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Ancient Harp Seal Hunters of Disko Bay

Subsistence and Settlement at the Saqqaq Culture Site Qeqertasussuk (2400-1400 BC), West Greenland

Morten Meldgaard

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The Qeqertasussuk site (photo: Bjarne Grønnow).

Preface

In 1983 Qasigiannguit Museum undertook systematic surveys covering much of Qasigiannguit municipality in order to identify and map the municipality's archaeological remains and cultural heritage.

One evening in August Bjarne Grønnow and Aappa Magnussen, finalizing a day's survey work in Sydostbugten, moored their small boat at the easternmost point of the Qeqertasussuk island. They climbed the raised beaches that connect a small knoll with the island proper and there on the ridge they discovered stone tools of Saqqaq Culture type and stone set fireplaces. In itself the discovery of traces from the first people to inhabit West Greenland was interesting, but the most exciting finds were revealed in the eroding profile along the northern shore where the sea had exposed permafrozen midden deposits with extraordinarily well preserved bones, wood, baleen and feathers. A carbon-14 dating confirmed that the midden deposits were in fact of Saqqaq Culture origin. It was clear that a fortunate combination of permafrost and a protective vegetation cover had preserved the site with what appeared to be both habitation areas and midden deposits, providing a unique opportunity to study these early settlers and their daily life.

Qasigiannguit Museum realized the site's research potential and launched a major interdisciplinary project with the Greenland National Museum, the Danish National Museum and the Zoological Museum of the University of Copenhagen as principal collaborators. The then director of Qasigiannguit Museum, Torben Simonsen, hired archaeologist Bjarne Grønnow as leader of the project and the present author as archaeozoologist and coordinator of the natural science investigations. Through the following 5 years Torben provided financial and logistic support for both field work and laboratory work. It was Torben and his logistics assistant carpenter Egon Geisler that made it possible for us to concentrate one hundred percent on science.

My zooarchaeological work was supported by a 2,5 year joint grant from the Danish Research Councils (Natural Sciences and Humanities), by a six month special grant from the Commission for Scientific Research in Greenland, and by a one year employment at Qasigiannguit Museum. It was carried out under the auspices of the Zoological Museum, University of Copenhagen where my mentor and colleague Dr. Kim Aaris-Sørensen, apart from undertaking a summer's fieldwork at Qeqertasussuk, also provided invaluable support and guidance. The Zoological Museum served as my scientific base for 14 years while I was a university student and during my PhD and Post Doc. years and it is from my colleagues there, especially Jeppe Møhl, Knud Rosenlund and the late Ulrik Møhl and Christian Vibe, that I received the inspiration and training which allowed me to undertake the present work and for all of which I am most grateful.

Sixteen years have passed since the Qeqertasussuk excavations were terminated in 1988 and it may seem a long time for the processing of the zooarchaeological data and for writing it up. The reason for the delay is that my career took a new direction in 1990 when I took on the directorship of the Historical Archaeological Experimental Centre in Lejre. Fortunately, the Danish Research Council of the Humanities supported the project "Man, Culture, and Environment in Ancient Greenland" (1995-1997) which again provided financial support for the final analysis of the faunal material from Qeqertasussuk. In this process the archaeologist Jens Fog Jensen proved an invaluable help and I was able to bring my work to a near closure.

Also, I have been fortunate to have been part of a North Atlantic network of scientists who have incessantly pushed the "frontier" and thus helped me put my own work into context and perspective. I would like to thank Professor Noel Broadbent, Umeå University; Director William Fitzhugh, Smithsonian Institution; Director Susan Kaplan, Bowdoin College; Professor Tom McGovern, Hunter College; Dr. Priscilla Renouf, Memorial University and Dr. Claus Andreasen, National Museum of Greenland for keeping me engaged and not giving up on me during my administrative years.

Many are the people that have been involved in the Qeqertasussuk Project and in the related subsistence studies. More than 50 scientists, students and helpers were involved in the fieldwork and in the subsequent data processing. Some spent many months working in and with midden deposits, faunal remains, and subsistence questions and I would like to thank Hans Lange, Thomas Berg, Maria Steenholt, Josephine Nyman Petersen and Elisa Evaldsen, all students at the time at Ilisimatusarfik in Nuuk and at the University of Copenhagen, for their endurance and skilful assistance. Also, the photographer Geert Brovad of the Zoological Museum who meticulously documented all interesting details "in situ" and Lektor Erik Brinch Petersen of the Institute of Prehistory, University of Copenhagen who, by his example, reminded us of the importance of meticulous archaeology even when the air is filled with snow and the fingers are numb from the cold. Warm thanks are also extended to the local informants who, based on their own experience in the area, gave us very important information on resource distribution, ice conditions, weather patterns etc. Finally, I would like to thank T. R. Larsen, then Director of Qasigiannguit Museum, who made my field work in April 1987 possible and gave me a fine first hand introduction to the sea ice and animal life of Disko Bay.

The interdisciplinary approach was strongly emphasized throughout the project and scientists from many fields added to the understanding of the daily life of the inhabitants at the site and of the natural conditions under which they lived. The natural sciences were represented by Jens Böcher of the Zoological Museum, University of Copenhagen (paleoenthomology), Bent Fredskild, Botanical Museum, University of Copenhagen (plant macrofossils and palynology) and Charlie Christensen, National Museum of Denmark (stratigraphy and quaternary geology). Subsequently, Böcher and Fredskild (1993) published "Plant and arthropod remains from the paleo-Eskimo site on Qeqertasussuk, West Greenland" and Charlie Christensen (1990) produced the report "Geologiske Undersøgelser på en palæoeskimoisk boplads i Diskobugten, Vestgrønland". Jens, Fredskild, and Charlie all did an excellent job, for which we are most grateful.

Preliminary results from the zooarchaeological work at Qeqertasussuk have been presented earlier (Meldgaard 1995, 1997) and Bjarne Grønnow has published a number of scientific papers on the site's cultural history (Grønnow 1988, 1990, 1994, 1996, 1997).

Public outreach and education were important elements in the Qeqertasussuk Project. Through all field seasons we were visited daily by local people who came to see and learn, and we had regular visits by local and national radio and TV. The discoveries were well known to most Greenlanders during those years. Supported by the Nordic Council, T. R. Larsen in 1988 oversaw the production of a slideshow for school use and a travelling exhibition that visited the Nordic countries. Also, popular articles were produced to inform a broader public of the Qeqertasussuk Project (Meldgaard 1987c, 1988b; Grønnow and Meldgaard 1986, 1988, 1989, 1991) and the results found their way into educational textbooks (Meldgaard 2001) and monographs (Gulløv in press).

The city council of Qasigiannguit strongly supported the project and in 1998 Qasigiannguit Museum, represented by its director Jens Fog Jensen, opened a permanent exhibition "The First People" based on the Qeqertasusuk findings (Jensen n.d.). Fittingly, the exhibition is housed in Greenland's oldest wooden house, beautifully situated by the harbour front.

With the publication of the present volume I feel a weight has been lifted from my shoulders. Had it not been for my old friend and companion Bjarne Grønnow, whose interest in my work and encouragement to push on never ceased, this book would probably not have seen the light of day. Thanks Bjarne!

Today all artefacts from Qeqertasussuk are stored at Qasigiannguit Museum, while the faunal material, according to a general agreement between the National Museum of Greenland and the Zoological Museum, University of Copenhagen, is stored at the Zoological museum in Copenhagen.

Abstract

Meldgaard, Morten 2004. Ancient Harp Seal Hunters of Disko Bay. Subsistence and Settlement at the Saqqaq Culture Site Qeqertasussuk (2400-1400 BC), West Greenland. Meddelelser om Grønland, Man & Society Vol. 30. Copenhagen, Danish Polar Center, 2003. 189 pp.

The Saqqaq Culture site Qeqertasussuk (2400-1400 BC) is situated in the south eastern corner of Disko Bay, West Greenland. The site was excavated between 1983 and 1987 by Qasigiannguit Museum. The stratified cultural deposits are exceptionally well preserved by permafrost and yielded hundreds of thousands of animal bones, feathers, plant remains, insect remains, wooden implements, and a wealth of other organic refuse as well as stone tools, house ruins, stone set fireplaces and other traces of habitation.

In order to understand the life conditions of the inhabitants at Qeqertasussuk, a comparative survey of the historic distribution, density and availability of the living resources in the area is undertaken. This resource model is then evaluated against the paleo-environmental data. Also, comparative ethnohistorical and ethnographic data on the exploitation of the living resources in the area is presented.

Subsistence and subsistence change at Qeqertasussuk is studied through a comprehensive analysis of the faunal material that consists of more than 200,000 animal bones. Quantitative methods are supplemented by detailed studies of seasonality and age composition of the hunting bag. Forty three species of animals are represented. Harp seal and ringed seal represent the most important game, but sea birds such as fulmar, Brünnich's guillemot, and little auk also play a significant role in the subsistence economy. Fish, especially Atlantic Cod, have been caught and remains of large whales indicate that these animals were utilized, but it can not be decided whether they were actively hunted. Most of the game was taken close by the site, however finds of caribou indicate that inland caribou hunting was undertaken and that Qeqertasussuk was part of a larger subsistence-settlement-system. Several species of plants were also utilized.

Temporal changes in the composition of the faunal material indicate that significant changes occur in the subsistence at Qeqertasusuk. Four phases are identified: (1) Base-camp period I (2400-2100 BC). A pioneer phase where the site is used as a year-round base camp with more than 90% of the biomass being harvested within an area of approximately 80 km^2, (2) Base-camp period II (2100-1900 BC), which seems to be the period of most intensive use and where new methods (probably netting) of harp seal hunting are introduced, (3) Hunting camp period (1900-1700 BC), where the site becomes more specialized and more seasonal with a focus on spring-summer hunting for harp seals, (4) high activity period (1700-1400 BC) indications of continued heavy sea mammal hunting.

The site is abandoned around 1400 BC. The causes of the abandonment of Qeqertasussuk is discussed and the impact of the general cooling around 1500 BC on key resources such as harp seal and capelin is highlighted.

Keywords: Greenland, Saqqaq Culture, Qeqertasussuk, Subsistence, Harp Seal hunting, Zooarchaeology, living resources

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Chapter 1

Introduction

The study area

The Arctic is an excellent place to study prehistoric cultural adaptation and subsistence dynamics. A cold climate, low species diversity, extreme seasonal variability and temporal changes in resource availability have promoted the development of arctic cultures with specialized hunting technologies and flexible procurement strategies. The balance of life and death in these regions is delicate, and slight changes in the distribution and availability of game may have decisive effects on subsistence and survival. To the researcher the simple Arctic ecosystems and strong effects of environmental change on human life provides a natural laboratory situation where the interrelationship between man and his environment stands out more clearly than in most other parts of the world.

As a study area Greenland provides additional value through its peculiar geography which can best be described as a 6000 kilometres long chain of islands surrounding the Greenland Ice Cap. This archipelago is in contact with the North American continent to the northwest, and through this high arctic

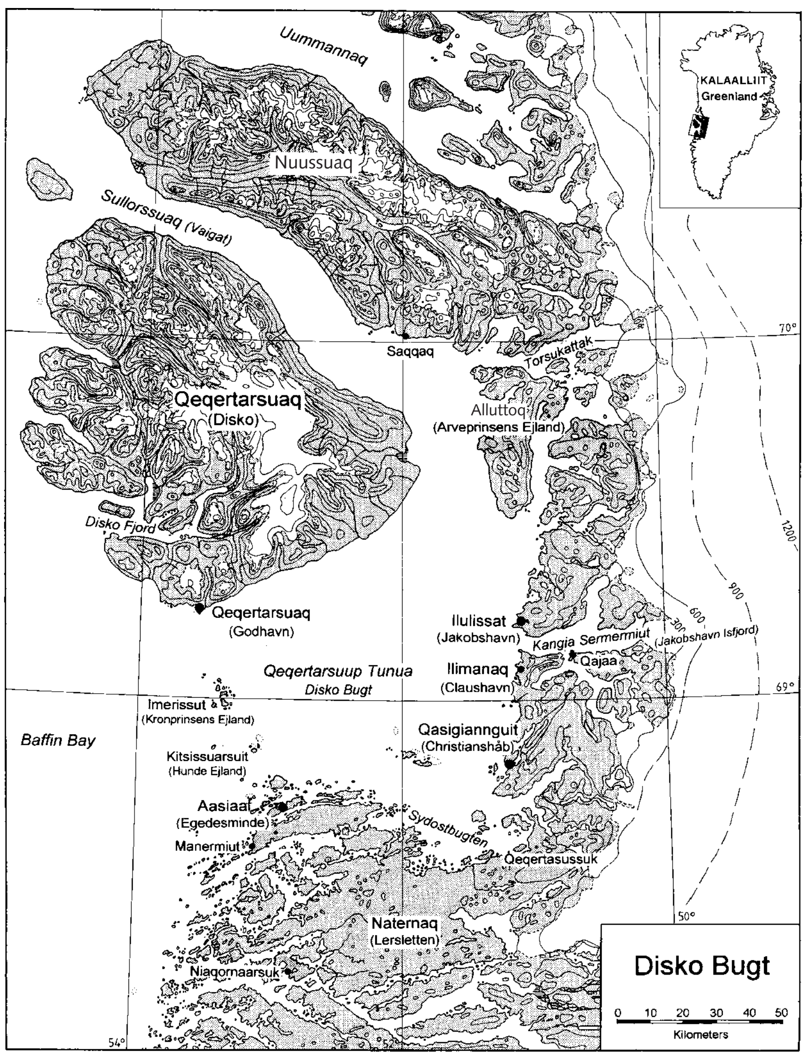


Fig. 1.1. Map of Qeqertarsuup Tunua (Disko Bay). The Qeqertasussuk site is situated in the southeasternmost corner of the bay well protected from the fog and waves of Baffin Bay.

Fig. 1.2. Qasigiannguit Museum instigated the Qeqertasussuk Project in 1984. The archaeological collections from Qeqertasussuk are all housed at the museum and a significant part of them are now on permanent exhibition (photo Morten Meldgaard).

gateway people have flowed into Greenland. The limited access only allows people well acquainted with the arctic way of life to enter Greenland. Also, the narrow coastal band of habitable islands restricts long distance movements to movements parallel to the coast. Together, these topographical constraints on human behaviour simplify the setting and improve the conditions for understanding some of the mechanisms that govern the dynamics of prehistoric societies (*e.g.* Grønnow *et al.* 1983; Meldgaard 1986).

The geographical focus of the present study is Disko Bay in central West Greenland. The bay is a biologically highly productive environment with a relatively high species diversity due to its position at the confluence of Atlantic and Arctic biospheres (Meldgaard 1995, 2001). Disko Bay is also known for its exceptionally rich archaeological record with well preserved organic materials ranging from 4500 BP to the present (*e.g.* Steenstrup 1873; Solberg 1907; Meldgaard 1952; Larsen and Meldgaard 1958; Mathiassen 1958; Møbjerg 1986; Møhl 1986; Andreasen 1998; Gulløv in press) and for its outstanding and detailed historical and ethnohistorical record of the living resources and their exploitation (*e.g.* Rink 1855; Ostermann *et al.* 1921).

