus (L.)			1					
Philonthus varians (Graven.)	1	1						
Philonthus cephalotes (Graven.)	3	6	7	1				
Gabrius spp.	2	3	1	1	3	1	1	1
Creophilus maxillosus (L.)			1	1		1		
Quedius mesomelinus (Marsh.)	3	6	3	1				
Quedius umbrinus Erich	1	1	1					1
Quedius fulvicollis Thoms.		2	1					
Quedius fulvicollis (Steph.)				2				
Tachinus corticinus Graven.	7	13	5	8		1		
Gymnusa brevicollis (Payk.)	1		1					
Atheta spp.	4	18	2	11	16	48	16	9
Oxypoda spp.	2	4	3	3	1	1	1	
Aleochara spissa Heer	7	15	8	6	2	1		
Pselaphidae								
Bryaxis puncticollis (Denny)		1						
Elateridae								
Hypnoidus riparius (F.)		2	2	1	1	1		1
Byrrhidae								
Cytilus sericeus (Forst.)		1						
Byrrhus fasciatus (Forst.)			1	1		1		
Silvanidae								
Oryzaephilus surinamensis (L.)	4	7						
Oryzaephilus spp.			2	2		2		

Table 3 continues on p. 184

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Appendix II: (Amorosi et al. 1992:180)

Norse and Later Settlement and Subsistence

Taxa	Sample Numbers							
	10	11	12	14	15	17	18	19
Cryptophagidae								
Cryptophagus scanicus (L.)	1	1						
Cryptophagus pilosus Gyll.		2					1	
Cryptophagus spp.	3	8	3	3	2		1	1
Atomaria spp.	2	5	1	1	2	3		
Coccinellidae								
Nephus redtenbacheri (Mulsant)	1				1			
Lathridiidae								
Lathridius minutus (L.) group	8	17	9	6	8	8	1	
Corticaria elongata (Gyll.)	1	7		3	1	1	3	
Mycetophagidae								
Typhaea stercorea (L.)	2	3						
Ptinidae								
Tipnus unicolor (Pill. & Mitt.)	2	1	1					
Ptinus fur (L.)	1							
Scarabaeidae								
Aphodius lapponum Gyll.	1	2			1	1	1	
Otiorrhynchus sylvestris (Scopoli)		1						
Curculionidae								
Otiorrhynchus arcticus (F.)	1	2	2	2	2	3	3	2
Otiorrhynchus raskyi (Mull.)	1	1		1	1		1	2
Barynotus squamosus (Germ.)	1							
Trophiorus obtusus (Boisd.)	1	1		2			1	
Sitophilus granarius (L.)	1	3		1				
Rhinoncus pericarpius (L.)	1							
Diptera								
Hippoboscidae								
Melophagus ovinus L.	3	9	1	1				
Cladocera								
Daphnia s l spp.			1		2			

Table 3 The insect species recorded from Bessastadir Taxonomy follows Lucht 1987 Table is continued from pp 182 and 183

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Appendix II: (Amorosi et al. 1992:181)

Bessastadir samples might be residual from such a process, or later stages in wool processing when the remaining dead lice would be likely to be combed or carded out before spinning.

By far the largest component of the Bessastadir assemblages is associated with rotting organic material, which account for between 12 and 64 percent of the insect species per sample. Several different types of organic debris are indicated including dry mouldering plant material, mainly hay, wet foul matter, dung and seaweed. Although Bessastadir lies in the warmer part of Iceland, it was still essential that sufficient hay be collected to ensure that the farm's resource base, namely its animals, survived over winter. It is the insect fauna associated with this winter storage of fodder that dominates the rotting component of the Bessastadir assemblages. Members of this assemblage include feeders on fungal hyphae such as the mould beetles, *Lathridius minutus* (group), *Cryptophagus* spp., *Atomaria* spp., *Corticaria elongata* (Gyll.) and *Typhaea stercorea* (L.), and the predatory staphylinids, *Xylodromus concinnus* (Marsh.) and *Philonthus sordidus* (Graven.), which are common in byres and hay ricks in Iceland at the present day (Larsson and Gigja 1959; Lindroth *et al.* 1973), all were introduced by the earliest Norse settlers (Buckland *et al.* 1991). The heavily microsculptured elytra and thoraces of the rove beetle, *Phyllodrepa floralis* (Payk.) occur in some abundance in Samples 10, 11 and 12. This species was previously thought to have immigrated into southwest Iceland "in rather recent time and to have not yet attained its final distribution" (Larsson and Gigja 1959, 58). Although on the European continent the species is found on flowers, in hollow trees, under bark, in animal nests and in vegetable refuse (Lohse 1964; Tottenham 1954), it is synanthropic in Iceland and is restricted to old hay and compost. In a farm complex, hay had other uses besides fodder. In the past it has been used for bedding, flooring material and insulation. Two species of spider beetles, *Tipnus unicolor* (Pill. & Mitt.) and *Ptinus fur* (L.), were recovered in low abundance from Samples 10, 11, and 12. The single occurrence of the latter species in Sample 10 is the first record from archaeological deposits in Iceland. Both species are flightless and strongly synanthropic and have small restricted populations in Iceland at the present day (Larsson and Gigja 1959). The insects are common in buildings and outhouses where they require high relative humidities to breed successfully (Howe 1965) and feed on a wide variety of animal and vegetable substances including cereal debris (Howe 1956). *T. unicolor* has been recorded in some abundance in samples from a post-medieval house floor at Reykholt (Buckland *et al.* this volume) and the species seems to be associated with the slightly drier, less foul conditions of human living quarters rather than the higher humidities encountered in byres.

Fouler rotting plant material is suggested by a suite of predatory species which include the rove beetles, *Omalium excavatum* (Steph.), *O. rivulare* (Payk.), and *Quedius mesomelinus* (Marsh.), the leiodid, *Catops fuliginosus* (Erich.) and the hydrophilid, *Cercyon analis* (Payk.) (Hansen 1987; Larsson and Gigja 1959). There is considerable overlap between the insects found in this type of habitat and those which inhabit herbivore dung (Skidmore 1991). Many of the *Cercyon* spp. and the eurytopic rove beetles, *Philonthus* spp. and *Quedius* spp. are common to both pabula. In Iceland, however, *Philonthus politus* (L.) and the large and distinctively marked *Creophilus maxillosus* (L.) are associated mainly with manure and animal waste (Lindroth *et al.* 1973). Perhaps the best indicators of dung are members of the Scarabaeidae, or dung beetles. *Aphodius lapponum* (Gyll.) is common in dung of all types of herbivore (Landin 1961; Larsson and Gigja 1959), but *Onthophagus vacca* (Scopoli) is found in both vegetable waste and well-rotted dung (Jessop 1986; Machatschke 1969). The occurrence of the carinate elytra of the latter species in Sample 11 is the only record of the insect in Iceland. It is apparent that, like the species of *Aphodius* recovered from post-medieval deposits from Storaborg and two species of ant from Reykholt, *O. vaccae* was introduced to Iceland by the Norse but failed to establish a population. Introductions, which either find a suitable man-made

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habitat and survive, or fail and become extinct, are not infrequent in the post-medieval and modern record (e.g. Buckland *et al* this vol., Olafsson and Richter 1985), where larger ships and large scale imports provide many opportunities for casual transport. Outside the basic synanthropic fauna found on most farms and originating at *Landnám* (Buckland *et al* 1991) and the grain fauna discussed below, medieval examples are rare, and restricted to the primary sites. The species probably made the journey from Europe to Iceland in rotting vegetation, perhaps hay, that had been used for dunnage in the clinker-built Norse vessels (Sadler 1991). Examined from the point of view of the probability of the presence of temporary imported species, its occurrence at Bessastaðir is a further indication of the site's contacts with Europe.

The occurrence of the saw-toothed grain beetle, *Oryzaephilus surinamensis* (L.) and the grain weevil, *Sitophilus granarius* (L.), indicate the presence of stored grain in Samples 10, 11, 12 and 14. Remains of barley from Bergþórshvoll (Friðriksson 1960) and Gröf in Öræfi (Friðriksson 1959) may belong to locally grown cereals, but the grain at Bessastaðir has another source. Recent experiments have shown that both grain beetles are deleteriously affected, as adults and imagines, by fluctuating relative humidities and prolonged periods of reduced temperatures (Evans 1983; 1987) and, that a high proportion of the eggs of *O. surinamensis* are killed when temperatures fall markedly (Jacob and Fleming 1986; Mullen and Arbogast 1979). It is doubtful whether the minimum temperature requirements necessary to maintain breeding populations, which lie between 15° and 21° Celsius (Howe 1956), were ever continuously maintained in Icelandic medieval farms. In addition, although there is evidence for barley cultivation in the first part of the medieval period (Þórarinsson 1943), its later decline and the possibility of crop failure, would further have made the maintenance of permanent pest populations unlikely. Importation with meal or cereals from Europe seems probable. It is again relevant in this context that examples of these pests only appear very infrequently at Holt in Eyjafjallasveit, Stóraborg and Reykholt and their appearance in four of the Bessastaðir samples probably implies regular import of this commodity from Europe. The species might have been deposited with spoiled grain which was discarded but the presence of the puparia of the fly *Heleomyza serrata* L. may indicate human faecal matter in the samples. The combination of faecal material and grain offers an alternative hypothesis. As Osborne (1983) so pointedly illustrated, grain pests can pass through the human digestive tract without damage, and it is possible the grain and beetles were deposited together in faeces.

Human faeces might also explain the presence of two grape pips in Sample 12, which provide the earliest record of importation of grapes, or more probably raisins, to Iceland. It is again probable that such foodstuffs were restricted to the more important farms and it is not surprising that they have not been found in samples from any of the other sites studied.

The remaining insects are not generally encountered indoors in Iceland and they offer an insight as to the wider environment of the farm and its relationship with the local landscape. The small rove beetle, *Omalium laeviusculum* (Gyll.), and the hydrophilid, *Cercyon littoralis* (Gyll.) are present in very low numbers in Samples 10, 11, 12, 14 and 17. Both are littoral species, common under decaying seaweed and coastal drift on sandy beaches (Hansen 1987; Larsson and Gigja 1959). Seaweed was widely collected and used in the North Atlantic region, for food, animal fodder, fuel, bedding (Henderson 1819; Kristjánsson 1980), salt production (Finnbogason 1943) and the manuring of arable (Fenton 1985). The low frequency of this faunal element (Table 1), however, which is matched by the virtual absence of seaweed breeding flies, suggests it might represent casual occurrences in an area where coastal drift would have been abundant on beaches.

The extent to which peat was used for purposes other than fuel in the past tends to be forgotten and the fossil faunas associated with it cause several problems in sample interpretation. It is difficult to

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distinguish such assemblages from those common to structural turf or, in some cases, the unimproved hayfield. Several species might have been introduced to the deposits along with peat. Although the ground beetle, *Trichocellus cognatus* (Gyll.) is the only strictly acidophile species, commonly associated with heathland on sandy substrates (Larsson and Gigja 1959; Lindroth 1974; 1986), several of the others are found in wetlands. *Acidota crenata* (F.), *Quedius umbrinus* (Erich.), *Lesteva longoelytrata* (Goeze) and *Lathrobium brunnipes* (F.) are recorded from bogs and marshes (Harde 1981; Larsson and Gigja 1959; Lohse 1964), and the carabids, *Pterostichus diligens* (Sturm) and *P. nigrita* (F.), are inhabitants of oligotrophic bogs (Lindroth 1986). The larvae of caddis flies, the ephippia of water fleas, *Daphnia* sp., and the water beetle, *Hydroporus nigrita* (F.) are, arguably, clearer indicators and are likely to have been introduced to the farm along with peat. This assemblage has been consistently recovered from pre-*Landnam* peat deposits at various sites in Iceland (e.g. Buckland *et al.* 1986a) and direct evidence of peat cutting, infilled by tephra from the c. 1362 eruption of Katla, has been noted at Ketilsstadir in southern Iceland (Buckland *et al.* 1986). The palaeoecological problems of the presence of peat in archaeological deposits was first noted in Roman York (Hall *et al.* 1980). Faunas from Norse farms in Greenland appear to show similar utilisation (Fredskild and Humle 1991; Sadler 1988). Kaland (1986) has illustrated the Norwegian practice of stripping the turf from peat bogs and allowing the exposed peat to weather during the winter. During the spring, the dried peat was collected up and used for animal bedding, soaking up the liquid part of the dung, being eventually used, with household waste as manure.