The Saqqaq Culture site on Qeqertasussuk

In recent decades archaeological research in Disko Bay has focused on the Paleoeskimo cultures of the area and, in particular, on the pioneering Saqqaq Culture (2400-800 BC) (*e.g.* Meldgaard 1983; Grønnow 1994; Olsen 1998; Jensen 2000). An important product of this research focus has been the investigation of two major Saqqaq sites, namely Qajaa at Jakobshavn Isfjord and Qeqertasussuk in Sydostbugten. These sites are unique in the Eastern Arctic for their exceptional conditions of preservation due to the protective actions of permafrost. Literally hundreds of thousands of animal bones, tons of cooking stones, perfectly preserved wooden implements, and an impressive variety of organic materials and tools provide a rare opportunity to study the subsistence economy and cultural history of these early settlers. Qajaa has been test-excavated (Meldgaard 1983; Møhl 1986) and the Qeqertasussuk site has been the target of 7 field seasons of comprehensive interdisciplinary studies.

Research objective and approach

This case study will present the results of the zooarchaeological investigations of the Qeqertasussuk site and attempt to draw a picture of everyday life at the settlement 4000 years ago. Focus will be on subsistence economy and settlement systems and on the dynamics of the natural and cultural environment in Sydostbugten.

The contextual approach chosen has been inspired by the works of scholars such as Fitzhugh (1972), Binford (1978) and Møhl (1978) and methodologically it is supplemented by the North European

Fig. 1.3. The field crew of 1985. From left to right: Anne Mette Olsvig, Hans Lange, Per Ole Rindel, Morten Meldgaard, Appaa Magnussen, Bjarne Grønnow, Geert Brovad (photo Geert Brovad).

mesolithic excavation tradition in which we were trained (*e.g.* Troels-Smith 1955; Clark 1972; Petersen 1972; Andersen 1974).

The present study is also a maritime development of a research strategy developed while working on the interior caribou hunting site Aasivissuit in the Sisimiut district in the 1970's (Grønnow *et al.* 1983; Meldgaard 1986). The approach is "holistic" in the sense that much effort is put into a comprehensive analysis of the landscape and the life in it, and of the general archaeology and ethnography of the area. These data sets form a basis for comparison which allows us to paint a more detailed and complete picture of daily life at Qeqertasussuk.

In many ways this approach is similar to the approach that the hunter must take in order to decide whether it is time to go fishing, sealing or caribou hunting. First every relevant piece of information has to be taken in and processed on the basis of experience and faith and then you draw your conclusion, make your decision, and act.

During the long process of collecting bits and pieces of environmental data, there were times when I felt I had it all in my head and that a three dimensional picture of a living past was being formed. It is my hope that the present study will provide the reader with a similar experience, and that you may see the contours of a small group of hunters carrying out their daily routines and hunting trips in the vicinity of Qeqertasussuk 4000 years ago.

The book's construction

The scientific step by step approach is reflected in the construction of the book:

Chapter *"2. The Present Environment"* aims to describe the natural environment in sufficient detail to demonstrate the physical and biological universe of Sydostbugten. Special focus is on the seasonal, and long and short term changes in resource availability, which are of importance to the development of settlement systems and to the long term sustainability of human societies in the area. Also, it is the aim to provide some generalizations concerning resource distribution and availability which have a bearing on subsistence and settlement. Chapter *"3. The Paleo-environment"* adds a time perspective to the environmental presentation and based on the paleo-environmental data the reconstruction of the conditions of life 4000 years ago is discussed.

Chapter *"4. Ethnography"* presents a study of subsistence and settlement at the historic Akulliit settlement situated 10 kilometres from Qeqertasussuk. This case study is primarily meant as a visualization of how people, still to a large extent living off the land, have adapted to the specific resource conditions in Sydostbugten and, as such, it can be used as a basis for comparison once Sydostbugten's prehistoric subsistence settlement systems have been laid out. However, it is also possible to draw some generalizations from the ethnographic data which are relevant to the interpretation of the archaeological record.

In chapter *"5. Archaeology"* a survey of the archaeology of Sydostbugten is presented. Specific focus is on the Saqqaq sites many of which were located during systematic surveys undertaken in connection with the present study. By the end of this chapter the reader should be equipped to deal with the following chapters on the Qeqertasussuk site itself where chapter *"6. Excavations"* introduces the excavation strategy and provides stratigraphic descriptions, C-14 datings and comments on preservation etc. all of which provide the foundation for the culture historical analysis.

Chapter *"7. Man, dog and material culture"* is a short introduction to the material culture of the inhabitants and especially to that part relating to subsistence. For in-depth analysis of artefacts and material culture, the reader is referred to Bjarne Grønnow's publications (Grønnow 1988, 1990, 1994, 1996, 1997). In chapter *"8. Faunal material"* the faunal remains are introduced along with discussions on identification problems, quantification methods and aging techniques. Combined with the data from earlier chapters, this information should allow the creation of a more complete picture of the subsistence economy and daily life on Qeqertasussuk. This picture is painted in chapter *"9. Subsistence"* where a systematic survey of the species hunted is presented and in chapter "*10. Subsistence and settlement*" where a synthesis of the data is given within a chronological framework.

Chapter 2

Present environment

Landscape

Disko Bay forms the largest open bay in central West Greenland (Figure 1.1 & 2.1). It extends *ca.* 150 kilometres from north to south, and 100 kilometres from east to west. To the north and west, the bay is delimited by the Nuussuaq Peninsula and the large Disko Island both rising to an altitude of almost 2000 m a.s.l. and both with local ice caps. The pre-Quaternary geology of Disko Island and Nuussuaq mainly consists of Cretaceous sandstones overlaid by Tertiary basalts (Henderson *et al.* 1976) and the landscape is characterised by Tertiary plateaus that have been heavily dissected by glaciers during the Quaternary.

The eastern part of Disko Bay is delimited by a *ca.* 50 kilometre wide land strip separating the bay from the Greenland Inland Ice. Several east-west oriented troughs and fjords dissect the land. In the central and northern part of Disko Bay the Inland Ice flows into two huge glacier fjords of Torsukattak and Kangia (Jakobshavn Isfjord) which are among the most productive in the Northern hemisphere.

South of Disko Bay, the landscape is dominated by flat raised marine deposits. Naterneq (Lersletten or the "Clay Plain"), as it is called, is crisscrossed by streams and rivers that connect hundreds of ponds and lakes. Naterneq forms the northern part of the central West Greenland mainland which at this point is approximately 150 kilometres wide. The mountains consist of gneiss and the low relief landscape (less than 500 m a.s.l.) has for a large part been formed by glacial scouring during the Quaternary glaciations (Escher and Watt 1976; Sugden 1974).

Sydostbugten (Figures 2.1 and 2.2), the geographical focus of this work, is an approximately 400 km^2 large protected bay in the southwestern part of Disko Bay, central West Greenland.

Sydostbugten has several islands: Tussaaq, Akulliit, Saarlat and Qeqertasussuk, ranging from 6 to 20 km^2 in size. They are supplemented by numerous small islets characterised by fine vegetation cover, low relief and sandy beaches. A little further west, Kitsissunnguit (Grønne Ejland), a small archipelago of luxuriantly vegetated bird-islands, protects Sydostbugten from the heavy seas coming from Davis Strait and Disko Bay.

Fig. 2.1. Sydostbugten seen from the East. The arrow points to the Qeqertasussuk site. Baffin Bay is seen in the horizon (photo 1948, courtesy of the Danish National Survey and Cadastre).

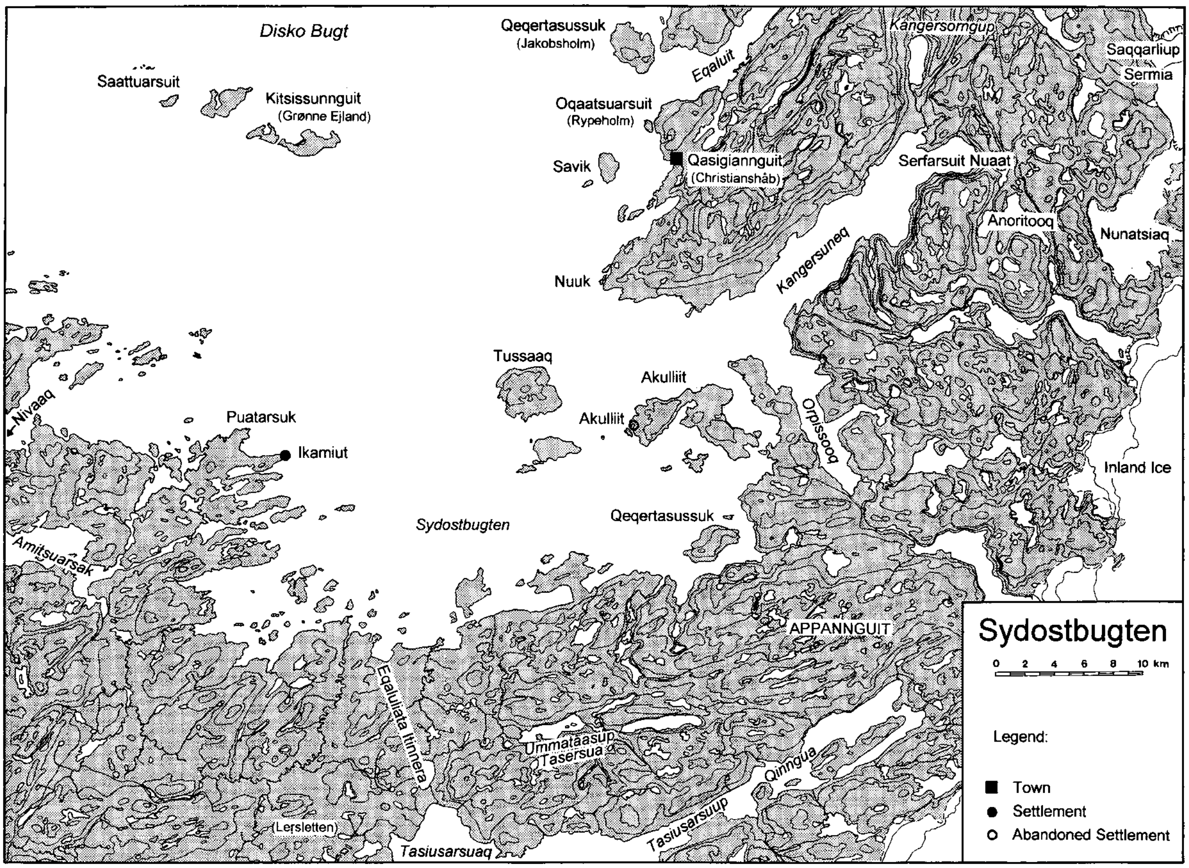


Fig. 2.2. The island of Qeqertasussuk with the Qeqertasussuk Site is tucked away in the southeastern corner of Sydostbugten.

Seascape

Bathymetry

The mouth of Disko Bay is delimited to the west by a submarine mountain range. The islands Kitsissuarsuit (Hunde Ejland) and Imerissut (Kronprinsens Ejland) are parts of this range. This underwater barrier is dissected by some up to 600 meter deep troughs that allow the deep sea currents to enter the bay. The bay itself has an average depth of approximately 400 meters, while Sydostbugten and Kangersuneq fjord average depths of between 100 and 200 metres. The bay's bottom sediment forms a fine substrate for marine benthic life (Andersen 1981a, 1981b; Bertelsen *et al.* 1989).

Shallow water areas are rare. Mostly they are quite local in nature, for instance at the head of fjords where sediment from rivers and streams is deposited (*e.g.* Orpissooq, Kangersuneq and Appannguit) and where beaches are formed through wave action and water transport of sediments (*e.g.* Saattut and Ilimanaq). However, the western part of Sydostbugten, which forms an underwater extension of Lersletten, is generally quite shallow (Porsild 1921:93).

Oceanography

The West Greenland current feeds into Disko Bay partly as deep warm water (below 200 metres) and partly as warm surface water. In the deeper parts of Disko Bay (below 2-300 metres) the year round temperature averages up to 3.5°C. However, in the upper 100 metres of the water column, there are marked seasonal temperature changes. In winter the sea temperature declines to approximately –1.75°C and in summer it may reach as high as 12°C.

Sydostbugten is well protected and the surface water becomes warmer than in any other part of Disko Bay. The average monthly values are: June: 4.1°C, July: 6.8°C, August: 7.2° C, September: 5.2°C, October: 2.4° C and November: 1.1°C. On average the surface temperature in Sydostbugten from June to November ranges one degree above the rest of the bay and up to 2.9°C above surface temperatures off Aasiaat (Andersen 1981b).

Tide

The spring tidal range at Aasiaat near the mouth of Disko Bay is *ca.* 4.1 meters while the difference in Sydostbugten for topographical reasons is reduced to *ca.* 2.5 meters (Porsild 1921:93; Bertelsen *et al.* 1989; Anon. 1990). The tide enters Disko Bay from the west, creating strong currents *e.g.* in the narrow straits of Nivaaq and Amitsuarsuk. From here it runs into Sydostbugten and then follows the coast northwards. In summer the tidal currents thus keep Sydostbugten clear of icebergs from the more northerly situated glacier fjords and in winter they create small polynias and thin ice in narrow straits, off promontories, between islands, and between islands and the mainland (Porsild 1921:93).

Climate

Temperature and precipitation

The climate of the inner parts of Disko Bay is of a low-arctic continental type (Figure 2.3). The average annual temperature is *ca.* –6°C and the average annual precipitation is *ca.* 230 millimetres, distributed over *ca.* 100 days (ca. 70 days in the form of snow). The wind force is generally low with *ca.* 100 days of calm per year and *ca.* 10 days of storm per year (Hammer 1921; Friis-Nielsen and Sveistrup 1944; Berthelsen *et al.* 1989). The winters are cold, dry and calm with an average monthly temperature from January to March of between –10°C and –15°C. Winter precipitation is low, averaging *ca.* 5 millimetres from January to March. Winter snow cover is consequently quite limited.

The average temperature increases rapidly from the winter low of *ca.* –5°C to above freezing in May, and positive average monthly temperatures prevail until September. In July temperatures reach their highest with an average of *ca.* 8°C. Precipitation is low in spring, averaging between 10 and 20 millimetres for April and May, but increases in the summer months of June, July and August reaching average values of between 20 and 30 millimetres.

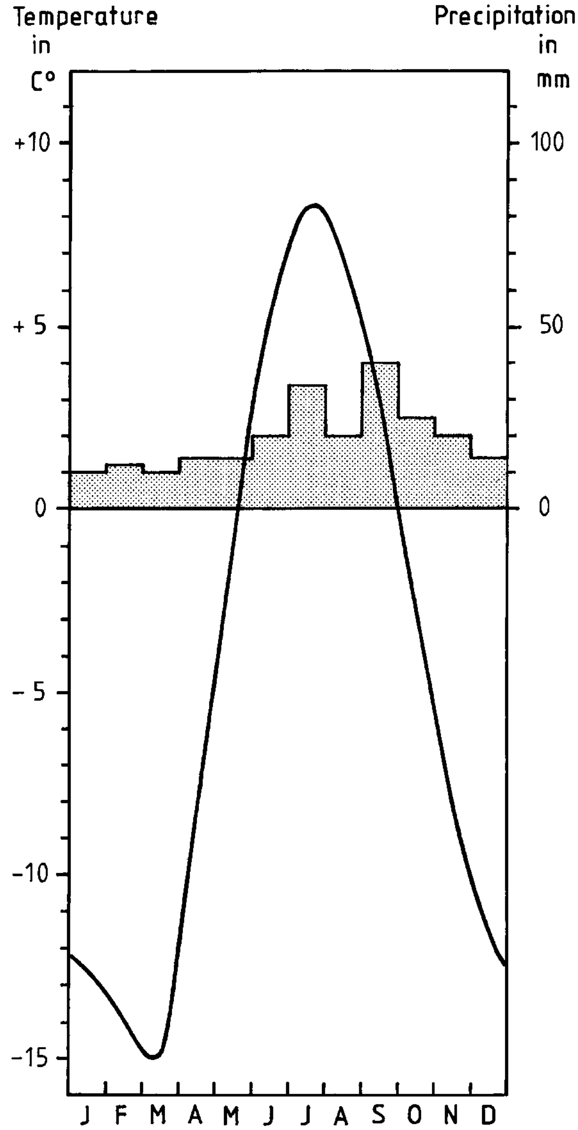


Fig. 2.3. The climate of the protected inner parts of Disko Bay is of a low-arctic continental type. The annual change in temperature and precipitation in Ilulissat (Jakobshavn) serves as an example (Berthelsen *et al.* 1989:32).

The fall and early winter months of October, November and December experience a temperature drop from 0°C to –12°C and a relatively high monthly average precipitation of between 15 and 25 millimetres (Berthelsen *et al.* 1989).

Wind conditions

During summer, the prevailing winds are southerly and westerly, while fall, winter and spring experience prevailing winds from the east. Storms may occur at all times of the year and are often of a highly local

Fig. 2.4. The calm and protected Qasigiannguit district is well known for its fine sea ice conditions. Dog-sledging, ice-hunting and fishing have always been common practices in the area (photo: Morten Meldgaard).

nature. This has to do with the occurrence of the warm katabatic winds, whose development is influenced by the Inland Ice and by local topographical features. These winds may develop very quickly and can be quite destructive (Porsild 1921; Friis-Nielsen and Sveistrup 1944; Berthelsen *et al.* 1989).

Insolation

There are large seasonal differences in insolation. The period of winter darkness in Sydostbugten begins around the 2nd of December and lasts until the 12th of January. Day length then increases until the 22nd of May when the sun takes over and stays permanently above the horizon until the 23rd of July (Villadsen 1984; Berthelsen *et al.* 1989).

Icescape

The southeastern part of Disko Bay is a relatively sheltered area and the winter ice cover is generally more stable, and is present for a longer period of time, than is the case in any other part of Disko Bay (Figure 2.4). The Qasigiannguit district is known as a district with fine conditions for dog sledging and ice-hunting and -fishing (Rink 1855:113; Anon. 1886:3).

Freeze-up

Ice formation starts in calm fjords and bays such as the heads of Kangersuneq and Orpissooq, Qoornua, the archipelago south of Ikamiut and the sheltered archipelago just south of Akulliit (Karl Olsvig, Villads Olsvig, Ane Møller, Søren and Kathrine Thorning, inf. 1986). Usually it takes place in late November or early December, but often initial ice formation will not occur before January or February (Anon. 1886; Ostermann *et al.* 1921:147; Porsild 1921:94; Søren Frederiksen, inf. 1986). As ice formation proceeds, Sydostbugten is the first large body of water to become bound by land fast ice. This normally takes place in early January. The ice edge moves quickly further west and soon Kitsissunnguit is surrounded by ice fields. If the weather is calm and the temperature low, ice formation can occur within hours over large areas (Fabricius 1988) and ice may in such cases cover all of Disko Bay in a matter of days (Ostermann *et al.* 1921: 147-8; Porsild 1921; Boye Møller, inf. 1986).

Sassat

If freeze-up is very rapid and the ice formation process starts in the outer part of a closed body of water a natural animal trap or "Sassat" may develop. Flocks of mammals and birds may be trapped (Figure 2.5). Harp seals, white whales, narwhal, killer whales, humpback whales, little auks and Brünnich's guillemots have been caught under such circumstances (Porsild 1916). They will be able to keep an opening from freezing for some time, but eventually the hole will freeze over and the animals will die. The protected waters of Sydostbugten (Porsild 1921:94) are especially favourable for the development of such sassats, but also Disko Bay itself has been the scene of many sassats. Sassats may result in the deaths of anywhere from a few to more than a thousand animals. Often white whales are

Fig. 2.5. "Sassat" – whales trapped in sea ice because of rapid freeze-up in Disko Bay. Drawing by Jakob Danielsen (1888-1936) (Rosendahl 1967:298).

trapped together with narwhal, but in Sydostbugten the white whales seem to dominate the sassats (Rink 1852:111; Winge 1902:509; Porsild 1916; Rosendahl 1942:66; Anon. 1944; Golodnoff 1956; Kasper Didrichsen, inf. 1986).

Ice quality

The thickness of the sea ice depends on winter temperatures and wind conditions. Usually it reaches a thickness of about 70 centimetres (Hammer 1921:3; Riis-Carstensen 1948:75), but if the weather has been calm and cold for an extended period of time, it may become much thicker (Anon. 1885:6, 1896:92, 1924: 256).

The smoothness of the ice surface is very variable. The southeastern part of Disko Bay is protected from the swells and waves from Davis Street and the sea ice is therefore mostly even and smooth. But if the weather is stormy during ice formation or if the winter ice is broken up by storms the sea ice can pack. Such packed sea ice may cover substantial areas and form extensive barriers (Anon. 1896:7, 1907:157; Fabricius 1988:164).

The character of the sea ice surface is also dependant on the snow cover. There are large annual variations in the depth of the snow cover and there are large variations in snow depth within southeastern Disko Bay depending on local wind conditions (Friis-Nielsen and Sveistrup 1944; Fabricius 1988). When the snow cover is thick it can weigh the ice down and sea water may seep up, creating a layer of wet snow on the sea ice. Such snow slush can sometimes be seen as darkly coloured areas on the otherwise white surface.

Open water areas and tidal cracks

The ice conditions are greatly influenced by the currents in the sea. Of prime importance is the West Greenland Current that enters the bay from the southwest and which is deflected northwards towards Jakobshavn Isfjord (Andersen 1981b). But the daily tidal currents are also of significance (Porsild 1921:93). The currents melt the ice from beneath and, at locations where the velocity of the current is increased, *e.g.* in shallow watered runs between neighbouring islands, between islands and the mainland or off promontories and peninsulas, there may be open water or very thin ice throughout winter (Rink 1852:110; Porsild 1921:93; Lars Johansen, inf. 1986).

Well known recurring open water areas are found in Tunutta imaa (Frederik Jensen, inf. 1982), in the runs north and south of Tinussaraaq (Ane Møller, Inf. 1986), off Tussaaq's southern point (Ostermann *et al.* 1921; Ane Møller, inf. 1986), off Nuuk and off the promontories at the entries of Orpissooq and Kangersuneq (Ostermann *et al.* 1921) (Figures 2.6 and 2.7).

The tides lift and lower the sea ice and tidal cracks are thus formed everywhere along the shore line. These cracks open and close according to the tide and water is often forced onto the ice surrounding the crack where it freezes and forms a glazed surface (Figure 2.8).

Break up

As insolation increases in spring, ice thickness decreases and open water areas and leads soon develop where the currents are strong (Søren and Kathrine

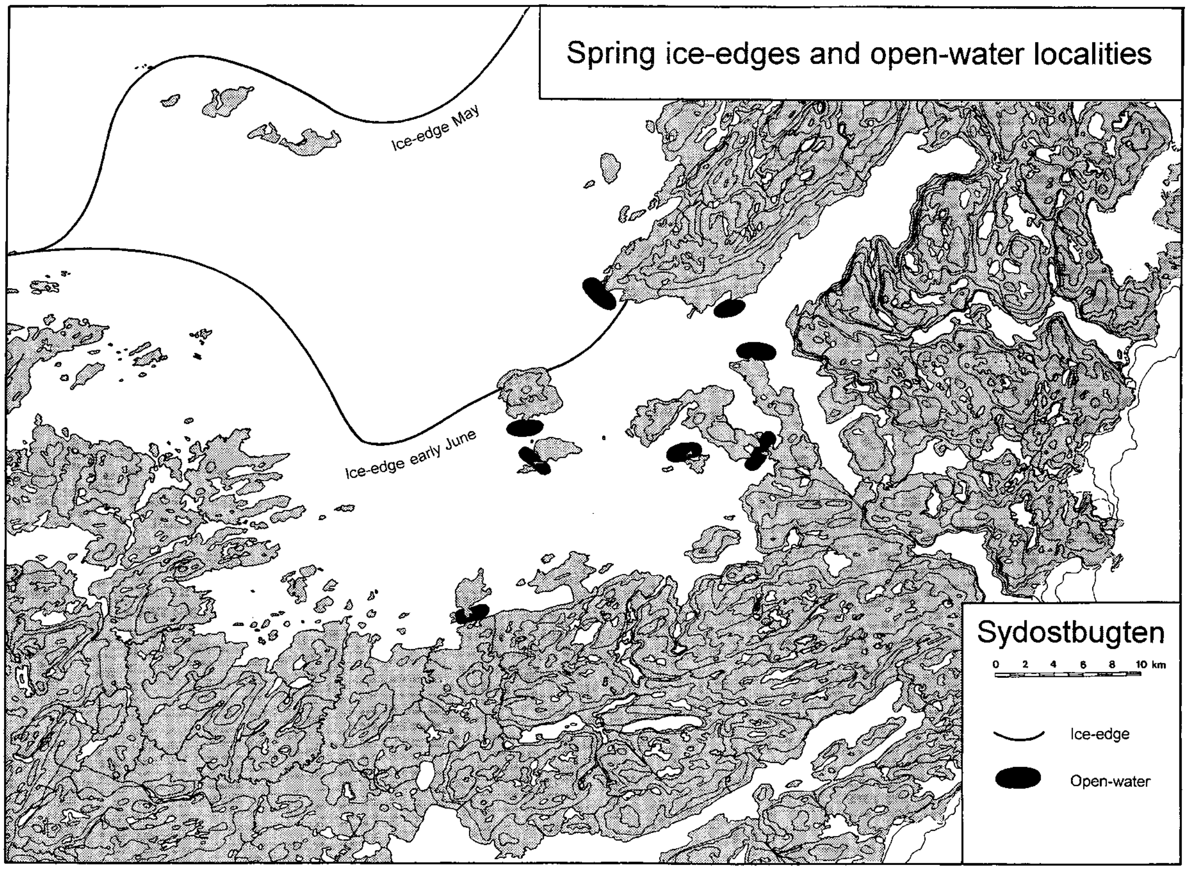


Fig. 2.6. Reoccurring open water areas in the vicinity of Qeqertasussuk and typical stable ice edges in Sydostbugten. Only open water areas in the southeastern part of the bay have been included.

Thorning, Henrik Iversen and Lars Johansen, inf. 1986). The ice in central Disko Bay disintegrates early in spring, usually in April, and gradually the ice edge moves southeast towards Sydostbugten.

The break up pattern is influenced by the position and the sheltering effect of the islands in the area. Usually break up is stopped temporarily at Kitsissunnguit in May, and this "Grønne Ejland ice edge" is

Fig. 2.7. Polynia in Tunutta Imaa, May 1987 (photo: Morten Meldgaard).

Fig. 2.8. Tidal crack along the shore (photo: Morten Meldgaard).

positioned just north of the islands (Figure 2.6) (Ane Møller, inf. 1986). When this ice edge disintegrates, the grip is loosened on the ice fields between Kitsissunnguit and Tussaaq. Soon there is open water in this area and the ice edge comes to a second standstill, usually in early June, at a line stretching from the northwestern shore of Kangersuneq (between Nuuk and Niaqornaarsuk Ilorleq) to Tussaaq and from here to the Ikamiut area (Frederik Jensen, inf. 1982; Karl Olsvig, Jens Vetterlein, Boye Møller, inf. 1986) (Figure 2.6). When this "Tussaaq ice edge" starts to disintegrate, break up proceeds quickly in Sydostbugten and in the more open parts of Kangersuneq and Orpissooq, and by mid-June these areas are ice free (Ostermann *et al.* 1921:126,147; Porsild 1921:94). Particularly protected waters, *e.g.* the archipelago south of Akulliit (Søren and Kathrine Thorning, inf. 1986), Qoornua, the head of Kangersuneq and the archipelago south of Ikamiut, may not become free of ice till late June (Anon. 1982, 1984a).

Open water areas develop quite early in spring where rivers empty into the sea (Fabricius 1988). A good example is the head of Orpissooq where there are two large rivers that empty into the fjord.

Ice cover variability

There are great annual variations in ice cover. Figure 2.9 illustrates the variation in the duration of the ice cover in southern Disko Bay through 19 years from 1916 to 1934. The data, based upon the annual reports from the managers of the Qasigiannguit district, gives a good general impression of the ice conditions of the area (Friis-Nielsen and Sveistrup 1944:11). The length of the period with sea ice varies from winters with hardly any ice formation at all (*e.g.* 1928-29 (Anon. 1933:246)) to winters where the sea ice lies solid from December through June (*e.g.* 1917-18 (Anon. 1924: 246)). These annual differences are also reflected in the reports on ice conditions in Greenland waters from 1966 to 1981 published by the Danish Meteorological Institute (Danmarks Meteorologiske Institut 1981, 1982, 1983a, 1983b, 1983c, 1983d, 1984a, 1984b, 1984c, 1984d, 1985a, 1985b, 1985c, 1985d, 1986a, 1986b) (Figures 2.10A and 2.10B).

In some years the ice cover lies undisturbed throughout the winter. But it is very common that sea ice is broken up by storms once or several times during a winter season (Anon. 1918:293, 1928:328, 1938:17, 1938:252). The timing and the character of spring break up is often determined by wind conditions. A good easterly storm can, for example, turn the ice covered bay into open sea overnight (Anon. 1896:7, 1907:61, 1909:8).