The ground beetle fauna, includes several elements less likely to have been introduced as fossils in peat. *Bembidion lunatum* (L.) is found on open sandy ground, including the seashore, whilst both *B. gilvipes* (Gyll.) and *Amara quensehi* (Schoen.) occur on open rocky ground. The phytophages afford some indication of the types of plants in the local area. The weevils, *Barynotus squamosus* (Germ.) and *Trophiorrhynchus obtusus* (Bon.) feed on the vegetative parts of clovers and dicotyledonous herbs (Larsson and Gigja 1959). Knotweed, *Polygonum* sp., and dock, *Rumex* sp., are the hosts of the small weevil, *Rhinoncus pericarpius* (L.), the larvae of which live in the plant's stalks or roots (Larsson and Gigja 1959; Lohse 1983).

An examination of the species lists (Table 3) indicates that the assemblages recovered from the samples differ markedly. The samples from Profile II are similar, and can be grouped together. They are characterised by the presence of human and animal parasites, grain beetles and an abundance of rotting plant debris. The two floor layer samples seem to be composed entirely of insects associated with decomposing material, particularly hay and peat whilst the samples from the small profile are intermediate between the other two sample groups. The heterogeneity of the groups gives an indication of the mode of accumulation of the samples. The samples from Profile 2 and, probably the small profile samples, represent waste or midden sediments. The presence of synanthropic insects associated with decomposing material and ectoparasites implies that a considerable proportion of the material originated from within a structure. These midden samples compare well with midden material examined at the site of Storaborg (Perry *et al.* 1985) and midden samples from Norse Greenland (Sadler 1988). The floor samples are markedly different from those examined from the midden. The sediments seem to comprise decomposing material (mainly hay residue) and peat.

This evidence is not in accord with floor layers examined from Icelandic sites at Storaborg (Perry *et al.* 1985) and Reykholt, Viking deposits in York (Hall *et al.* 1983), Dublin (Coope 1981), Oslo (Kenward 1980) and Greenland (McGovern *et al.* 1983). In each of these cases, there is a certain unsavoury continuity between the midden outside and the floors inside the farms. The latter seem to have been warm, foul, well-trodden nutrient-rich areas comprising decomposing vegetation and other organic waste. There are two possible explanations which might account for this inter-site

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variation. First, the floor material accumulated in a phase of abandonment and/or the structure was used as a store for hay and peat. Recent work examining insects from the floor of a modern byre used to overwinter cattle at a farm in South Yorkshire supports the second explanation. This work has indicated that the pooling of ammoniacal materials restricts the development of faunas associated with decomposing vegetation and animal waste products. The floor samples were found to contain fragmented remains of mould-feeding insects introduced in the hay and straw used for fodder and litter (Smith 1991). Since it is well documented that stock were overwintered in byres in Iceland one could apply a similar line of reasoning to Bessastaðir. It seems likely, therefore, that the sediments were deposited in a byre, where peat and hay were utilised as fodder and litter.

Conclusion

The presence of grape pips and the consistent occurrence of the grain fauna has wider implications, since grain beetles are only rarely encountered in Icelandic deposits. The grain weevil, *S. granarius* has been recorded only twice from Storaborg and once from Reykholt. There are also only three records of the saw-toothed grain beetle, *O. surinamensis*, from Holt, Storaborg and Reykholt. Elsewhere records are similarly scarce and the species have not been recorded in Norse Greenland or Viking York, England (Hall *et al.* 1983; Sadler 1988). It is an indication of the prime status of the farm at Bessastaðir that grain beetles occur in such abundance reflecting regular importation and, perhaps, strong trading links with the Scandinavian core and the European continent. Similar indications of the sites status can be found in the vertebrate record. The occurrence, for example, of the bones of walrus, polar bear, pig, and perhaps ironically, the brown rat serve to emphasise the cultural links of the Bessastaðir farm.

Although the interpretation of further samples has yet to be undertaken, the analysis of the large and diverse faunas from Bessastaðir has aided the interpretation of the archaeology. The insect remains from the midden indicate both an unhygienic household environment when compared to present day standards and suggest also that the farm site enjoyed primary status from the Commonwealth into the better documented later periods. The faunas do not differ significantly over the time period investigated which mirrors the consistent nature of the pastoral system carried out on the farm. Further work will undoubtedly refine and augment this interpretation.

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Appendix III

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1992 Norse and Later Settlement and Subsistence in the North Atlantic. pp.103-138. Glasgow: Archetype Publications, University of Glasgow, Department of Anthropology.

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Appendix III: (Amorosi 1992:103)

Climate Impact and Human Response in Northeast Iceland: Archaeological Investigations at Svalbarð, 1986 –1988

Thomas Amorosi

The archaeological investigations at the site of Svalbarð are focused upon eight centuries of life in northeastern Iceland. Although the analysis of the site materials are still under way, a rich set of data concerning climatic change and human response to such change can be illustrated. There are multiple signatures in Svalbarð's artefactual and faunal data to indicate that northeast Iceland experienced a particularly stressful period during the climatic cooling associated with the Little Ice Age. These same "hard times" patterns are consistent with historical Icelandic annals, and point out that the farmers at Svalbarð attempted to draw upon an increasingly wider range of resources during the 17th – 18th centuries occupation of Svalbarð.

Research history

The research at Svalbarð represents an international co-operative effort (Icelandic, USA, UK and Canadian) to study the processes of Norse cultural expansion, stabilisation and contraction across the North Atlantic Region from a zooarchaeological perspective. This effort was begun in 1980 with the bioarchaeological analyses of materials from the Stóraborg (Russell 1985; Russell *et al.* 1986; Snæsdottir 1987a; 1989; 1991) and Aðalból (McGovern 1982) collections. Since then efforts have been expanded to encompass research from numerous sites around Iceland. Presently, cooperative research continues with the major sites of Aðalstræti 8 (Hallgrimsdóttir 1987 a & b), Akurvik, Bessastaðir (Amorosi *et al.*, this volume., Ólafsson 1991; Sadler 1992 in press, Smith 1988), Gjögur, Granastaðir, Miðbær, Nesstofa (Vilhjálmsson 1989), Reykholt, and Viðey (Snæsdottir 1987b; Hallgrimsdóttir 1987c; 1987d; 1987e; 1989; 1991) as well as numerous small collections (Amorosi 1986; 1987; 1989; 1992b; in prep.; Amorosi and McGovern 1988; McGovern 1990). The overall research goal has been to contribute to the understanding of Iceland's past through the application of zooarchaeology, palaeoentomology, and palaeobotany. All are relatively new sub-fields of archaeology concentrating on the use of biological remains to reconstruct past environments and past human economies.

More specifically, the Hunter College effort has attempted to use faunal data to explore questions of evolving land use in Iceland's natural environment. This involves a wide range of topics such as the documentation of past agricultural strategies and their outcomes, the understanding of the impact of climate change and the flexibility of human response, the changing balance of marine and terrestrial resources in different parts of Iceland. Prior work in Greenland and Shetland has provided useful comparative material and a set of archaeological expectations and techniques, all of which required re-adjustment for Icelandic conditions.

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Appendix III: (Amorosi 1992:104)

Norse and Later Settlement and Subsistence

Beginning in 1986, we attempted to locate deeply stratified sites in Northeastern Iceland with favourable conditions for organic preservation that would be comparable to the major stratified sites of the south and southeast. Much of the available diachronic data came from these most ecologically favoured portions of Iceland. Since a major concern of our research has been the interplay of society, economy, and climate change, we hoped to provide information on long-term change in a region more vulnerable to climatic impact. In 1986, the site of Svalbarð was briefly visited when the farmers led our team to an eroding midden deposit, and a small surface collection was made from the eroding midden face. The use of a soil corer indicated over 1.5m of stratified undisturbed deposit.

The richness of the surface collection and the results of the coring prompted a second investigation in the summer of 1987. A small team returned to the site and placed a 2-by-2m test unit at the top of the midden mound. The unit proved very deep, and was carried to subsoil in one metre square only. Finds were collected by level and stratigraphic layer, profiles were drawn, and the unit was carefully backfilled. The 1987 season had demonstrated that the deposit was nearly 2m deep in some locations, and that regular stratigraphy could be observed. Over 45kg of animal bone were recovered, and an early medieval bone mount with ring and dot ornamentation was recovered from the basal level (No. 1529, stylistically dating *c.* A.D. 1050 –1150).

The 1988 season was intended to expand the successful 1987 test unit, both to better document stratigraphic relationships and to expand the collection of stratified animal bones and datable artefacts. The 1988 season opened 26m² of midden deposit, recovered over 750kg of bone from stratified deposits and recorded over 2500 registered artefacts, as well as a series of ecological samples now under analysis at the University of Iceland, the Vulcanological Institute, the University of Sheffield, and the University of Alberta (Zutter 1989). These analyses will take some time to complete, but now enough information has been collated to warrant a progress report.

Site history and description

The site of Svalbarð is located in the southwestern coastal strip of the Svalbarðshreppur in the Norður-Þingeyjarsysla (see Fig. 1 for a regional map – 66°12' N, 15°43' W – and Fig. 2 for site area photograph). The site is part of a very active and rich farmstead just beside the river Svalbarðsa. The actual midden is located just outside the present farm's homefield (*tún*) and forms the northeastern bank of a bluff above the Svalbarðsa. The midden sits upon a raised Holocene river terrace, approximately 11m above the river.

Historic records first describe the site as being settled by 1318 (Þorarinsson *et al.* 1986). However, this might be a relatively late date for first actual settlement. Preliminary survey data suggest that the church farm of Svalbarð was one of the original four or five farms that first settled in the Svalbarðshreppur portion of the Þistilfjörður (also see Þormóðsson 1970). The archaeological evidence supports his as the farm midden was well-established by the early 11th century. Svalbarð is a church farm of some importance as the place name still serves as a pivotal reference point for the *hreppur* (local community) and many localised areas within the *hreppur* (the river – Svalbarðsa, and valley – Svalbarðsdalur) bear the church farm's name.