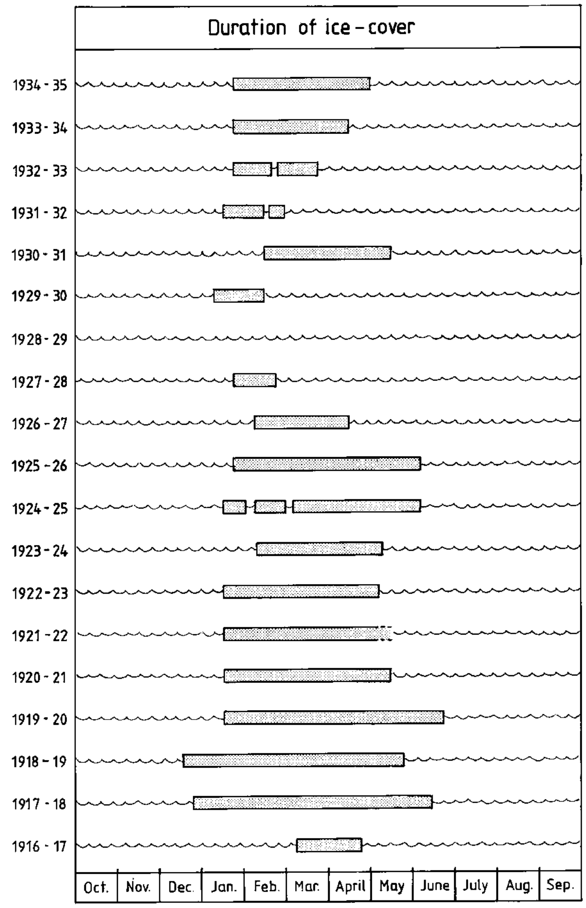


Fig. 2.9. Annual variation in duration of ice covers in Qasigiannguit district (Anon. 1924, 1928, 1933, 1938).

Icebergs, West Ice and East Greenland pack ice

The icebergs produced by the large glaciers in Kangia and Torsukattak are primarily taken north and west by the prevailing currents in the bay, and only few reach the southeastern part of Disko Bay (Porsild 1921:93). However, in most parts of the area it is normal to have several icebergs within sight, either afloat or frozen in.

In most winters, drifting winter ice from western Baffin Bay can be seen in Aasiaat (Egedesminde) district in December and January (Riis-Carstensen 1948:79). This drift ice has been called "Vestisen" (the west ice). Vestisen rarely enters Disko Bay (Anon.

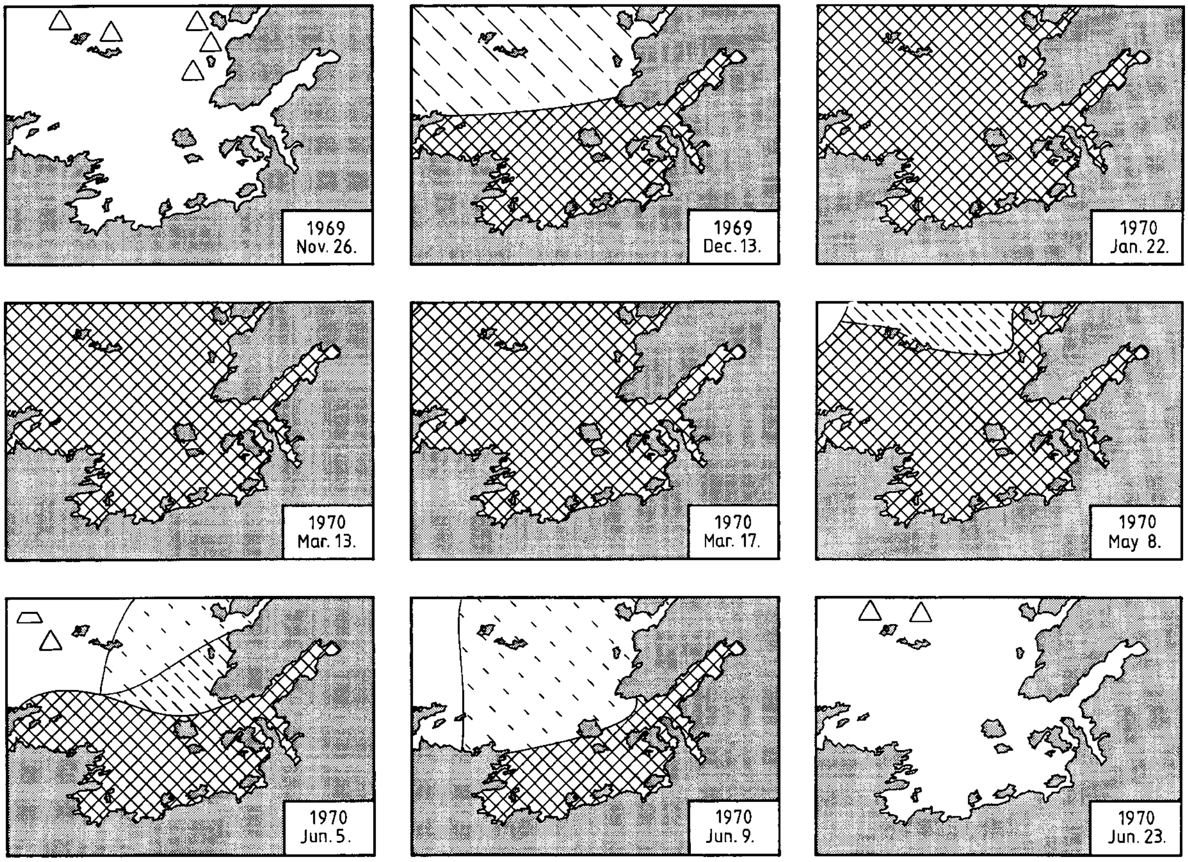


Fig. 2.10 A & B. Variability in ice cover. A: illustrates the development and disappearance of the ice cover in the winter of 1969-70. B: illustrates the development and break-up of the ice cover during the much milder winter of 1979-80 (Danmarks Meteorologiske Institut 1984a, 1984b, 1985d, 1986a).

1907:61, 1924:167, 1933:712) and when it does, it usually stays in the outer parts of the bay. But on a few occasions the west ice may drift far into Disko Bay, even reaching Kitsissunnguit, where it may freeze up with the winter ice (Anon. 1914:1).

East Greenland pack ice is carried northwards by the currents along the West Greenland coast in spring and early summer. Usually it does not reach further north than Nuuk (Godthåb) (Riis-Carstensen 1948), but in certain years it may appear as far north as Disko Bay. This was for instance the case in August 1898 when scattered pack ice was observed (Anon. 1901: 73).

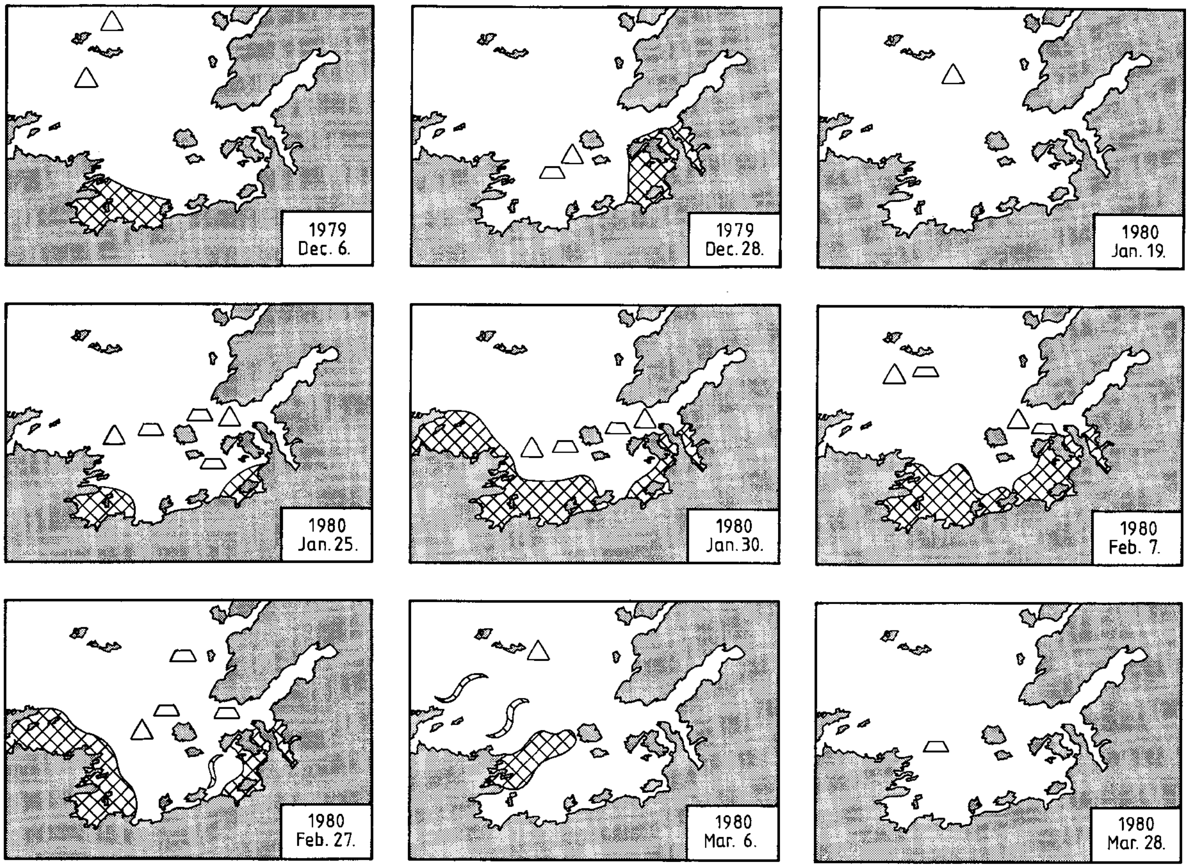
The living resources

Disko Bay is a biologically very productive low arctic marine environment with a high species diversity due to its position at the confluence of Atlantic and Arctic biospheres and due to the up-welling of nutrient rich bottom water caused by the huge glacier fjords that empty into the bay (Meldgaard 1995, 2001; Mikkelsen and Ingerslev 2002).

A rich fauna of benthic and pelagic fish frequent the waters and in summer the shallow bays are crowded with capelin and cod. In their wake, migratory seals such as harp and hooded seal appear, while ringed seal and bearded seal, boat breathing-hole experts, make a living in the area throughout the year.

Whales from the south (*e.g.* pilot whales, hump back whales and killer whales) and whales from the north (*e.g.* bowhead whales and narwhal) come to the bay to feed on the abundant sea life. The many grass-clad islands house large colonies of gulls, terns and eider-ducks and nesting Brünnich's guillemots, kittiwakes, cormorants and fulmars cover many steep cliffs along the shores of the bay and fjords.

Terrestrial animals such as caribou, arctic fox, hare and ptarmigan are encountered in the inland parts of Disko Bay as are many edible plants and



berries. Especially south of the bay on the extensive rolling plains around Lersletten the habitat is suitable for herbivorous mammals and birds.

Resource dynamics

The detailed biology, history and dynamics of each economically significant species is presented in chapter 9. The following section on resource dynamics is based on this data. The reader is referred to chapter 9 for details and references.

All living resources in Disko Bay are characterised by substantial variability at three different but interacting levels, 1) temporal variability, 2) spatial variability and 3) variability in density.

The temporal variability of a species can be subdivided into 1) seasonal fluctuations, 2) fluctuations from year to year and 3) long term changes. Seasonal variability is reasonably predictable, whereas the large inter-annual variations in the distribution and density of most significant living resources occur more at random. At the same time they are superimposed on long term trends in resource distribution and density changes that take place in the course of decades and centuries. The inter-annual variation may often be of a more local nature than long term changes which can involve the whole of West Greenland (Meldgaard 1986, 1995, 2001).

It is evident that the inter-annual variations in resource distribution and density are largely determined by annual differences in weather, ice cover and hydrography. Changes in the physical environment may act directly on the game species for example through changes in ice cover, or indirectly through changes in *e.g.* primary production (Buch 1986).

Seasonal changes in resource density and diversity

The background for seasonal changes in marine resources is the pronounced variation in primary production, which again is affected by changes in insolation and temperature (Figure 2.11).

Many of the species that exploit the waters of

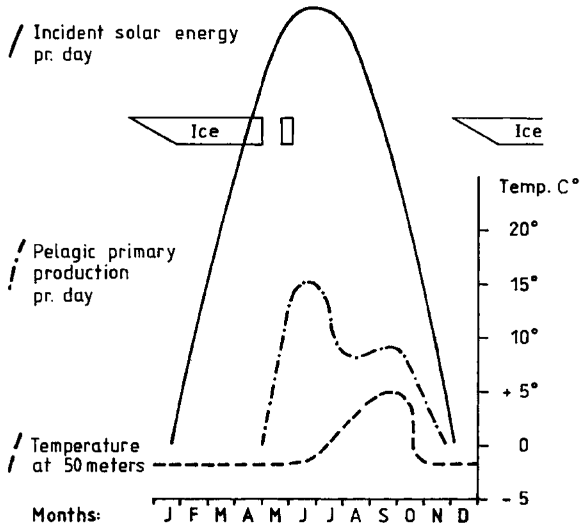


Fig. 2.11. Seasonal variations in insolation have a dramatic effect on temperature and primary production in Disko Bay. These variations in turn influence the timing and occurrence of the marine animals in the area (modified from Petersen 1964).

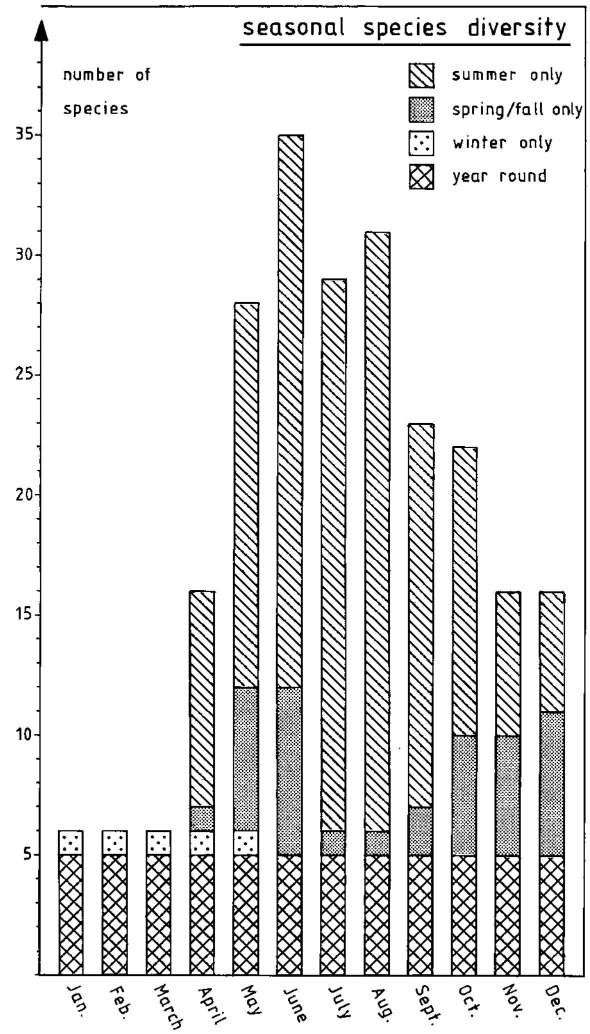


Fig. 2.12. Seasonal changes in species diversity in Sydostbugten. Only marine mammals, bird and fish species of potential economic importance are included.

Sydostbugten during the summer half of the year occur in enormous concentrations at specific locations and often for very short periods of time. Other species are of a more solitary nature and do not occur in significant concentrations, even though they may generally be quite common, while other species are rare. From a human point of view there are a number of plant and animal species that occur in sufficient numbers and concentrations to represent potentially important resources.

Counting all marine mammalian, bird and fish species of economic importance that occur regularly in Sydostbugten, seasonal changes are striking (Figure 2.12). From a winter low of 9 species, diversity increases fourfold during break up to a maximum of 38 species in June. During late summer and fall diversity decreases, and at freeze-up, usually in December, the last summering and the last migratory species have left the area, leaving *ca.* 7 species of fish and 2 species of seals beneath the sea ice.

Only six terrestrial mammals and birds occur around Sydostbugten, and of these five (arctic hare, arctic fox, caribou, ptarmigan and raven) occur year round, while one, the white-fronted goose, only spends the summer in the area. Species such as loons, that breed by freshwater lakes but seek most of their food in salt water, are not considered "terrestrial".

A number of seasonal trends in resource composition, density and distribution emerge from a study of the seventeen significant resource elements (Figure 2.13, 2.14).

(1) There is a resource "boom" in spring. White whales, ringed seals, capelin, harp seals and nesting birds and their eggs are dominant resources in spring. They are extremely abundant and highly concentrated. Capelin and bird eggs serve as practically unlimited resources. The concentrated occurrence of resources is partially due to the social behaviour of the species involved (flocks, colonies) and partially due to the concentrating

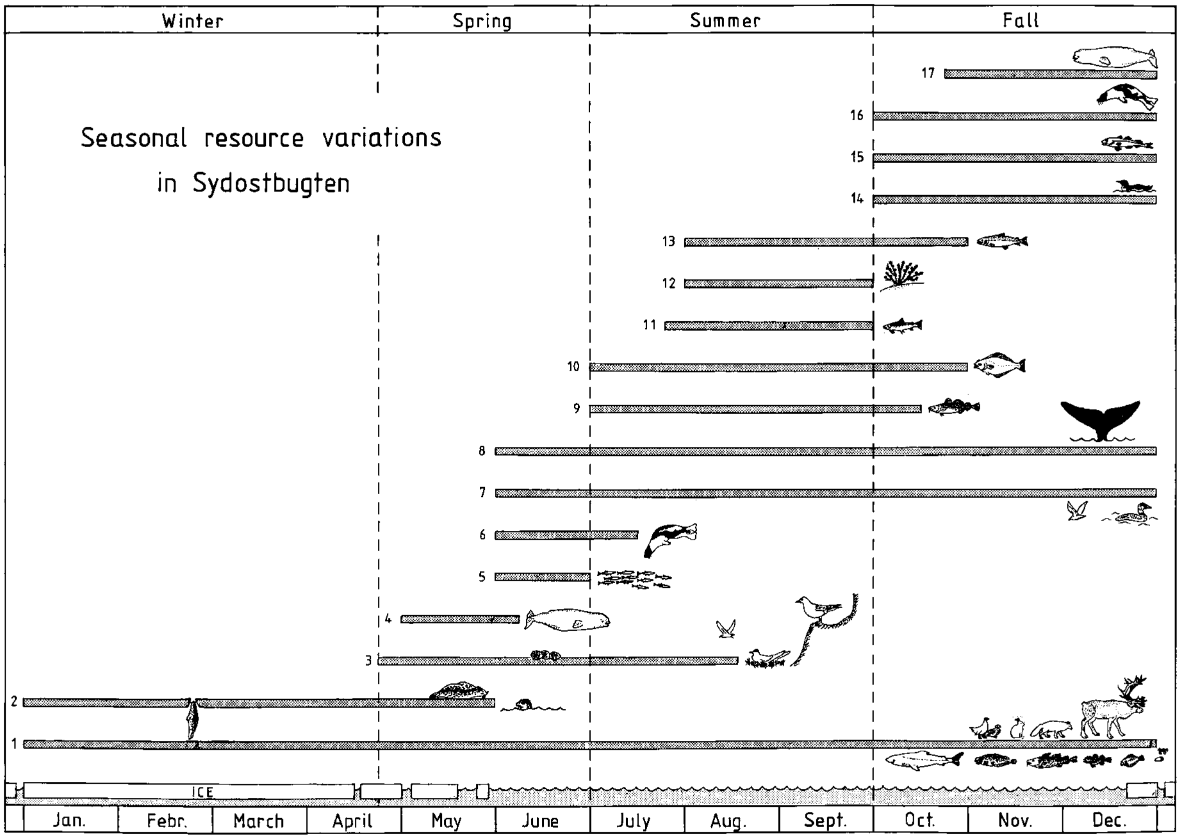


Fig. 2.13. There is a marked seasonal pattern in the occurrence of the major game species in Sydostbugten. (1) Ptarmigan, arctic hare, caribou, Greenland shark, catfish, Greenland cod, sculpin, long rough dab, crabs and mussels, (2) ringed seal, (3) bird colonies (terns, gulls, eider ducks), (4) white whale, narwhal and bowhead whales, (5) capelin, (6) harp seal, (7) fullmars, gulls, kittiwakes and eider ducks, (8) minke whales, fin whales, humpback whales, harbour porpoises, killer whales and grey whales, (9) atlantic cod, (10) benthic fish, (11) arctic char, (12) berries, (13) salmon), (14) migrating waterfowl, (15) polar cod, (16) harp seal, (17) white whales, narwhal and bowhead whales.

effect of the sea ice (ice edge, leads) (Figure 2.15B).

(2) There are relatively few seals in summer, while large whales and especially fish (cod, salmon, char) are more common during this season. Resources are generally abundant, but they are more dispersed than in spring, although char runs are an exception. Terrestrial resources (berries, caribou) are of some importance in this season (Figure 2.15C).

(3) In fall most resources are represented by migrating species. With the occurrence of the migratory white whales, harp seals, and waterfowl (Brünnich's guillemot, little auk, king eider), resource

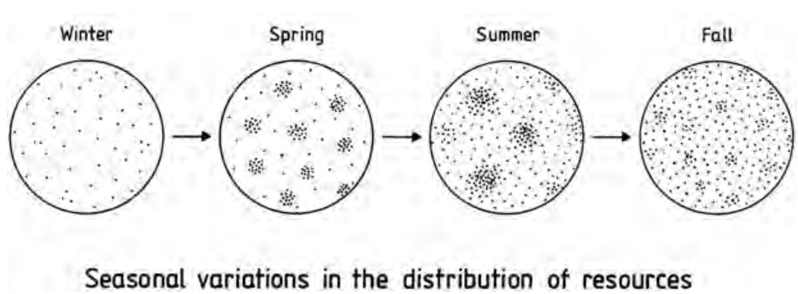


Fig. 2.14. Model illustrating the seasonal variations in the distribution and density of resources in Sydostbugten. Winter is characterised by low densities and even distribution; Spring by very high densities and very lumped distribution; Summer by high densities and a more even distribution, and fall by high densities and even distribution.

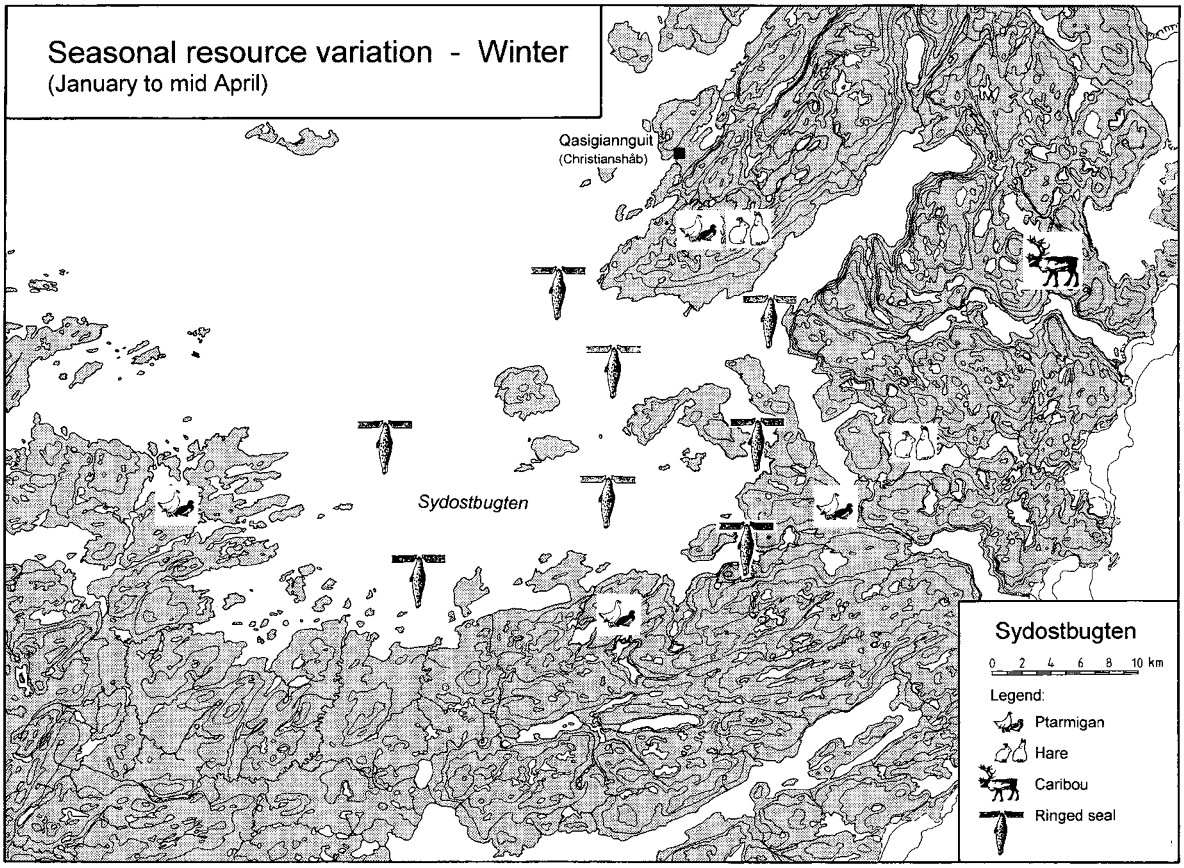


Fig. 2.15. Sydostbugten from season to season. A: Winter (January to mid-April). Ice formation starts in late November and early December in the more sheltered parts of the district, and by January the whole area is covered. The stable resource during winter months is the ringed seal. Fox with prime fur may be found along the coastline. Arctic hare, ptarmigan, and a few caribou are found in the valleys. B: Spring (late April to June). Spring is a period of substantial change in the resource base. As the sea ice breaks up and recedes, the few over wintering species are replaced by the many migratory species passing through the district or arriving for the summer. C: Summer (July to September). Following the departure of the migratory seals, and until their return in the fall, the district is almost devoid of seals. Only a few summering harp seals or a solitary bearded or harbour seal may be encountered. Harbour porpoises, killer whales, humpback whales, fin whales, minke whales, and earlier possibly grey whales appear in the district. Thousands of birds of many species nest on the many small low relief islands. Throughout August and early September running char migrate upstream towards their spawning grounds. In late summer and fall the caribou are in prime physical condition and their fur quality is the finest. These inland resources are supplemented by crowberry, blueberry and craneberry. In August and especially September these berries ripen everywhere in the district. D: Fall (October to December). In early October the migrating harp seals return to the district from their summering grounds along the northern part of the West Greenland coast. The white whales follow in late October. In October many locally breeding bird species such as the arctic terns, kittiwakes, cormorants, and razorbills have already departed, but other species such as the gulls, the red-breasted merganser, the divers, and the eider-duck occur everywhere in the district. Important additions to the local bird fauna in fall are the migrating species that stop over in the district on their way south.

abundance increases but not nearly to spring levels. Resources tend to be even more dispersed than they were in summer (Figure 2.15D).

(4) There is a winter resource minimum. Resource density is very low and only one species, the ringed seal, is of real importance. The ringed seal is evenly dispersed below the winter ice (Figure 2.15A).

The seasonal resource zones of Sydostbugten

Correlated to the seasonal resource shifts, there is a general geographic displacement of the key resources.

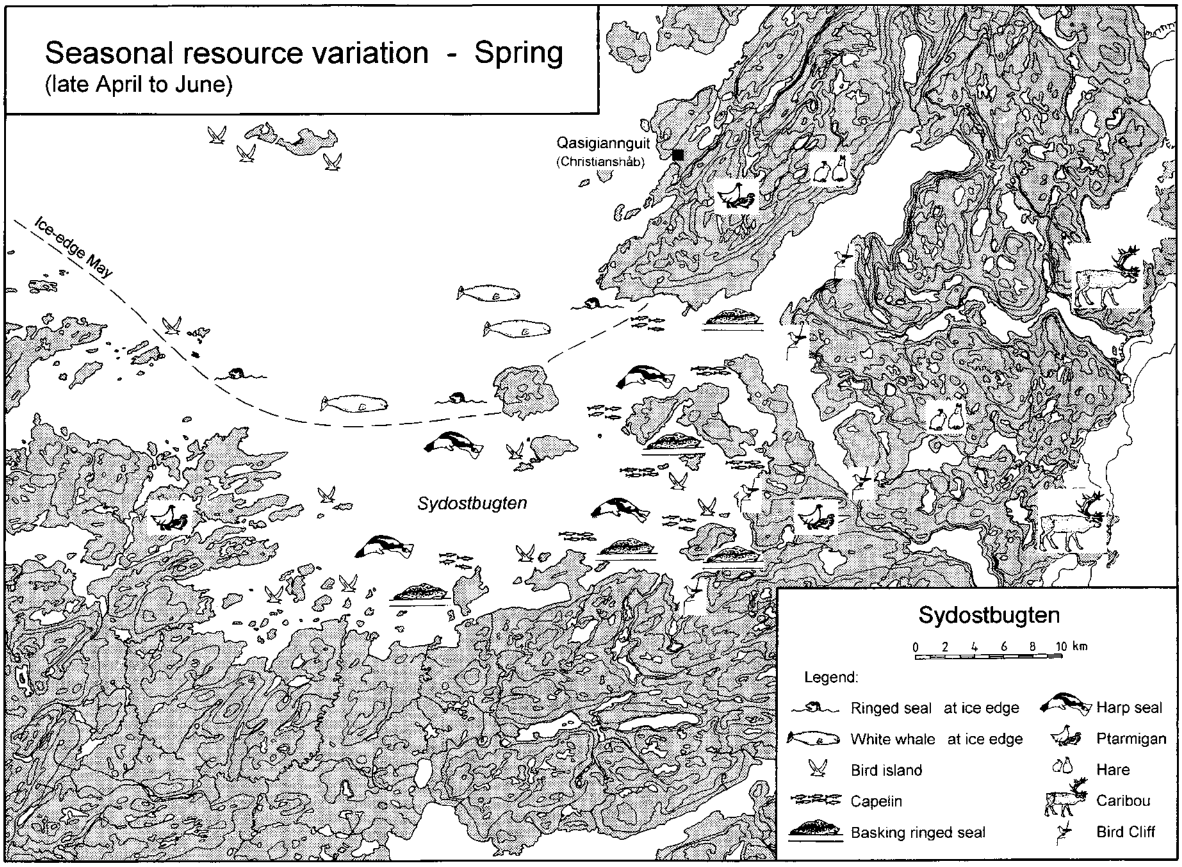


Fig. 2.15 (B).