In the early 1700s, the Árni Magnússon (Magnússon and Vidalin 1943) land register describes the church farm as a beneficium of the northern episcopal see of Hólar. Svalbarð's holdings included most of the area, east of the Svalbarðsa, with the western border along the Sanda river. Svalbarð also claimed many of the beach rights on the western part of the Þistilfjörð, including the collection of all jetsam, sealing and a portion (not specified in the register) of any stranded or beached whale. This farm controlled one of the relatively few safe boat landings at Sævarland and Viðarvik. The entry

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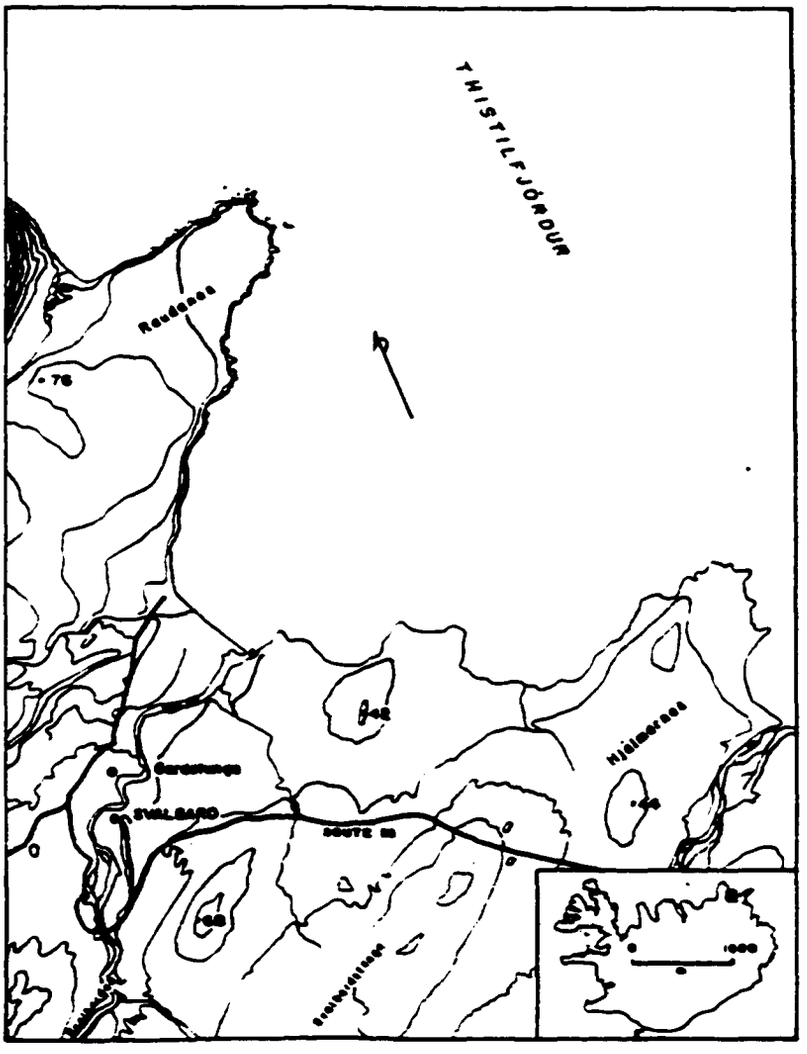

Figure 1. The area of the Svalbarð site in Þistilfjörður, northeastern Iceland. (National Museum of Iceland Reference Number 6707 - 00)

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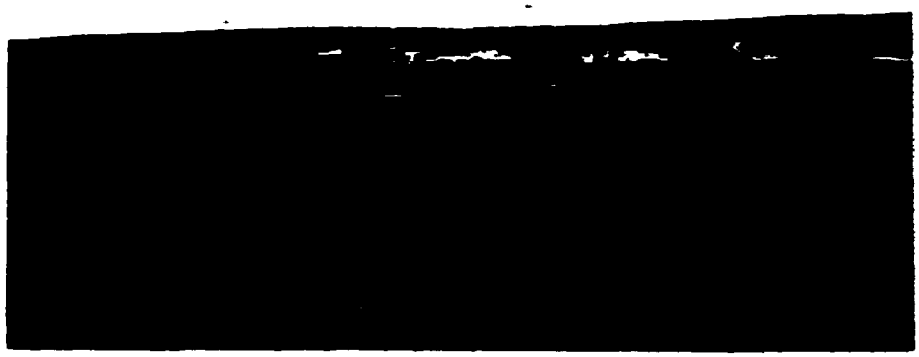

Figure 2. An eastern view of the contemporary Svalbard farmstead as seen from the Garðstunga site.

also makes mention of the farm's livestock holdings, animal houses, fodder reserves and grazing land (homefields), turf making, birch tree holdings, trout fishing, and damage caused by the spring melt of the Svalbarðsá.

The following is the translated excerpt for the farm of Svalbarð taken from the Jarðabók (Land Register) for the Distilfjordur area in Svalbarðshreppur and is dated to August 4, 1712. Parenthetical inclusions are this author's.

> Svalbarð: A church and Beneficium [of Hólar, the northern Episcopal see of Iceland]. The value of the land is uncertain since there are no tithes paid on this property. The occupant farmer is the staðarhaldarinn [church keeper] and Sr. [priest] Eggert Jónsson. The land rent is uncertain, since Svalbarð has not been rented as far back as anyone can remember.
>
> The church cow values are 3, and the priest has the right to the entire yield since he is responsible for them. There are no special tithes or duties. Livestock present at Svalbarð are 2 cows, 1 calf at one winter old, 58 milking ewes, 11 castrated rams at two winters old or older, 34 castrated rams at one winter old and 29 lambs; 1 stallion, 2 untamed horses and 2 young mares. There are fodder reserves for 2.5 cows, and hay from distant heathland (the register does not mention where) can be added. Grazing land around Svalbarð is tolerable, but the grazing at the beach is better and has not failed when there is no sea ice present [in the Distilfjord]. Lambs must be given a constant supply of fodder. The grazing for horses is average.
>
> The land is barely adequate for turf making. Peat has been recovered from Svalbarð's land in the past and there are peat-ditches present although not in use in 1712 [again the register does not mention where]. There is some dwarf birch present on Svalbarð's land and it is used for fuel. Dung from the farm's livestock and smaller wood [not building lumber] are used

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Appendix III: (Amorosi 1992:107)

for fuel. Trout fishing was done in the Svalbarðsá [Svalbarð's river] but is not now used. There are small amounts of [Iceland] moss to be collected. There is enough angelica and it's roots for household consumption, but it is not used. Some seal can be hunted, usually done by large nets where the seal litter. The people of this community [*hreppur*] have had variable success in this regard and rarely is this a pre-requisite. Svalbarð's land is a good location for driftwood, and the wood is used for construction, but few whales wash up against Svalbarð's coast, as long as men can remember. Svalbarð owns all the jetsam that washes up on it's beach. The farm has a share [not specified] from every whale stranded in the parish, and the priest has been known to take advantage of this in a good natured manner. The meadow around Svalbarð is small [along the Svalbarðsá, the western homefield or *tún* area] and often damaged by the river cobbles caused by the flooding of the Svalbarðsá. The outlying Svalbarð pastures are good and extensive. The ocean can present a threat to livestock, as do brooks and the local bogs.

Svalbarð's sheep houses are located against the sea, and a long road leads to them, but one can lose one's way [during a fog or a snow storm?]. The sheep houses often get wet [by the ocean] and this causes problems for grazing.

The waterway along the Svalbarðsá is dangerous in winter, so that water must be carried along the high banks without the assistance of cattle. Fishing can be done as well. The landing [for small craft] at Svalbarð is good and not disturbed by [heavy] surf. But the coast is rocky and rarely used as the ship's wall [an artificial sea wall constructed at the mouth of the Svalbarðsá] is too long. However, the church owns a place for boat landings at Víðarvík on the land of Sporðland. Víðarvík is generally used for fish drying, firewood and places to store fishing tackle.'

One gets the impression that the farmers at Svalbarð may have purposely undervalued the farm's holdings, stressing drawbacks and limitations rather than resources. This was perhaps due to the popular fear at the time that the Árni Magnússon land register was to become a tax document for the Danish Crown (Helgason 1960).

In the time between this census and the first Danish Geodetic surveys of Iceland (1900–1908), Svalbarð increased its holdings during the general mid-19th century expansion. The cottager farm of Garðstunga, and the area Garðdalur were used by Svalbarð. Local ethnographic data indicate that Svalbarð had access to the upland heaths of Helgafell and use of the lake Stóra-Víðarvatn. Today the farmers at Svalbarð still use the homefields of a number of abandoned farms in the area, as well as the upland Helgafell heath.

Excavation strategy

As in previous excavations of Norse and Late Norse midden deposits in Greenland (Buckland *et al.* 1983; McGovern 1979, in press; McGovern and Bigelow 1984; McGovern *et al.* 1983) and Shetland (Bigelow 1984; 1985), the complex stratigraphy of the middens required a combined vertical and horizontal approach for effective documentation. Given the depth of the deposit, narrow trenches would rapidly turn into dark and difficult 'telephone booths', and instead a modified open area approach was applied. Using an open area approach, a wide strip of the whole midden was excavated at the same time, initially peeling from levels (measured from modern ground surface to provide an initial 'bedding angle') over the surface, but shifting to stratigraphic excavation whenever possible. In every case, efforts were made to keep a given unit in phase to allow a broad horizontal view at all times. Horizontal plans and photographs were regularly made.

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Norse and Later Settlement and Subsistence

Three major excavation units were opened in 1988. The first was the 1987 test unit (referred to as the "OLD" units), which was emptied of fill and cleaned prior to the arrival of the main body of the crew. This unit provided a very valuable window on deposits, and a reference point for stratigraphy in the two adjoining units. Observed strata were tagged and labelled to aid this process. The most important result of these observations was the discovery and documentation of a stratigraphic horizon described as SU8 (SU referring to a natural stratigraphic unit). This band of charcoal and burnt earth appears all across the OLD units, and was easy to recognise from its colour and texture in most areas. As work progressed, it became clear that this horizon extended all across the sampled midden surface. The SU8 horizon is not itself a tephra, but instead seems to represent a grass fire that spread across this part of the site. The horizon appeared to divide the Early Modern artefactual materials (glass, ceramics, kaolin or clay pipes) from the Medieval deposits beneath. It acted as an invaluable guide during excavation. The SU8 interface helped to minimise the stratigraphic mixing in all excavation units. Later in the season, it was discovered that the SU8 horizon had two tephra layers associated with it, both above and below the stratum, tentatively identified as the Hekla 1636 and Vatnajokull 1717 ash falls.

Just to the east of the OLD units, a 3-by-8m MAIN unit (grid reference 120.G27) was laid out and deturfed. Because the north-south grid orientation of the OLD unit would have fitted badly on the restricted midden face, the 1988 MAIN site grid was offset +4 degrees from magnetic North. This eased excavation and site shelter placement, but required an oblique juncture with the OLD unit's edge. Since soil was hard frozen approximately 30cm below ground surface in late June, the excavation team was unable to accurately delimit the midden deposit with the soil cores. As a result, we discovered that we had over-estimated the extent of the midden in the east, and that half the MAIN units covered largely sterile deposits.

The eastern most four metre squares in the MAIN units (125.G27) were closed and a new unit to the west of the OLD units was opened. Because of the shape of the erosion face, these units returned to the north-south grid orientation of the OLD units. This 3-by-3m unit was called the EXTENSION units and has the grid reference of H15.F17.

During the early weeks of the excavation, a portion of the erosion face was cleaned (grid reference. B20.B22). The possibility of cutting back this face further was investigated, but because of an extremely steep 'bedding angle' (80° slope) it became almost impossible to excavate and this unit was abandoned. At Svalbard, it proved a better strategy to excavate horizontally down from the surface rather than vertically in from the unstable erosion face.

A smithy-like structure was encountered approximately 20–25m east of the midden deposits along the western *tún* fence line. The area appeared on the surface as a compacted turf mound, and local place names indicated that the area served as a smithy during the 19th century, where the local farmer processed bog iron. In order to test non-invasively for the archaeological traces of this structure, a series of Proton Magnetometer readings, soil resistivity readings and soil corings were performed (the proton magnetometer and resistivity equipment was kindly loaned by Dr. Jim Moore of the Department of Anthropology, Queens College, CUNY). Both the proton magnetometer and the soil corings indicated high concentrations of iron. However, the ground moisture content was too high for the resistivity meter to give reliable readings, and indications of sub-surface structural elements could not be determined.

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Site shelters made of wood and woven polythene fibre, weighted with sandbags and heavily guyed, were erected over the three units at the top of the midden (original design by G. F. Bigelow). These proved vital to the continued progress of the excavations, as wind and rain dominated the final six weeks of the excavation. Similar shelters are highly recommended, not only as crew protection, but as a means of keeping site surfaces dry enough to effectively observe stratigraphy.

The systematic sieving program used at Svalbard involved a 50% sample passing through a 4mm mesh, with a 2.5% sample wet sieved through a 1mm mesh. Substantial systematic soil samples were column and spot collected for macrofloral and microfaunal analysis, and a separate column sample was taken for pollen and tephra investigation.

Description of the deposits

'Bedding Angle'

Based upon previous work on middens in Greenland (McGovern in press) and the observations made in 1987 at Svalbard, excavation paralleled the modern surface 'bedding angle'. This strategy did work well for the excavation of the MAIN units, while the OLD and EXTENSION units presented some problems. The dip of the strata was the greatest within the OLD units and gradually tapering through the EXTENSION units. Only in unit G20 of the MAIN units did the dip into the OLD units become severe (Figs. 3 and 4).

It was realised that the OLD units were sitting in a natural depression into which the rest of the deposit sloped. The OLD units had the poorest drainage, as evident from the frozen ground and damp deposit in the lower strata. The deposits were at their thickest in the OLD units (see Fig. 3 for a profile drawing of the east Wall, and Fig. 4 for a photograph of the south Wall), and the thinnest in the MAIN units. This had a sump-like effect across the midden, where the most neutral pH deposits were inside the OLD units and the deposits became more acidic towards either end of the midden. While preservation for large scale organics (animal bone) was very good throughout the midden, preservation within the OLD units was excellent.

Cryoturbation

A number of cryoturbated features were observed in the MAIN and OLD units. The MAIN unit SU8 was extremely hard to follow while excavating. In profile and in plan, a series of small (5–10cm deep) frost wedges forming patterned ground features (75–100cm across) were documented across the eastern portion of the MAIN units (see Fig. 4). While there was some ground movement around the frost wedges, the deposits were not badly disturbed. In the OLD units there were signs of minor cryoturbation lobing evident in the northern face of the unit G19. A number of the SUs took a steep dip, which becomes the terminus of Analytical Unit (AU) 6 (terms follow Harris 1979).

The interface of AU1 with the actual midden deposits represents another cryoturbated feature in the MAIN units. In plan, several cryoturbation rings of stones were evident during the excavation of Feature 2 – the 'Whale Bone Layer'. The stone rings are approximately a metre in diameter, and exhibit the classic cryoturbated sorting of cobbles into a small scale patterned ground pavement (see Fig. 6).

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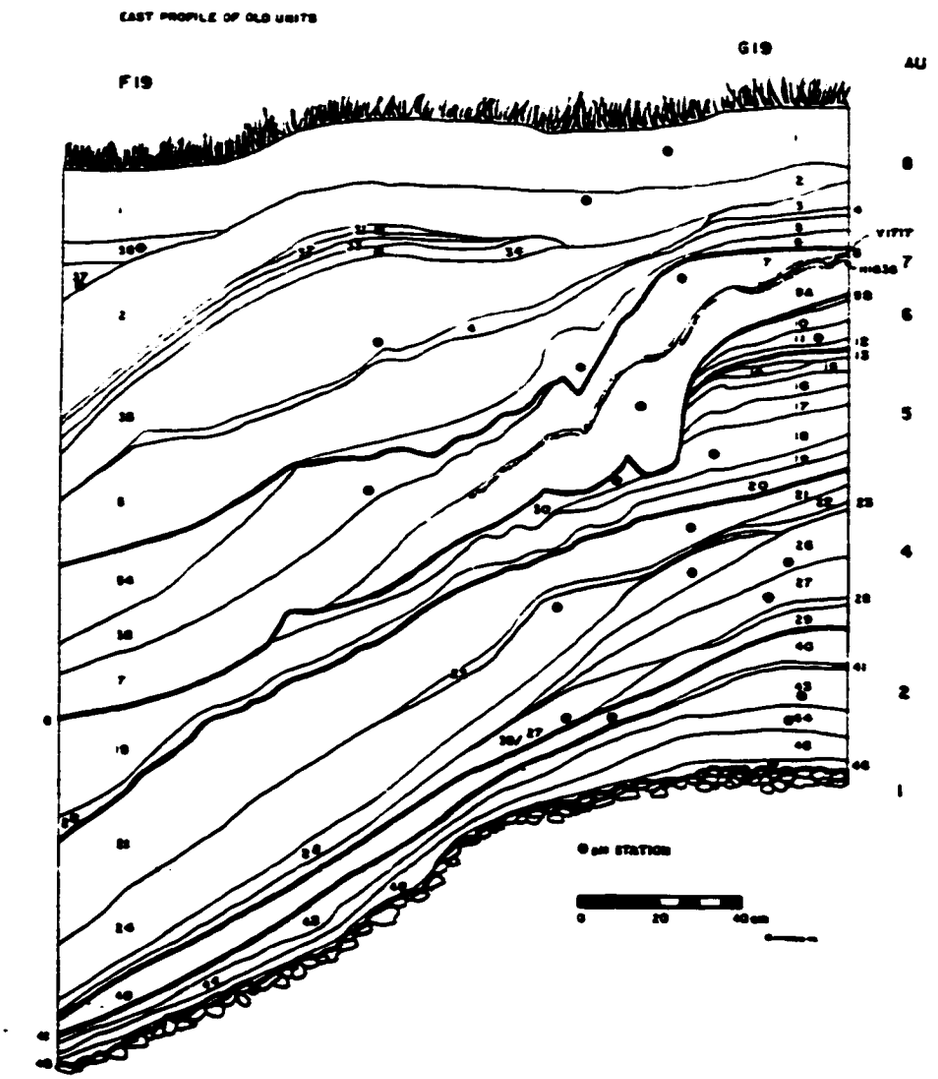

Figure 3. The east profile of the OLD units.

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Appendix III: (Amorosi 1992:111)

Figure 4. The south profile of the OLD units. The photo scale represents one metre. The bone mount No. 1529 was recovered at the base of the photo scale (SU46).

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Appendix III: (Amorosi 1992:112)

Figure 5. The "Whale Bone Layer," Feature 2, looking west in the MAIN units

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Figure 6 The MAIN units over Feature 2 ("Whale Bone Layer") was removed. The remaining bank (G30) seen in the upper right-hand corner of the photograph was removed after mapping the circumferential stone rings seen across the MAIN units

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Feature 2 – The 'Whale Bone Layer'

At approximately a metre in depth, a continuous ground surface was encountered in the MAIN units (see Fig. 5). It was observed that the midden deposits were interrupted by areas of palaeo-turf, and then by a thick covering of cut-up whale bone chunks. The depth of this deposit was approximately 10–15cm. The deposit was mostly contained in the MAIN units (I20, 21, H20, 21 and G21, 22). Around the whale bone deposit were a number of large stone cobbles marking the perimeter of the feature. Several bone combs and other artefacts were recovered from this whalebone deposit that would suggest a date of A.D. 1050–1150, and its stratigraphic position suggests the latter end of this time range. The bone materials consist mostly of whale bone, but include some cattle and caprine bones.

The whale bone appears to be waste from an open-air workshop. The stones that mark the perimeter suggest a possible tarp or other loose cover was once placed over the whale bone pieces. The palaeo-turf may represent the vigorous grass community that became quickly established once the deposit was abandoned as a working surface.

Such workshop surfaces have not been encountered in previous Icelandic excavations. This might be partly due to the concentration on excavating architectural remains, and not midden deposits away from structures. McGovern (in press, 15–16) makes note of similar outdoor deposits in Norse Greenlandic midden deposits. The surface may represent a "fair-weather" work area away from the house, and started as a partially grass covered area. These outdoor activity areas might also serve as a site for secondary butchery of game and domestic animals. Norse dogs and children would also contribute to the creation and modification of these types of deposits as well as acting as sources of attrition of bone and artefacts.

Stratigraphic Unit 8

This stratum was used as a temporal marker while excavating the midden. In the field SU8 had appeared consistently across all units. It was also observed that early modern artefacts mostly appeared above SU8, while Medieval deposits appeared below the stratum.

In its wide distribution SU8 resembled a tephra deposit, but exhibited none of the other usual characteristics associated with tephras (acidic in taste and glass fragments can be observed with a magnifier loop). Finally, in the EXTENSION units at an approximate depth of one metre, SU8 became 10 cm thick (grid references H15–16). In the thickest part of the ash deposit, an area (H15–G15) was filled with fire-cracked rock.

It would appear that SU8 represents another ground surface that spreads across the entire midden. The black, sooty nature of this deposit also suggests a grass fire, perhaps caused by the fire-cracked rock feature in the EXTENSION units. This feature is also the highest part of SU8, and a heavy rain would wash the sooty deposit downhill, where the thinnest deposits would be over the MAIN units.

The site of Ntaquusat W48 in Greenland, had similar types of burnt deposits. McGovern (in press, 16) suggests that these soot and ash horizons could have been derived from hearth-clearing or outdoor cooking pits where heated stones were used. Whether accidental or deliberately set, these fires occasionally burned over a large part of the midden surface, charring sub-surface bone and artefacts. New grass communities became established, and a subsequent phase of deposition continued the midden's accumulation.

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It is interesting to speculate as to why such midden surfaces were burnt. Perhaps the burning of carrion and other waste might be used as a form of fertiliser for the home field. Although there is no evidence to suggest this in Iceland, perhaps the intent was to prevent the attraction of dogs and their destructive digging, or worse the occasional polar bear.

Tephras

Three tephras (generally a volcanic ash) were encountered in the course of the excavation. These tephras are presently under analysis by Guðrun Larsen (University of Iceland) and Haukur Johannesson (Icelandic Museum of Natural History), and only a preliminary reporting is presented here.

The first tephra is encountered sporadically at the base of the midden. This tephra is the Hekla 3 (1000 B.P.), forming an old erosion face between the Holocene river cobbles and the midden deposits. The other two tephras were encountered immediately above and below SU8. These tephras are tentatively identified as the Hekla A.D. 1636 and the Vatnajokull A.D. 1717.

Depositional Model

While a few discrete horizons presumably formed over a short period (such as SU 8 and the whalebone layer), the deposits at Svalbard mainly represent a series of small lot dumps accumulating over time. Like most middens, the majority of the deposit at Svalbard is "accretional" rather than "catastrophic" (Amorosi 1984, 1991a; Grayson 1983; McGovern 1985) the product of a great many discard events gradually blending together into a series of superimposed strata. As a result, such deposits are more likely to provide a generalised digest of changing activities on a site rather than a sharply focused picture of a discrete moment.

These strata contained a large amount of fireplace sweepings, evident from the numerous burnt bones, artefacts, and ash-like soils (either a low grade peat-ash or carbonised soil). The strata were deposited with little or no subsequent reworking and compaction. Excavators observed that they sank into many of the uncompacted peat-ash deposits by several centimetres, indicating little prior traffic or ground disturbance. The steep slope edge probably discouraged extensive human activity over most of the deposit that was sampled.

Shifting midden accumulation

A model of shifting deposition can be proposed for the Svalbard midden. The midden deposits were the oldest in the MAIN units and became progressively younger toward the EXTENSION units. As Guðmundur Ólafsson has observed (pers. comm.; also see Bertelsen 1979; 1984) Icelandic farmsteads tended to shift laterally over the years, pivoting about their infields as turf and stone structures became unrepairable and were replaced by fresh construction nearby. At Svalbard, the church and churchyard probably acted as a centre point for such farm rotation. Midden deposition should also gradually shift, as a particular dumping area becomes more or less convenient to residents in the various houses. Thus a given area might see regular, intensive dumping for several generations, a period of little or no deposition, and then a new phase of rapid deposition as the farm buildings shifted back into range.