The optimal resource situation in May is found at specific locations along the ice edge and in leads; in June it is found at specific locations in the inner parts of Sydostbugten on islands and along the seashores; in July, August, and September it is found at the mouths of specific rivers and more generally in the interior; in October, November, and December it is not very localised but is found everywhere along the coasts of the mainland and the islands and at sea; and in January, February, and March resources are more evenly spaced than at any other time of the year and there are no specific locations with particularly optimal resource conditions.

Based on the abovementioned resource patterns, one can divide Sydostbugten into four seasonally defined resource-zones (Figure 2.16):

I: A spring outer island zone
II: A summer inner bay zone
III: A summer/fall inner fjord and interior zone
IV: A fall/winter bay zone

Seasonal light and weather changes

An assessment of seasonal resource changes must be combined with an evaluation of changes in light and weather conditions, which are the two prime physical factors that influence resource availability.

Due to the midnight sun, spring and early summer resources are available on a 24 hour basis. However, light conditions deteriorate quickly in late summer and by late November the sun has practically disappeared. For the next six weeks the sun does not show above the horizon and only when the moon is out, or around noon on a clear day, is it possible to see reasonably well, but only in shades of black and white. When ice and snow covers sea and land, light conditions improve somewhat due to light reflecting from the snow. By mid January the sun has returned and already in March there are twelve hours of daylight. Clearly, bad light conditions in fall and winter severely limit hunting and gathering activities.

Seasonal changes in weather conditions also influence resource availability. Winter, spring and

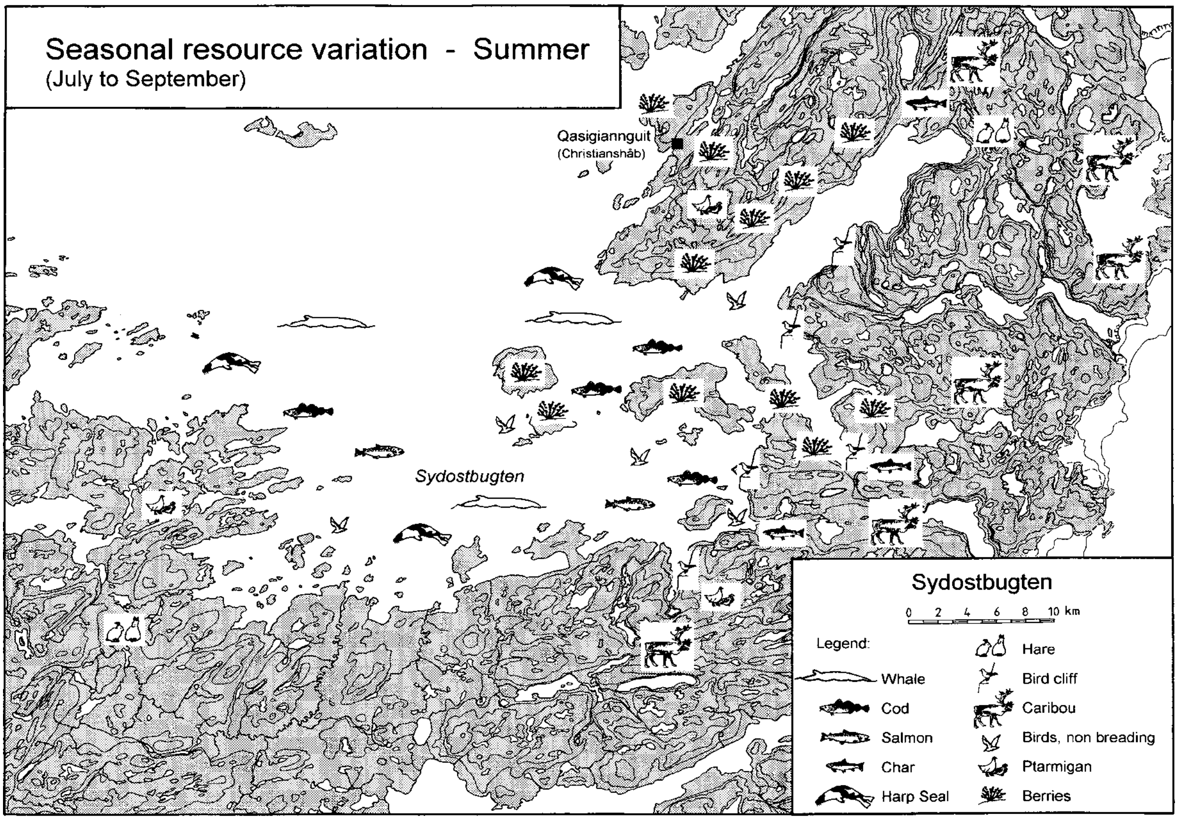


Fig. 2.15 (C).

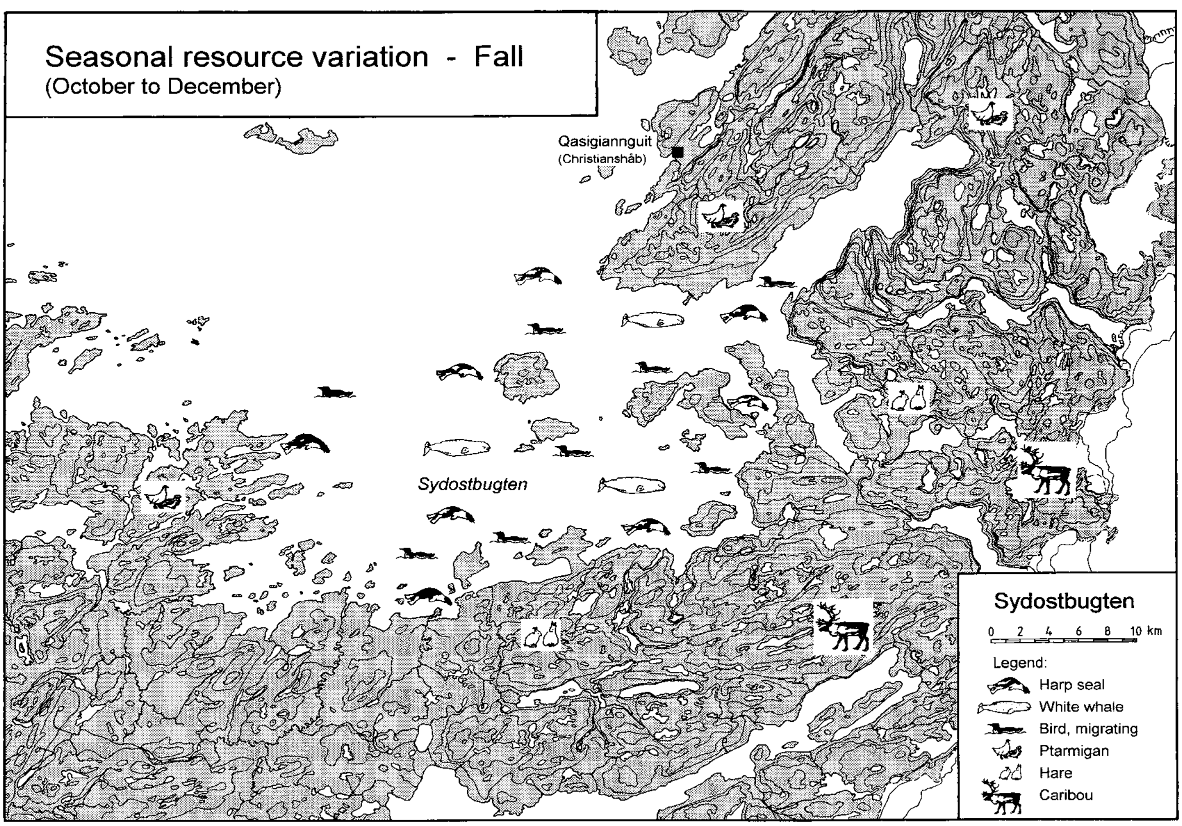


Fig. 2.15 (D).

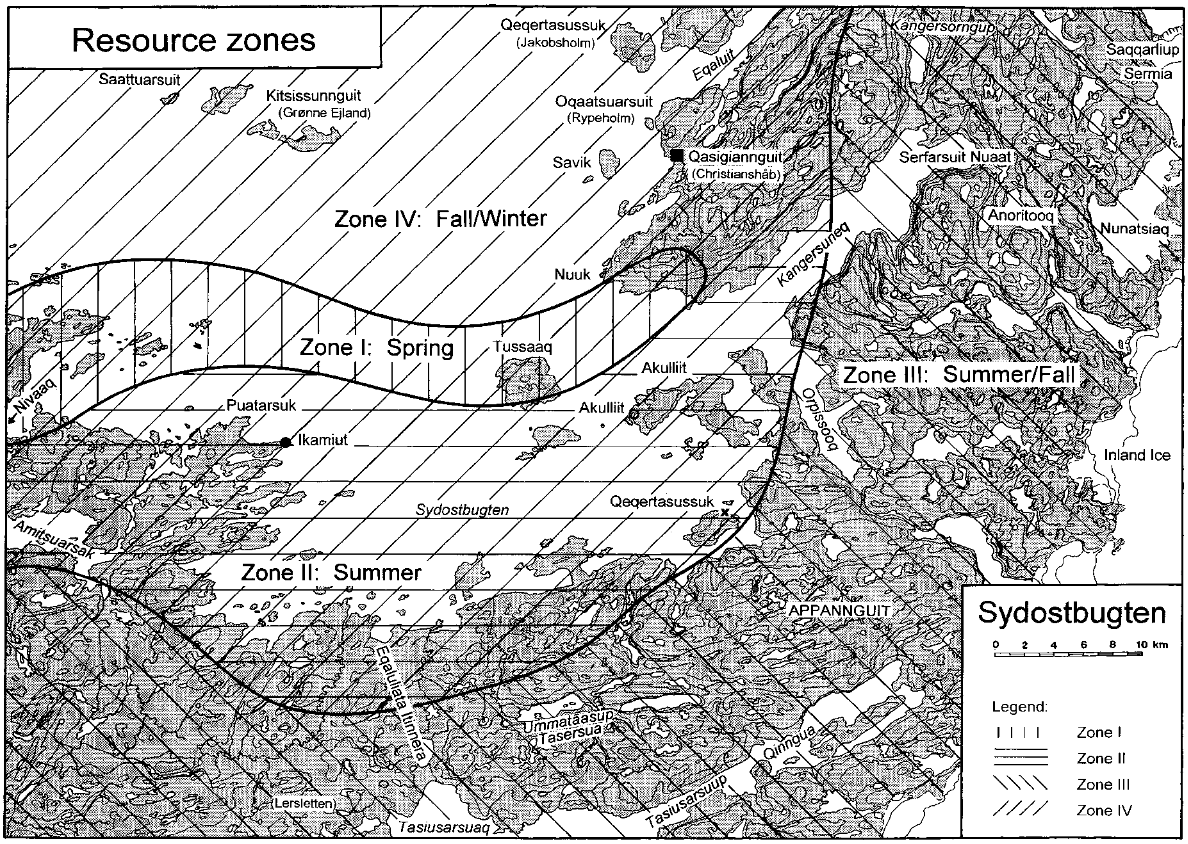


Fig. 2.16. Sydostbugten experiences four seasonally defined geographic zones where the resources are more concentrated and available : I: A spring outer-island-zone, II: A summer inner-bay-zone, III: A summer/fall inner fjord & interior-zone, IV: A fall/winter bay-zone.

summer are generally calm seasons, while fall is known for its more adverse weather with frequent windy periods (Porsild 1921:162; Anon. 1942:398). "Føhn" storms (catabatic winds) are well known from the area where they occur regularly throughout the year, most commonly in winter. From a resource point of view, they are particularly important in winter when they may destroy a firm ice cover in hours and thus completely change the availability of winter resources. (Anon. 1888:34, 1890:98, 1901:39,73, 1907: 157, 1918:293, 1924:8; Friis-Nielsen and Sveistrup 1944).

Inter-annual resource dynamics

The annual variations in the physical environment greatly affect game dynamics on a year to year basis. Changes in ice conditions may, for example, mean that sea mammals in a mild winter with no ice, have to be approached in open sea, while in a normal winter with good ice cover, they can be reached from the ice surface. Also wind conditions may differ greatly from year to year. One fall frequent strong winds may prevent most hunting at sea and the next the situation may be reversed. The negative effect of adverse weather and ice conditions on resource availability is often commented on (Porsild 1921:161; Friis-Nielsen and Sveistrup 1944).

Catch statistics from Qasigiannguit district directly illustrate the annual variations in availability of the main resources (Figures 2.17 and 2.18). These statistics have been collected since 1862 and were originally used as a basis for the annual "repartition" by which each hunter received a share of the municipality's yearly profit answering to the size of his annual hunting bag. The hunters therefore kept careful record of their harvest and these statistics can be trusted directly to reflect annual variations in the occurrence of available resources (Rosendahl 1961). A comparison of the statistics with the annual written reports from the colonial managers confirms their reliability.

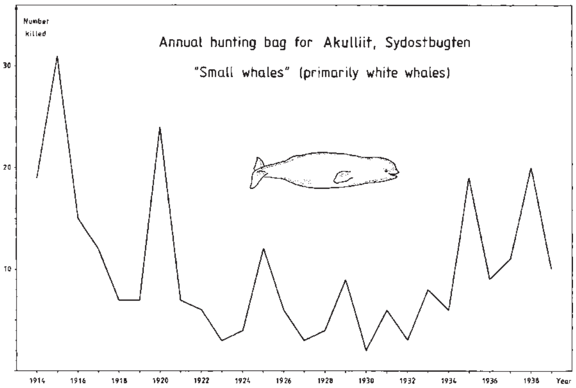


Fig. 2.17. Graph showing the annual variation in the hunting bag of small whales (primarily white whales) for the settlement Akulliit in Sydostbugten. Local conditions such as delay in break-up and the presence of killer whales may influence hunting success greatly. Numbers are taken from Sammendrag af Fangstlisterne for Nordgrønland (Anon. 1916).