At Svalbard the houses of the last century were further to the north and east than the present main farm house, and the newest farmhouse has been constructed still further to the southwest. Presently the farmstead has moved away from the river bank area, and an associated possible second midden deposit was encountered close to the present buildings inside the homefield. Surface scatters of these materials indicated artefacts dating well within this century.

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It would appear from these observations that midden deposition over time does follow the movement of the farmstead at Svalbarð. Whenever the farm houses were the closest to the river bank the midden area sampled in 1987-88 was used, but other periods would have seen deposition in other areas (now erased by field flattening). This would account for several cultural breaks in the stratigraphy, and the grass communities observed in the floral evidence (C. Zutter this volume and pers. comm.). Such breaks are the brown soil deposits noticed in the OLD units around SU7. The palaeo-turf and 'Whale Bone Layer' in the MAIN units, indicating a grassy ground surface during part of the Medieval period of the site. Feature 3, the fire-cracked rock area in the EXTENSION units indicates another ground surface in the early modern period.

There has been some discussion as to why such deep midden accumulations form over time. Brox (1965) first formulated a model that midden deposits form after the rise of commercial fisheries in Norway, which produced a lack of male labour to spread burnt kitchen waste in the homefield. This might not be the case in the formations of the Icelandic middens. It would seem that such accumulations were used to stabilise the erosion of the farm mound area and raise the farm above ground surface. This had two effects, first to prevent erosion from snow melt and rain, and to act as drainage for accumulations of surface water (there are often deposits of bone separated by strata of burnt peat ash). Recent field work in Árneshreppur (northwest Iceland) suggest that this became increasingly necessary as sea ice conditions became worse during the 'Little Ice Age'. Farmers in this region still fear massive accumulation of sea ice, that can become suddenly unstable and surge across to the relatively flat land areas were farms are located. Several farmers in the Árnes community remember such surges carrying with them large pieces of drift wood and tree parts that would be "shot" across heaths into byres and houses.

The midden accumulation at Svalbarð would also seem to be a stabilisation of the farm mound. The Árni Magnússon land register makes mention that the Svalbarðsa would often surge with river ice in spring, often destroying part of the western homefield, and killing livestock (see above). The midden deposits would serve as a buffer zone against the spring river ice, protecting the eastern homefield (also the most productive field), church and farm buildings.

Description of Analytical Units

Currently there are 9 basic Analytical Units (AU) spanning the entire midden deposit at Svalbarð. Following Harris (1979), AUs are groupings of Stratigraphic Units (SU) observed in the field, and represent attempts to group roughly contemporary deposits for analysis. Designations were derived on the basis of field stratigraphic observations, tephra associations and artefactual contents (see Figures 3 and 7–9). Tables 1 and 2 summarise the AUs, the SUs, and probable dating of these deposits.

The dating of deposits was based upon the associations of tephra dates, and artefact typologies. The Medieval AU dates were derived on bone comb typologies developed for the United Kingdom and Scandinavia. AUs above the A. D. 1636 tephra were dated by association of known English ceramic manufacture dates. Radiocarbon samples were collected in the field for AMS dates, and are currently pending. It was felt that the tephra and artefact associations provided a clear dating sequence for most of the site. Once these materials were clearly identified and dated, an AMS strategy could be developed (in this case to date the earliest basal deposits) as a cost effective measure.

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Appendix III: (Amorosi 1992:117)

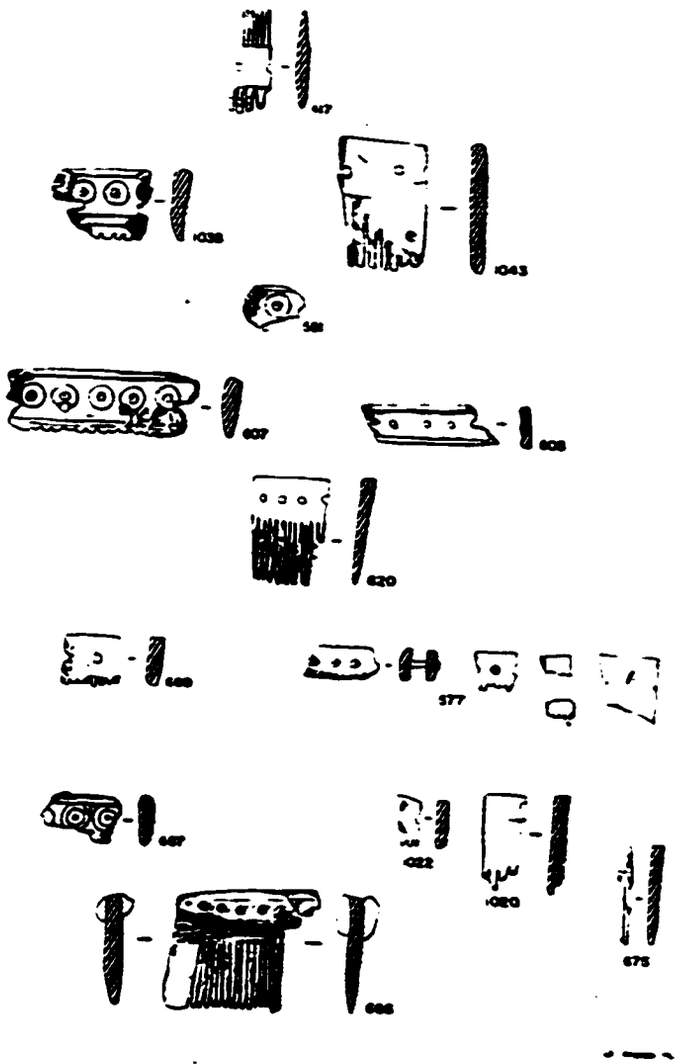

Figure 7 The composite comb sequence from the MAIN units. Double-sided: AL5 (c. 1250 – 1400) No 417 Single-sided: AL4 (c. 1150 - 1250) Nos 581, 607, 608, 620, 1038, 1043 AL2 (c. 1050 – 1150) Nos 577, 666, 669, 675, 687, 1020, 1022.

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Appendix III: (Amorosi 1992:113)

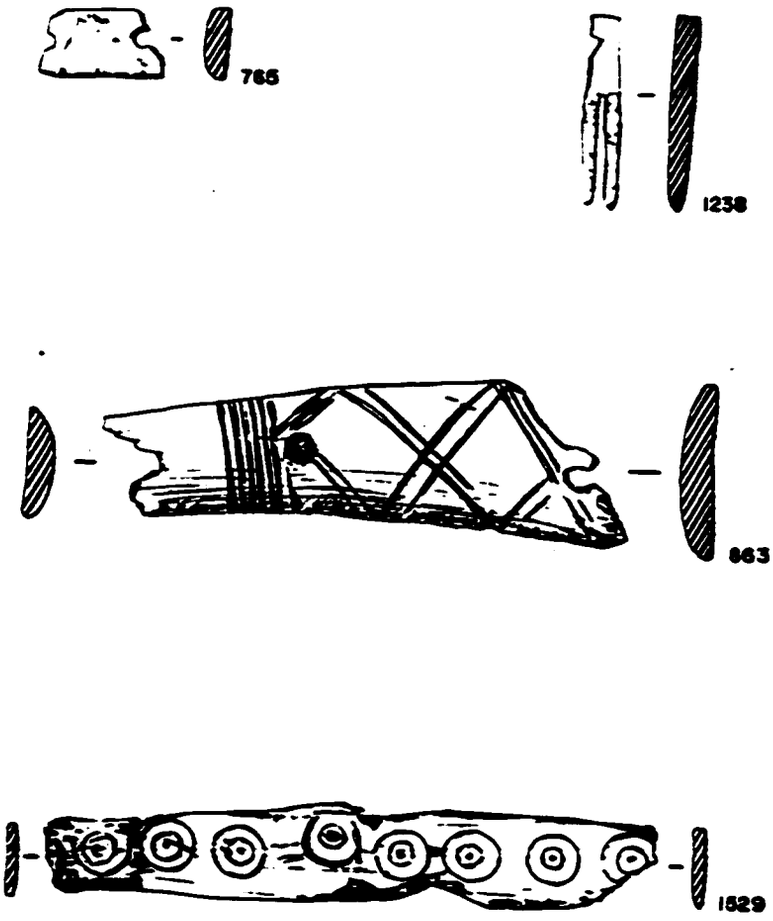

Figure 8 The composite comb and bone mount sequence from the OLD units. The illustration scale is 1:1. Single-sided: AU4 (c. 1150 – 1250): Nos. 765, 1238. AU2 (c. 1050 – 1150): No. 863. Mount AU2 (c. 1050 – 1150): No. 1529

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Appendix III: (Amorosi 1992:119)

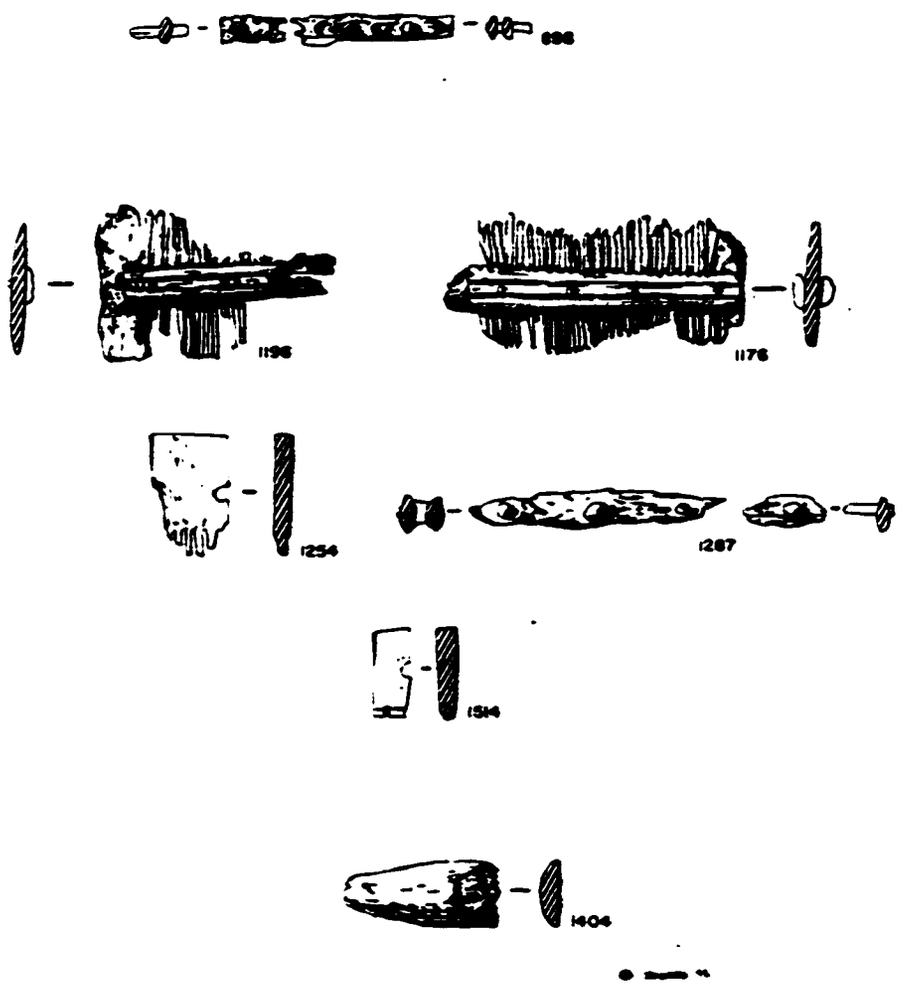

Figure 9 The composite comb sequence from the EXTENSION units. Double-sided: AU5 (c. 1250 – 1400) Nos. 898, 1176, 1196. Single-sided: AU4 (c. 1150 – 1250): Nos. 1254, 1287, 1514. AU2 (c. 1050 – 1150) No. 1404

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Appendix III: (Amorosi 1992:120)

Norse and Later Settlement and Subsistence

MAIN	OLD	EXTENSION
		AU9 - SU31-39
AU8 - SU1-5 6(Vatnajokull 1717)	AU8 - SU1-5 6(V.1717)	AU8 - SU1-5 6(V.1717)
AU7 - SU7-8 Hekla 1636 SU9	AU7 - SU7-8 H. 1636 SU9	AU7 - SU7-8 H.1636 SU9
	AU6 - SU9B.10.11	AU6 - 10.11
AU5 - SU10.11	AU5 - SU18.19.20.30	AU5 - SU12. 14.16
AU4 - SU12.13.14.15. 16.17.18.27.35. 36.37	AU4 - SU11.12.22A &B. 23.24.25.39/27. 26.27.28.29.51	AU4 - SU18
AU3 - "Whale Bone Layer" or Feature 2	-	-
AU2 - SU19.20.21.22. 23.24.28.38.39. 40	AU2 - SU40.41.43.44.45. 46	AU2 - SU22. 23.26
AU1 - Hekla 3,000	AU1 - H.3,000	AU1-H.3,000

Table 1 AU/SU correlations for the MAIN, OLD and EXTENSION Units at the Svalbard site (07U6-6U).