The graphs give a clear impression of a high degree of inter-annual variability in the occurrence of available seals and white whales in Sydostbugten. The annual fluctuations commonly exceed 25% and occasionally 50%. The same degree of variability is also typical of the other significant resources found in the area (Vibe 1967). The annual fluctuations of some species seem to be synchronised, which implies that the total occurrence of available resources in some years may be extremely small and in others very large. The availability of summer resources does not seem to be much affected by climatic changes; however the shortened period with winter ice, in combination with increased winter wind activity have a negative impact on the accessibility of marine resources (Porsild 1921: 161; Friis-Nielsen and Sveistrup 1944:22)

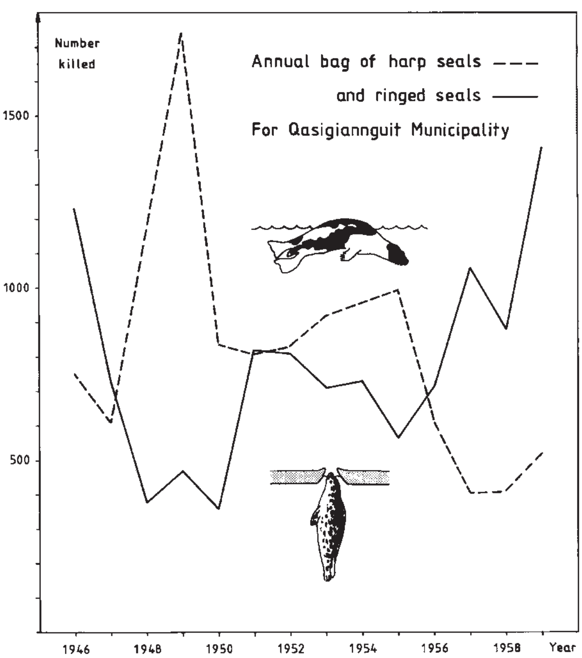


Fig. 2.18. Graphs showing the pronounced inter-annual variability of annual bag of harp seals and ringed seals in Qasigiannguit district. Numbers are from Vibe (unpublished, on file at Arctic Institute, Copenhagen).

Resource dynamics – on a long term scale

All Greenlandic vertebrate populations undergo marked changes in population size and distribution over decades and centuries. These long term fluctuations are especially well known for species such as ringed seal, harp seal, cod and caribou (Figures 2.19 and 2.20), species which have been of economic importance to the Greenlanders and the colonial administration, and for which hunting and catch records and skin trade statistics are available, along with a wealth of other information (Braestrup 1941; Rosendahl 1961; Vibe 1967; Meldgaard 1986).

From 1920 to 1940 drastic changes were observed in the occurrence of most marine species in central West Greenland. Because this particular case is very well documented, it may serve as an example of the type of long term changes in diversity, density and distribution of marine resources that can be expected to have taken place through decades and centuries.

From 1920 to 1940 a number of more southerly boreal species expanded northwards along the West Greenland coast and into Disko Bay. The Atlantic cod (*Gadus morhua*) is a classical example (Figure 2.21). In the 1920's the cod moved north and by 1931 had reached Disko Bay, where it was caught in great quantities (Hansen 1931, 1970; Jensen 1939; Tåning 1948: 28; Jensen and Fristrup 1950). Following the same pattern, new immigrants such as haddock (*Melanogrammus aeglefinus*) and spur-dog (*Squalus acanthias*) also turned up in Disko Bay, but only as occasional guests (Tåning 1948:29; Hansen 1949; Muus 1981). Other boreal species, such as salmon (*Salmo salar*) and halibut (*Hippoglossus hippoglossus*) that previously occurred in the area in small numbers became more common, but were never present in quantities comparable to cod (Jensen 1939; Tåning 1948; Hansen 1949).

The occurrence of boreal fish species and the increase in their densities in Disko Bay was associated

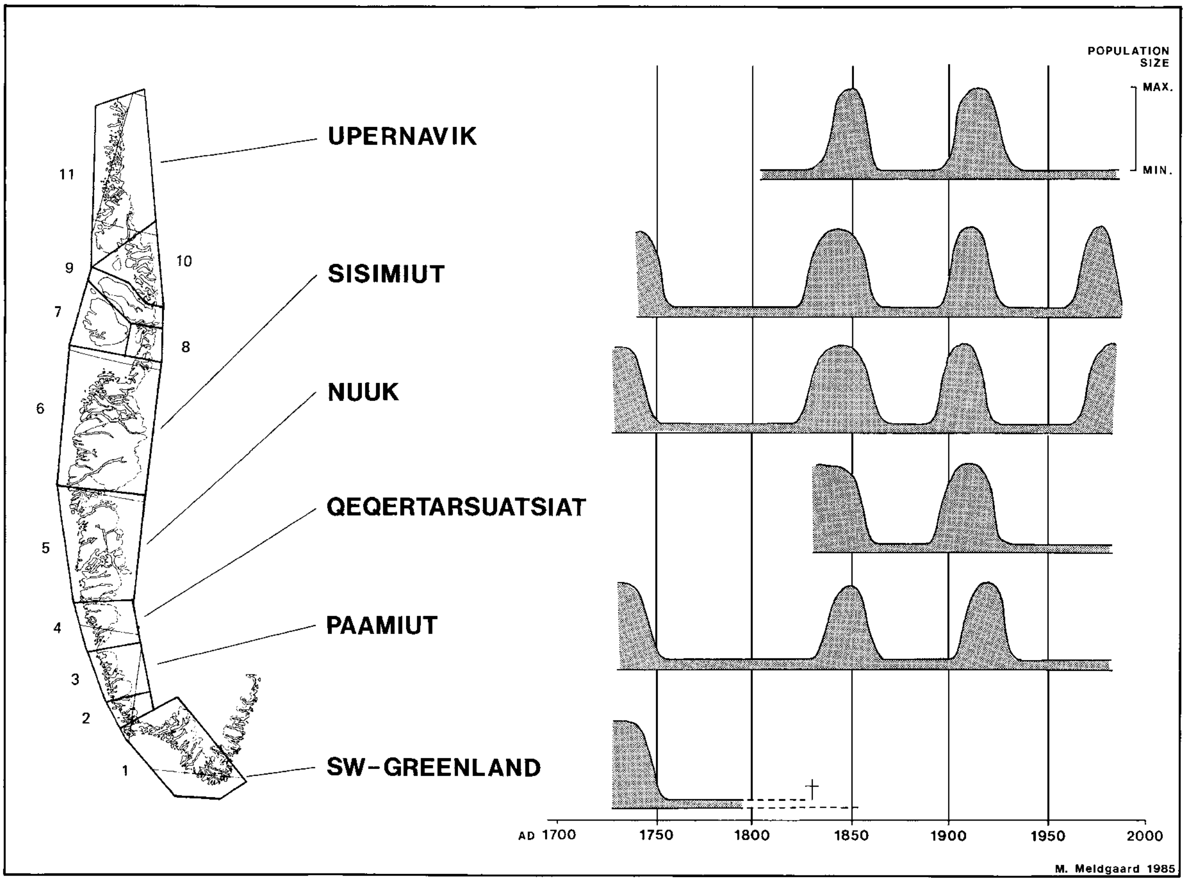


Fig. 2.19. Fluctuations in the caribou population are very pronounced. During the past 250 years four major oscillations have occurred in the West Greenland caribou population. Population maxima have occured around 1740, 1850, 1910 and 1960 (from Meldgaard 1986:58).

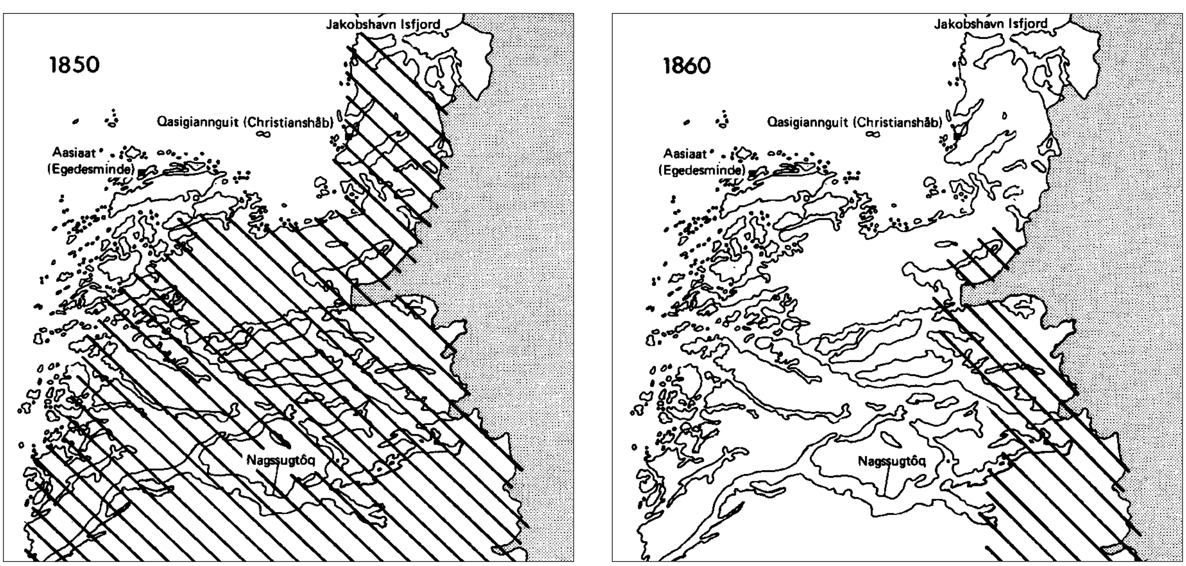


Fig. 2.20. a. Caribou distribution in central Western Greenland during population maximum ca. 1850. b. Caribou distribution during population minimum ca. 1860 (from Meldgaard 1986:60).

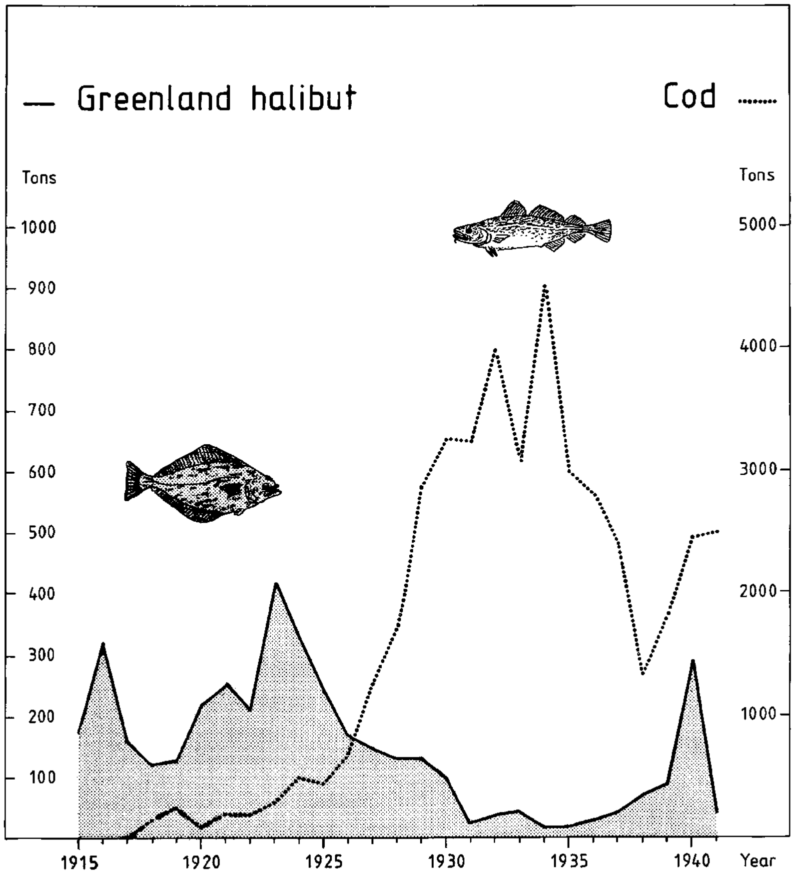


Fig. 2.21. Graphs showing the variations in the catch of Atlantic cod and Greenland halibut off West Greenland during the North Atlantic warming episode from 1920 to 1940. The boreal fish species expanded northwards as the arctic species retreated northwards (adapted from Hansen *et al.* 1981:265).

with a decrease in the densities of more arctic species such as Greenland halibut (*Reinhardtius hippoglossoides*) (Figure 2.21), polar cod (*Boreogadus saida*) and Greenland cod (*Gadus ogac*) (Jensen 1939; Rosendahl 1942:58; Anon. 1944:653,663; Hansen 1949:14; Hansen *et al.* 1981).

Also among the sea mammals there was a replacement of arctic with boreal species (Figure 2.22). The white whale (*Delpinapterus leucas*) shortened its winter stay in the Disko Bay area by *ca.* two months and the narwhal (*Monodon monoceros*) shifted its wintering quarters to the north and became less common in the area (Jensen 1939; Hansen 1949; Vibe 1967:74; Kapel 1977a). At the same time the Atlantic pilot whale (*Globiceps melas*) turned up in the bay in small numbers (Jensen 1939:22; Vibe 1981). Likewise the ringed seal (*Phoca hispida*) was replaced by the harp seal (*Phoca groenlandica*) (Figure 2.22). The decline in the ringed seal population in Disko Bay set in around 1920 and numbers remained low for the next decades (Anon. 1944:605; Rosendahl 1961:25; Vibe 1967:51-56). At the same time the occurrence of harp seals increased rapidly, and it is likely that they also extended their summer stay in the area (Anon. 1944; Vibe 1967:67-8; Kapel 1975b).

Changes were likewise observed among the birds in Disko Bay. The white-fronted goose (*Anser albifrons flavirostris*) increased in numbers in this northern part of their breeding territory, and many species such as the glaucous gull (*Larus hyperboreus hyperboreus*), the Iceland gull (*Larus glaucoides glaucoides*) and the old squaw (*Clangula hyemalis*) wintered in the area in greater numbers than prior to 1920. Furthermore some species, such as the kittiwake (*Rissa tridactyla tridactyla*) prolonged their stay in their breeding territories (Fencker 1947; Salomonsen 1948).

These shifts between boreal and arctic species of mammals, birds and fish were related to contemporary changes in climate and hydrography.

These documented changes were the result of a marked climatic shift. Around 1920 the northern hemisphere experienced a climatic amelioration which made itself felt in West Greenland through increased sea temperatures (Jensen 1939; Kiilerich 1943) (Figure

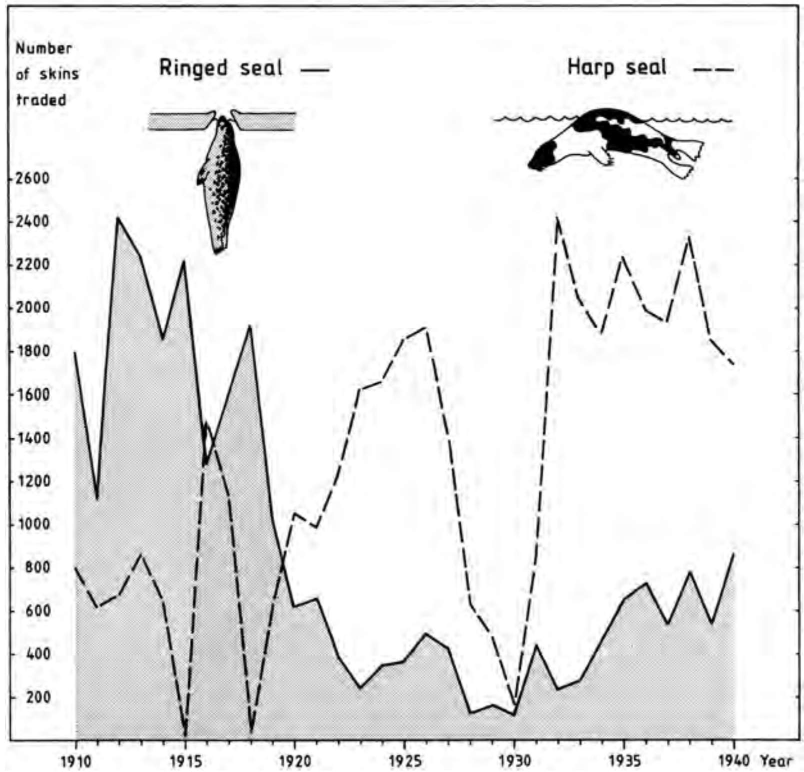


Fig. 2.22. Graphs showing the variations in the fur trade of ringed seal and harp seal in Christianshåb, Jakobshavn and Ritenbænk municipalities during the North Atlantic warming episode from 1929 to 1940. The boreal sea mammal species expanded northwards while the arctic species retreated northwards.