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Appendix III: (Amorosi 1992:121)

Analytical Unit	Date
9	1800-1880
8	1717-1800
7	1636-1717
6	1400-1636
5	1250-1400
4	1150-1250
3 - 'Whale Bone Layer'	1050-1150
2	A.D. 1050-1150
1	3,000 B.P.

Table 2 Summary of the proposed dating of the Analytical Units at Svalbarð

Artefactual materials at Svalbarð

Numerous artefacts were encountered and recovered at Svalbarð (see Amorosi and McGovern 1988 for a preliminary catalogue of the diagnostic artefacts). Medieval artefacts range from bone combs to stone spindle whorls. Early modern artefacts include numerous bone artefacts as well as 19th century European export ceramics. Figures 7–9 illustrate a seriated sequence of the Medieval bone combs and bone mounts for the site. Although the analysis of the artefactual materials is a long way from being completed, several distinctive patterns are apparent from these materials.

Composite antler/bone comb sequence for Þistilfjörður

Figures 7–9 present a seriated sequence (based upon the comb's stratigraphic position), for the MAIN, OLD and EXTENSION units, of medieval composite antler/bone combs and mounts. Although a bit simplistic in its presentation (see Ambrosiani 1981; Andersen 1968; Christophersen 1982; 1988; Grieg 1933; Mann 1982; MacGregor 1985; and Wiberg 1987 for more refined sequences in Europe and Scandinavia) this represents the only stratigraphic sequence of bone combs and mounts for northeast Iceland. Norse, late Norse and early modern period artefact sequences and typologies are yet to be fully worked out for both Greenland and Iceland. Figures 7–9 thus should not be interpreted as a refined artefact sequence, rather as a first attempt to build such a sequence. Presently several other researchers are attempting to build and refine artefact typologies (Hallgrímsdóttir, Ólafsson, Snæsdóttir and Sveinbjarnardóttir – Early modern ceramic sequences; Einarsson and Vilhjálmsson – Norse and late Norse artefacts).

The combs are listed by AU and by their SU with their registration number. It should be noted that the comb material is fragmentary. This might suggest curation of materials until the object was thoroughly used or badly broken.

'Hog-Backed' combs were encountered in deposits dating from A.D. 1050–1150. Stylistically, the 'Ring and Dot' pattern with two sets of horizontal engraved lines remains popular for single-sided combs till A.D. 1250. The actual decoration seems to be an Icelandic variation of English and Norwegian styles (V. O. Vilhjálmsson and G. F. Bigelow pers. comm.). The advent of double-sided combs would seem to fall between A.D. 1250 and 1400.

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Appendix III: (Amorosi 1992:122)

General trends

There are also numerous medieval bone artefacts, including gaming pieces (chessman and dice), toggles, a spindle whorl and miscellaneous manufacture debris. The manufacture debris are either the results of 'knife carved' or pole lathe work. Medieval iron and copper materials were also present in some numbers.

There is a transition of artefactual materials from the Medieval to the early modern deposits. There is a general decrease in the raw frequency of worked bone and stone materials as one proceeds through time. These materials are replaced by the ceramic and glass categories. What this reflects in the economy of Svalbarð remains uncertain until the analyses of the artefacts and faunal materials have been completed. But it is interesting to note that many of the ceramics are English in origin and were heavily worn and in some cases mended. This might suggest that the contact with English seamen and merchants was very limited during the 19th century, due to sea ice restricting shipping lanes around Iceland (Ogilvie 1979/80; 1981; 1991; Grove 1988, 15–27). Such conditions have been reported as early as the 16th century, when European visits were timed against ice choked coast lines (see Icelandic 1596 map of Bishop Guðbrandur Þorlaksson in Hermannsson 1926; Hakluyt 1904: vol. IV, p. 103).

The iron and copper categories are not informative as they now stand. The corrosion makes it difficult to tell the difference between a knife and a bolt. This will prohibit a further discussion of Svalbarð's economy as based on the artefact component until the function of each artefact can be determined. Fortunately, experiments with X-ray machines have yielded positive results, and future work with X-rays will be carried out.

Svalbarð's archaeofauna

The 1987 and 1988 investigations generated an animal bone collection in the range of 40,000–70,000 identifiable fragments. This large archaeofauna was one of the core objectives of the research project. The systematic 4mm and 1mm sieving carried out in the field has collected a great many small fragments, many of which can be identified. However, such large collections also require a substantial amount of time to fully analyse and complete. Nonetheless, considerable progress has been made during the first stage of analysis of selected deposits and this sample is broadly representative of the collection as a whole. It now seems appropriate to provide a working assessment of patterns as we now understand them.

The material described here is the sample collected from the OLD units (F to G, 18 to 19). This unit was originally opened during the 1987 test, where grid unit G18 was carried to sterile subsoil. The other squares were completely excavated during the main 1988 season. These units were selected because of the thickness of deposits, and the artefact dates were the widest possible range (*c.* A.D. 1050–1800). These units also provide a good deal of material from AU 2, 4 and 5 (Medieval units, *c.* A.D. 1050–1400) and from AU 6, 7 and 8 (Early modern units, *c.* A.D. 1400–1800). It should also be noted that relatively little material was recovered from AU 6, and none of AU 3 was present (Feature 2 – the Whale Bone activity floor, mostly contained in the MAIN units) nor of AU 9 (*c.* A.D. 1800–1880). Thus a comparison of Commonwealth, later Medieval and 18th century materials can be presented. Comparisons of the Svalbarð archaeofauna with other Icelandic archaeofaunas has been made in Amorosi (1989; 1991a), and will not be duplicated here.

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Appendix III: (Amorosi 1992:123)

Species exploited

Throughout the sequence at Svalbard the bone collections are dominated by four taxonomic groups: cattle, caprines (both sheep and goats), fish (mostly Gadids) and seals. In the lower phases (AU 2 and 4), birds (mainly sea birds – Alcids and Gulls) contribute up to 25% of the collection, and bones of whales are also present in significant numbers in the later Medieval phases (AU 5). The numerous whale remains most probably result from manufacture waste rather than hunted species. In the uppermost layers (AU 7 and 8) shellfish comprise over 12% of the assemblage.

There are other animal species that appear in trace amounts in these materials. There are only a few remains of goat (*Capra hircus*), dog (*Canis familiaris*), horse (*Equus caballus*) and pig (*Sus scrofa*). However, sheep (*Ovis aries*) and cattle (*Bos taurus*) are the most numerous. The most common game animals are seals. The harbour or common seal (*Phoca vitulina*), and the migratory, ice riding harp seal (*Pagophilus groenlandicus*), are the most numerous. Only one fragment of the bearded seal (*Erignathus barbatus*) and another of the walrus (*Odobenus rosmarus*) in the uppermost levels have been identified.

Other marine mammals, such as the polar bear (*Thalarctos maritimus*) and whale bones have been encountered. The whale bone material still remains to be identified, since only small and often modified chunks were recovered. Two terrestrial species have also been encountered, arctic fox (*Alopex lagopus*) and imported reindeer (*Rangifer tarandus*), the reindeer bones are derived from worked or modified manufacturing debris and not from hunted species.

Fish materials abound in the assemblage. The most common species are the cods, with the Atlantic cod (*Gadus morhua*) as the most numerous. The ling (*Molva molva*) and the Atlantic salmon (*Salmo salar*), are present in very small numbers. Shellfish remains are mainly represented by clams (*Mya* spp.) and blue mussels (*Mytilus edulis*) although there are some gastropod species which are comparatively rare in the collection.

Diachronic patterns

The deep midden deposits at Svalbard offer the potential for examining continuity and change through time in at least one major farm in the Distulfjordur, and as such diachronic information was a major target for the excavation project. Table 3 and Figure 10, present the mix of mammalian species and pattern of major taxa for each AU. Several general trends can be noted. Commonwealth phases show little difference in the relative importance of the caprines and cattle, the later medieval phase (AU 5) shows a decrease of seals and an increase in caprines. The AU 7 and 8 materials shows a dramatic increase in seals, with the phocid bones becoming more common than those of the bovids.

Figure 11 presents a changing ratio of cattle to caprine remains. Svalbard has evidently placed a heavy emphasis on sheep herding, with Commonwealth bone ratios showing 1 cow to 4–5 sheep. This is a bit unexpected since the larger farms in the south regularly seem to have maintained more cattle and fewer caprines, especially in early Medieval times (see Amorosi 1989; 1991a). In the later Middle Ages, this ratio seems to have shifted still further towards caprines. This new ratio, 6–7 caprines to 1 cow seems to have persisted into the early modern period. This intensification of sheep raising (goats are very rare in Icelandic collections) may relate to increased emphasis on wool production, and it may also reflect declining prime pasture areas and a move toward less fodder dependent animals.

Although it will be some time before survivorship (or harvest) profiles can be constructed, some age-specific mortality patterns are already clear (Fig. 12). Most cattle seem to be either quite old (longbones are fused and teeth are worn) or very young (less than 3 months of age). These data

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Appendix III: (Amorosi 1992:124)

	ANALYTIC UNIT:	2	4	5	7/8	
	DATE:	1050 -1150	1150 -1250	1250 -1400	1636 -1800	
TAXON						**UNIT TOTAL**
Bos taurus	cattle	107	64	35	58	264
Equus caballus	horse	1				1
Sus scrofa	pig	5				5
Ovis aries	sheep	15	25	29	39	108
Capra hircus	goat		2		5	7
Ovis/Capra sp.	caprine	431	153	225	271	1080
Phoca vitulina	common seal	9	3	1	32	46
Pagophilus groenlandicus	harp seal				33	33
Phocid sp.	seal sp.	82	44	22	691	839
Cetacea sp.	whale sp.	30	48	72	29	179
Alopex lagopus	fox				1	1
Ursus maritimus	polar bear			1	1	
Odobenus rosmarus	walrus				1	1
	Birds sp.	128	604	72	45	849
	Fish sp.	642	554	588	2027	3811
Mollusca sp.	Shellfish	52	96	14	430	592
Total NISP		1502	1594	1058	3663	7817

Table 3 Number of Identified Specimens (NISP) of each taxa from the OLD unit excavations at Svalbard 0706-00, 1987-88.

suggest a two stage culling strategy, with the two Commonwealth samples showing a higher (+40%) percent of young animals. There is also some suggestion of a shift in the cattle husbandry pattern associated with the changing cattle to caprine mix. In either case, cattle would appear to have been kept as dairy animals.

A significant number of very young lambs seem to have died shortly after birth (Fig. 13). Numerous neonatal caprine bones have been recovered at Svalbard, with a dramatic increase in the relative percentage of these in the upper layers. Their presence indicates that lambing regularly took place nearby and that still-births were common or that many lambs died soon after birth. The apparent jump in mortality between early and later Commonwealth periods may reflect random

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Appendix III: (Amorosi 1992:125)

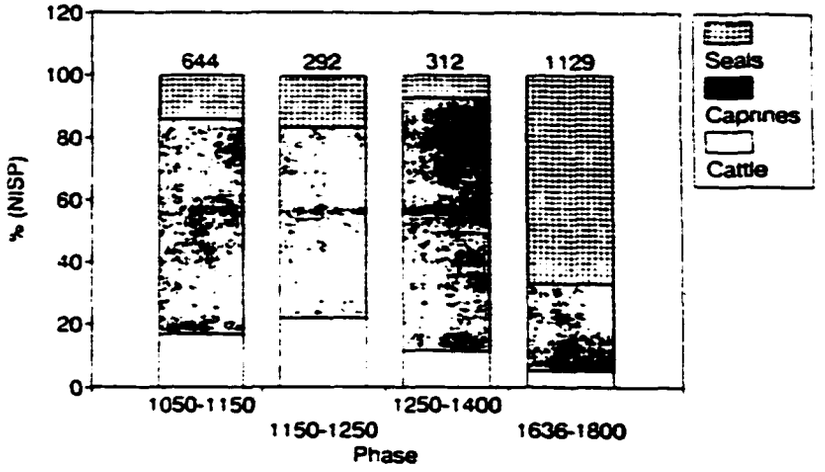

Figure 10 A histogram of the major mammal taxa recovered from Svalbard, OLD unit midden.

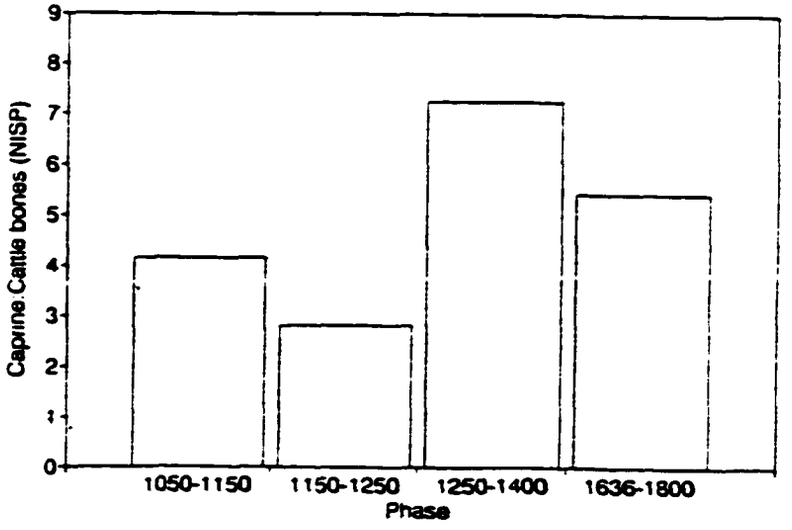

Figure 11 A histogram representing the changing ratio of cattle to caprines in the OLD unit midden.

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Appendix III: (Amorosi 1992:126)

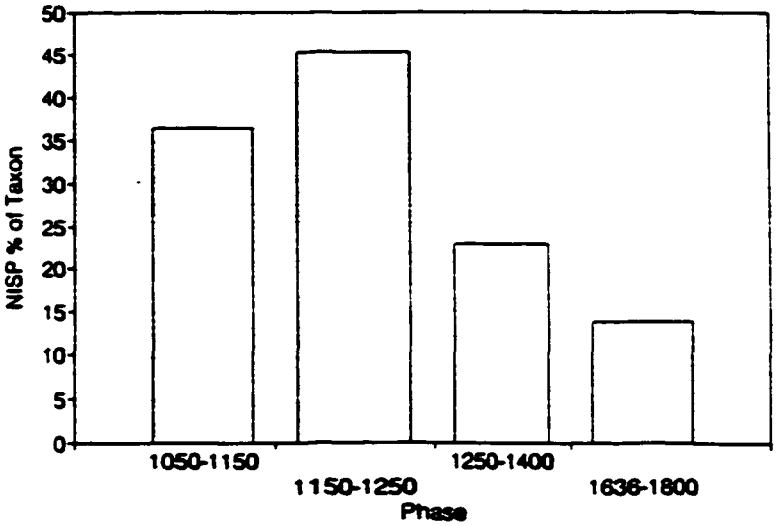

Figure 12. A histogram representing cattle age-specific mortality (as percent cattle neonatals) from the OLD unit.

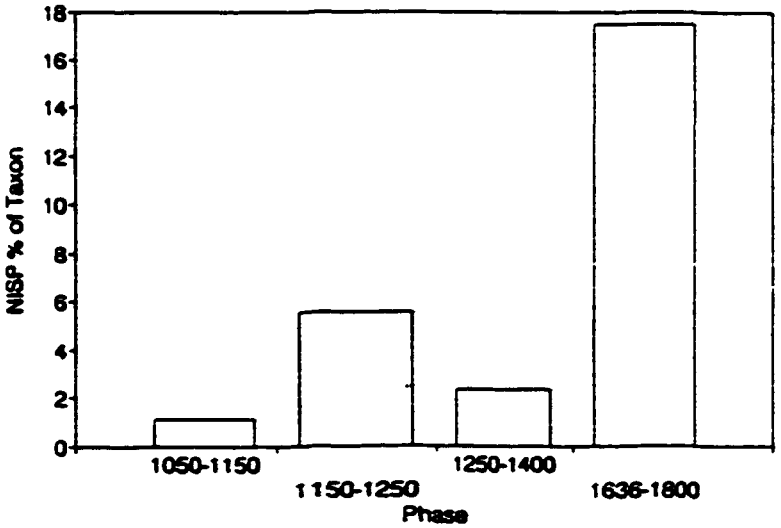

Figure 13. A histogram representing caprine age-specific mortality (as percent caprine neonatals) from the OLD unit.

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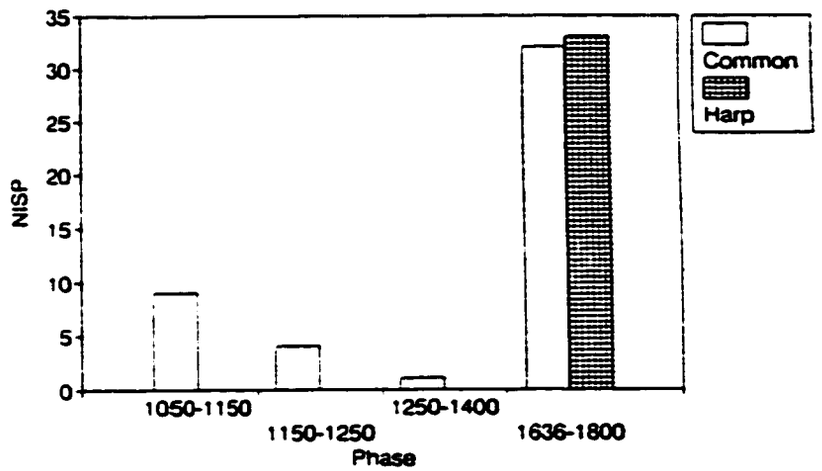

Figure 14 The changing pattern of seal exploitation at Svalbard in the OLD unit.

taphonomic noise or small scale or shorter term weather events. Cold and wet weather during lambing has been recorded as causing mass lamb mortality since the 16th century (Ogilvie 1981: 250). The second jump in the early modern period is more difficult to explain as a result of sampling error, and would appear to reflect a more severe and prolonged period of uncontrolled stock loss.

As noted in the survey of Árni Magnusson of 1712 (see above) the sheep houses and lambing area of the Svalbard farm are located along the shoreline. This may have made the Svalbard flocks particularly vulnerable to sea ice effects, perhaps more vulnerable than farms further inland. It is thus tempting to associate this marked rise in lamb mortality with increased spring sea ice of the later 16th–18th centuries (Ogilvie 1981; Bergþorsson *et al.* 1987). Sea ice arriving during the spring lambing season could be particularly hard on the Svalbard flocks, but spring or summer drift ice was a serious threat to all Icelandic farms in the north.

> 'It makes a great difference at what time of year the ice comes. In the autumn, and at the time of winter solstice, when the frost has already got into the ground and there is snow cover, its presence does less damage. But during the spring and summer when the weather is becoming milder the ice invariably brings disaster with it, because that is when it has the greatest power and the grass is most adversely affected. The northerners are thus far worse off than the southerners who never see this ice, as, whenever it starts to drift to east or west, it is swept back by the strong currents of the great sea.'
>
> Oddur Einarsson *Qualiscunque descriptio Islandiae* (c. 1593, trans. Ogilvie 1979/80)

Changing patterns of seal exploitation (Fig. 14) also seem to signal the presence of increased drift ice. There appears to be continuity in seal exploitation throughout the Commonwealth, a decline in the later Middle Ages and a sharp rise of seal exploitation by the 18th century. Materials from AU

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Appendix III: (Amorosi 1992:128)

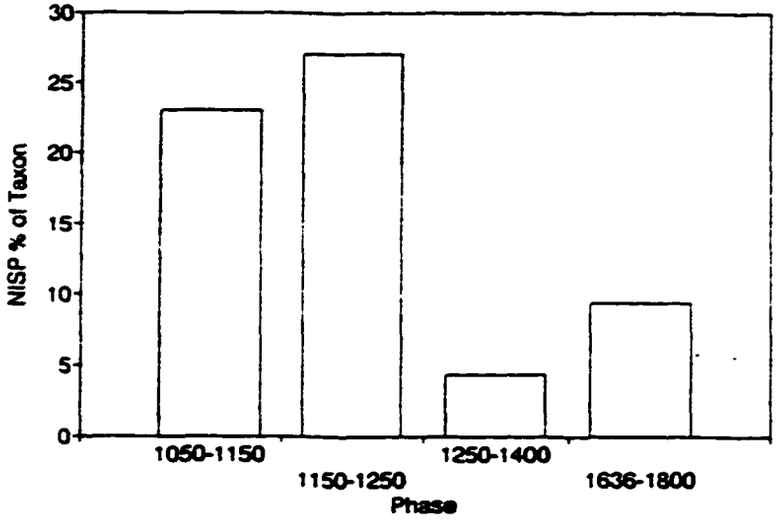

Figure 15. A histogram representing seal age-specific mortality in the OLD unit (see text).

6 indicate that the seal increase began in the early 17th century. Intensive sealing seems to have ended by the later 19th century, as ethnographic interviews reveal that no local residents had eaten seal in recent memory (Jón Haukur Ingimundarson pers. comm.) and the high percentages of seal bones in the upper layers were as much a surprise to the current farmers as to this researcher. Like summer drift ice, intensive sealing has faded from the modern experience in Þistilfjordur.

However, sealing has a long history in the region. Even the Commonwealth levels reveal a much higher percentage of seal material than is common for other Icelandic sites (Amorosi 1991a). It would seem that seal were commonly exploited from the first settlement at Svalbard. It is not only the intensity, but the character of the seal hunt that changed from the medieval levels to the early modern strata. In the Medieval levels, the common seal was the most heavily exploited. It is only in the early modern period that the exploitation of harp seals becomes archaeologically visible (see Fig. 14). The first harp seal bones appear in AU 6, and the AU 7 and 8 collections are half harp seal. This sudden appearance of quantities of harp seal along with remains including some bearded seal bones, walrus, and polar bear fragments are almost certainly associated with the appearance of drift and pack ice. [Numerous polar bears are drawn climbing among drift ice in Þistilfjordur on Bishop Guðbrandur Þorlaksson's map dating to 1596 (*cf.* Ogilvie 1980, fig. 2).]

Contemporary accounts from the late 16th century describe sealing on the sea ice as a regular part of the subsistence round in northern Iceland:

> 'Why: it is an ancient custome of the Island that they which inhabite neare the sea shoare do usually go betimes in a morning to catch Seales, even upon the very same ise which the historiographer make to be hel, and in the evening returne home safe and sound.'

(Jónsson 1593 in Benediktsson 1950: English trans. Hakluyt 1904, vol. IV, p. 123.)

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Appendix III: (Amorosi 1992:129)

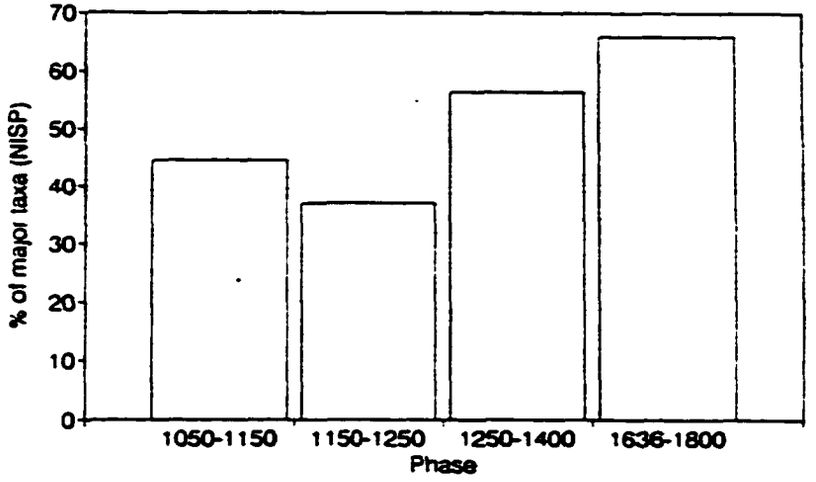

Figure 16 The changing frequency of recovered fish remains at Svalbard. Fish as percent of major taxa in the OLD unit

The presence of newborn seal pup bones (less than one month old) suggests a spring hunt of both seal species (see Fig. 15). During the Commonwealth period the numbers of common seal pup bones suggest the intensive exploitation of rookeries. The later medieval collections exhibit a drop in neonatal seal remains, as well as a drop in all seal remains. This may reflect an over exploitation of these animals in the Distrikjonhur area, possibly reducing the seal population or driving them to a more remote location. The recovery of the neonatal percentage in the early modern period is due to the large numbers of harp seal pups in the collections.

These harp seal pups suggest a different marine ecology in this part of northeast Iceland than has been experienced in recent years, and may indicate a dramatically different distribution of North Atlantic drift ice and harp seal pupping grounds. Presently major pupping areas for harp seal are restricted to either Newfoundland or Spitzbergen, with an occasional pup being carried to Iceland during extreme sea ice years (D. Sargent pers. comm.). But the number of archaeological specimens suggest that sea ice conditions in the 17th and 18th centuries may have provided a stable pupping area in northern Iceland, between the two modern pupping populations.

Fish remains also increase in the later phases of the occupation at Svalbard (Fig. 16). These are overwhelmingly gadid, though some salmon bones have also been identified. This rise in fish relative frequencies starts well within the medieval periods and by the 18th century fish remains make up over 60% of the major taxa. This archaeological signature may indicate a change from subsistence inshore fishing to a more commercial pattern of fishing (Amorosi 1991a).

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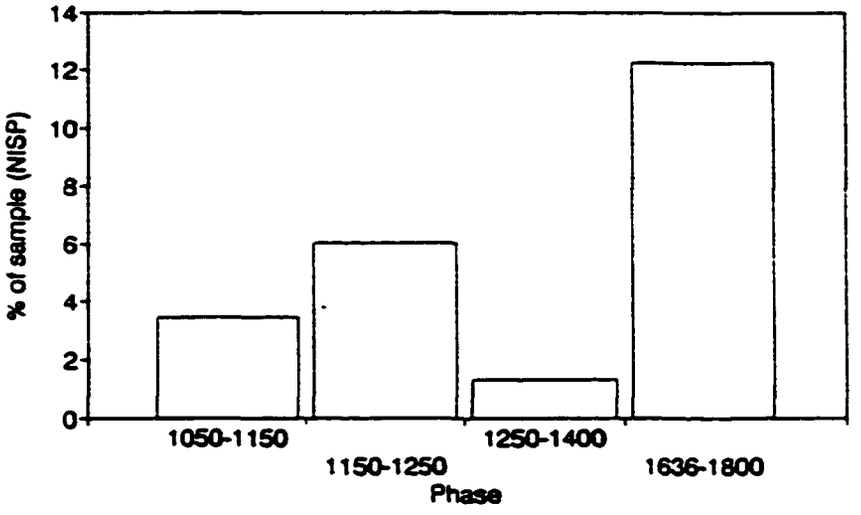

Figure 17 The changing frequency of recovered mollusc remains at Svalbarð in the OLD unit.

There are also significant increases in the upper layers in the number of shellfish (Fig. 17). Nearly all the remains are from the blue mussel. This increase may be associated with bait preparation for intensified fishing. However, ethnographic accounts suggest that this rise more likely indicates the expanded use of molluscs as human food – a stress indicator in Iceland. Local tradition in Svalbarðshreppur makes mention of the use of shellfish as famine food.

The combination of these patterns suggests that the early modern period was a time of marked stress. Increased lamb mortality, changing seal bone frequencies, and shellfish concentrations indicate the impact of unfavourable farming conditions, but also the human response to these impacts. Secondary, "buffering" resources (Halstead and O'Shea 1989) were increasingly employed, marine hunting and fishing was expanded, and every possible use was made of the newly available resources of the drift ice. The increased contact with external markets demonstrated by the imported pottery and glass in the upper layers may also signal a different sort of response to local climate impact. The farmers at Svalbarð were thus not passive victims of the Little Ice Age, but actively re-ordered their subsistence system to survive hard times.

Taphonomic observations

There are many processes of attrition that affect most archaeofauna, and the Svalbarð collection is no exception. Carnivores, mostly dogs, had access to some parts of the midden deposit. There are numerous dog chewing marks on the bone fragments. Dog gnawing increases dramatically on caprine remains in early modern times. Were more dogs kept in later periods, or did their access to sheep carcasses change in later times?

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Appendix III: (Amorosi 1992:131)

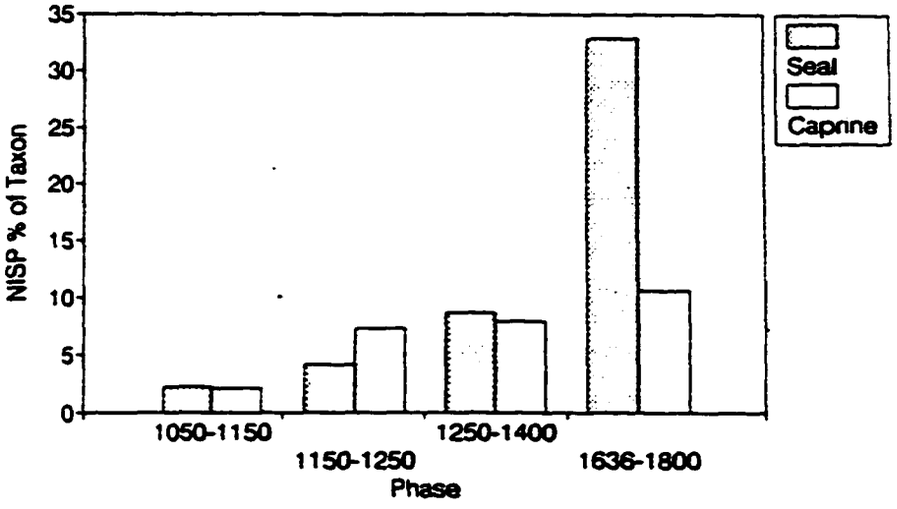

Figure 18. The changing frequency of burnt bone at Svalbard in the OLD unit.

Burning of bone materials also increases in the early modern period (Fig. 18). Burnt bone fragments occur in all layers, as do wood charcoal fragments and what is probably burnt sod, but bone seems to have been used for fuel increasingly in later phases. Figure 18 also indicates a marked increase in the burning of seal bones in later periods. The relative percentages of burnt seal and caprine bones remains fairly equal until the AU 6–8 period (*c.* A.D. 1636–1800), where burnt seal bones outnumber burnt caprine bones by a factor of two to one. Marine mammal bone would serve as a better fuel in a colder/wetter climate (marine mammal bone is greasier and longer burning than caprine bone), and it is possible that this pattern also signals a Little Ice Age impact.

Butchery patterns

Several observations can be noted about the Svalbard assemblage. All portions of the skeleton of the major taxa are represented in the collection, both meat bearing and low meat-value elements. On-site butchery seems likely, with consumption and food processing debris mixed in the refuse. Horncores are regularly removed from crania, and several show signs of cut marks suggesting that the horn sheath was removed. Several sheep crania show evidence of production of the traditional dish *svid*, being carefully split on the sanities plane. *Svid* evidently extends back not only to the Commonwealth but also to earlier Viking times.

Also of interest is the technique of marrow extraction from sheep metapodials. Circular punctures in the proximal articular facets and the posterior-plantar surface of the diaphysis near the distal end occur for most of the sample. Longitudinally split metapodials are only found in the earliest of the Svalbard levels.

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The proximal/posterior-plantar punctures of caprine metapodials seems to be a characteristically Icelandic and Shetlandic feature (Bigelow 1991) in the later medieval and early modern periods, but this butchery technique does not seem to be a feature of the Viking Age. A recently excavated archaeofauna dated to the mid-10th century from Granastadir in Eyjafjörð shows only split, and no punctured caprine metapodials (Bjarni Einarsson, pers. comm. 1991; Amorosi in progress). Archaeofauna from Greenland, Ireland and Norway do not exhibit this pattern of butchery even in later medieval times. At present there is no clear explanation for the distribution of this butchery pattern in these two very different parts of the Late Norse/early modern world (discussion in Bigelow 1992 in press).

Summary

Svalbarð's archaeofauna demonstrates a number of diachronic patterns consistent with 'hard times' signatures that Ogilvie (1981) reports in the historic Icelandic annals. The cattle and caprine ratios show a shift from 1 cow : 4–5 caprines to 1 cow : 6–7 caprines. There is a jump in lamb mortality over time as the climate deteriorates. Sealing becomes more frequent throughout the Commonwealth and into the early modern periods, suggesting the worsening impact of sea ice in the Þistilfjörður area. The height of the Little Ice Age cooling sees a time of marked stress. The farmers at Svalbarð apparently attempted to draw upon an increasingly wider range of resources, including famine foods.

The Svalbarð investigations of 1986–88 produced a rich body of data documenting over eight centuries of life in northeastern Iceland. The analyses of these collections are still underway, and it must be expected that further research will modify some of the patterns reported here. However, it seems clear that the midden deposits at Svalbarð document a dramatic change in North Atlantic climate and human resource use between the days of the Commonwealth and the 17th – 18th centuries.

Note

Recently a radiocarbon date from a sheep scapula from AU3 yielded an uncalibrated date of 810 ± 60 BP for C_{14} age at 1 sigma (Beta–52970, author's reference 385–sheep scapula). The C_{14} adjusted age is 850 ± 60 BP.

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