2.23A) and increased air temperatures (Ahlmann 1948:12; Lysgaard 1949:18; Dansgaard *et al.* 1975) (Figure 2.23B). The increase in air temperature was primarily due to a rise in winter temperature (Figure 2.23B). In Disko Bay, winter temperatures (expressed as the annual average temperature of the months November through April) increased by approximately 4° C. from approximately 10° C. in the period from 1900 to 1920 to approximately 14° C. in the period from 1920 to 1937 (Friis-Nielsen and Sveistrup 1944:9; see also Vibe 1967). The temperature increase was accompanied by increased winter precipitation (Clausen *et al.* 1988), by a higher frequency of windy days (Frydendahl pers. comm.; see also Porsild 1921:161), and by a greater incidence of southwesterly winds (Anon. 1942:395; Lysgaard 1949:58).

The increased winter temperatures and the windier weather had a strong effect on the ice conditions in Disko Bay. The period of time with complete ice cover was significantly shortened and in some years there was practically no winter ice at all (Figure 2.9) (Friis-Nielsen and Sveistrup 1944:11; Fencker 1947; Ahlmann 1948:15; Jensen and Fristrup 1950:23; see also Porsild 1921:161).

All these observed changes were brought about by shifts in the position of the polar front and associated changes in the patterns of cyclonic activity over Greenland. In the 1920's, especially during winter time, the polar front was displaced much further to the north than usual, resulting in a generally warmer and moister climate along the West Greenland coast (Ahlmann 1948:12; Frydendahl pers. comm.). The general displacement of the polar front over longer spans of time seem to have been the driving force behind the climatic changes observed in West Greenland over the past centuries (Dansgaard *et al.* 1975; Williams and Bradley 1985). This type of climatic change has probably taken place many times throughout the postglacial period.

General trends: 1920 to 1940

Disko Bay is an area where sub-arctic and high arctic biotas meet and blend. The climatic changes of the period resulted in a northward displacement of the sub-arctic zone and a higher productivity and species diversity in Disko Bay (Dunbar 1955:2).

The biological changes that took place from 1920 to 1940 can, focusing on Disko Bay, be summarised as

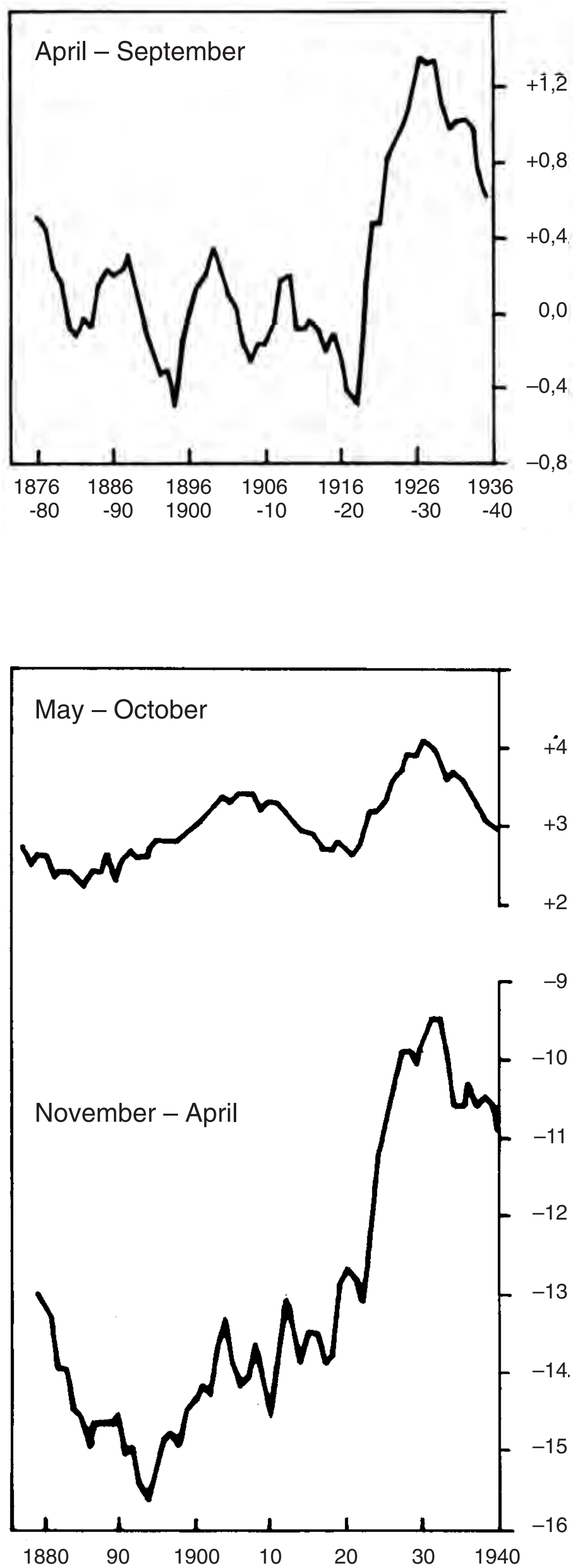


Fig. 2.23 A & B. Sea surface temperature off West Greenland (five year running mean) (after Buch et al. 1994) and air temperature at Illulissat in Disko Bay (Vibe 1967:31) during the North Atlantic Warming episode from 1920 to 1940.

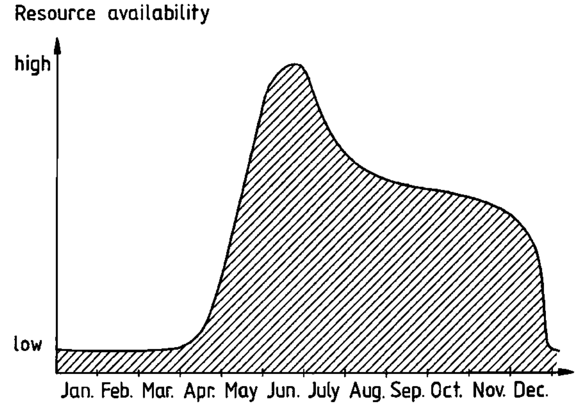


Fig. 2.24. Relative seasonal variations in resource availability. Estimated from biological and physical data presented throughout chapter 2. Changes in availability, due to changes in light and weather conditions are also incorporated.

follows: (1) more marine species immigrated than emigrated and general resource diversity rose, (2) the density of some significant marine summer resources (cod, salmon, harp seal) rose, (3) the density of the major marine winter resource (ringed seal) fell, (4) the general density of fish rose, (5) the density of white whales and narwhal fell, (6) the density of the caribou population fell and their distribution was reduced. These resource changes were associated with a decrease in the accessibility of winter resources (Figure 2.24).

Resource dynamics: a summary

The resources of Sydostbugten are subject to pronounced long and short termfluctuations, where seasonal variations are most evident, with clear resource minima in winter and resource maxima in spring and early summer. Annual variations are related to and superimposed upon the long term changes. Fundamentally, these variations reflect shifts between years (or series of years) with a warmer and wetter climate and higher sea temperatures (a more "Atlantic" climate), and years (or series of years) with a colder and dryer climate and lower sea temperatures (a more "Arctic" climate) and hydrography. A shift towards more "Atlantic" conditions generally improves the summer resource situation, while winter resource availability seems to be negatively affected by the more unstable and more or less ice free conditions. Thus long term fluctuations influence the effect of the seasonal resource changes.

Chapter 3

Paleo-environment

The Baffin Bay region

The Holocene Thermal Maximum is relatively well documented from Western Greenland and the general Baffin Bay area. Based on pollen records, ice cores, and glacial deposits, the Holocene Thermal Maximum, characterized by a climate that was generally warmer than that of today, has been dated to a period from *ca.* 8000 to *ca.* 4000 BP (Dansgaard *et al.* 1971, 1975; Fredskild 1973, 1985, 1996; Funder 1978; Kelly 1980, 1985; Weidick *et al.* 1990; Williams and Bradley 1985).

This warm period was reflected in the local marine environment. Based on finds of thermophilous, subarctic molluscs now extinct in the region, a "marine thermal maximum" has been defined from *ca.* 8400 to *ca.* 4900 BP (Funder 1978; Funder and Weidick 1991; Kelly 1980, 1985; Williams and Bradley 1985). Very close to Qeqertasussuk, on raised marine terraces in Orpissooq, species of thermophilous molluscs have been collected. Among these *Zirphaea crispata* has been dated to between 5190 ± 100 and 4870 ± 110 BP (Kelly 1980; Funder and Weidick 1991).

More detailed information on Disko Bay paleo-climatic conditions has recently been retrieved from sea bottom cores taken in Kangersuneq and Disko Bay (Jensen, K. G. 2003). The data from these cores gives a more detailed picture of the local changes in the marine environment. In summary, the diatom flora indicates a time period from 6700 to 4800 BP with a marine physical environment much like that of today, a time period from *ca.* 4800 to 4000 characterized by warmer than present conditions, a period from 4000 to 3500 BP which is different, probably warm or more windy, and a period from *ca.* 3500 to *ca.* 1050 BP which is increasingly cold and colder than the 6700 to 4800 BP period (Jensen, K. G. 2003). The decrease in temperature around 3500 BP marks the beginning of the Neoglacial.

The diatom data on the warmer than present interval (4800 to 4-3500 BP) can be supplemented by palynological data which indicates changes in wind conditions in the period from *ca.* 5500 to *ca.* 3500 BP. Exotic pollen in samples taken throughout West Greenland thus indicates that southwesterly and westerly winds, at least during spring and early summer, were more frequent in this period than in the following (Fredskild 1973, 1984).

These climatic and hydrographic changes are to a large extent governed by changes that take place in the upper tropospheric wind patterns and in the average position of the polar front. Discussing the climatic change from mediaeval warmth to "the little ice age" in the thirteenth and fourteenth century AD, Dansgaard *et al.* (1975) proposed that it was caused by a slow eastward displacement of the climatic belts in the Northwest Atlantic region combined with a general southward displacement of the polar front. In a more general presentation of the paleoclimatology of the Baffin Bay region, Williams and Bradley (1985) underline the climatic importance of the position of the trough over Baffin Bay. They show that an eastward displacement of the trough is associated with an enhanced northerly and northeasterly airflow and lower temperatures, while a westward displacement is associated with increased southerly and westerly winds and higher temperatures.

Based on these paleo-climatological models, the Holocene Thermal Maximum, which was characterized by higher than present temperatures and more frequent southwesterly and westerly winds, was probably associated with a generally more westerly position of the Baffin Bay trough and, on average, a more northerly position of the polar front. The onset of the Neoglacial around 3500 BP, which was characterized by lower temperature, increased precipitation and a lower frequency of southwesterly and westerly winds, was probably a result of a more frequent eastward displacement of the trough, and a general southward movement of the polar front.

It must, however, be borne in mind, that even though the average positions of the Baffin Bay trough and the polar front change over longer spans of time, there will still be pronounced seasonal and annual variations in their positions.

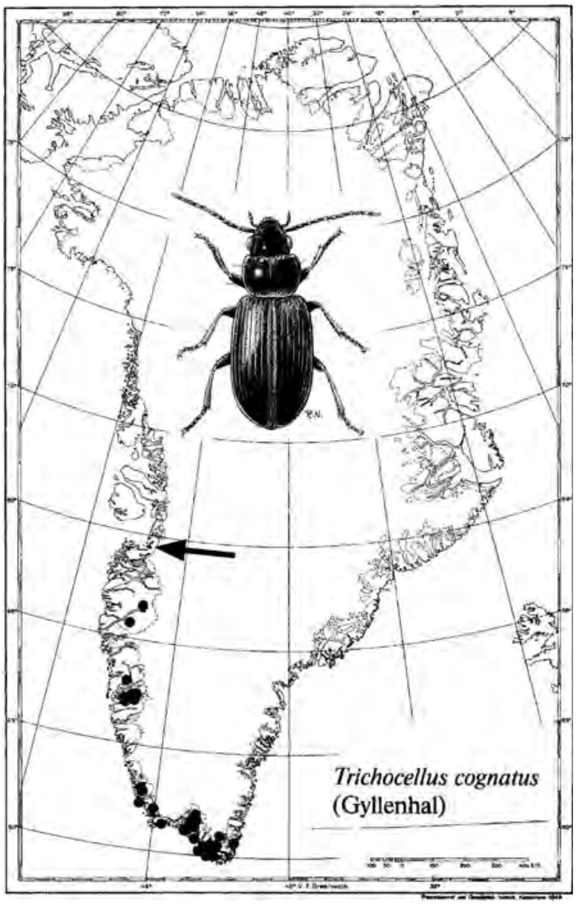


Fig. 3.1. The dots indicate the present distribution of the circumpolar and boreal beetle Trichocellus cognatus (Böcher 1988b:14). The more northerly find at Qeqertasussuk (arrow) indicates that a warmer climate prevailed in this area 4000 years ago (from Böcher & Fredskild 1993:17).

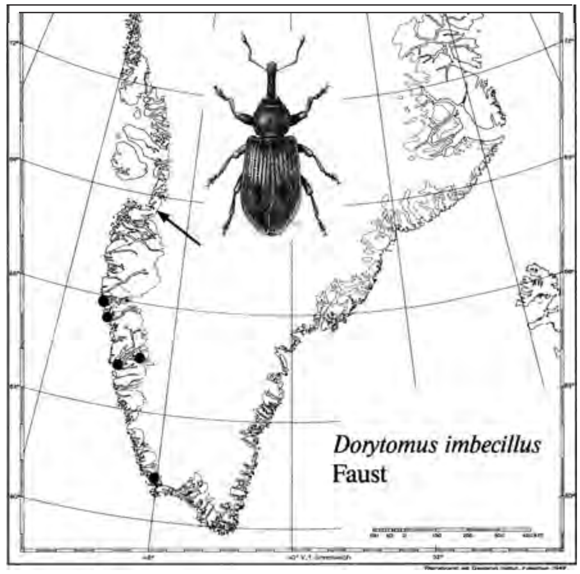


Fig. 3.2. Present distribution of the holarctic, boreal to low arctic weevil Dorytomus imbecillus (Böcher 1988b:66-7). The rare beetle was found in midden deposits at Qeqertasussuk ca. 300 kilometres north of its present range indicating a warmer than present climate (From Böcher & Fredskild 1993:24).

The Qeqertasussuk area

Paleoentomological investigations at the Qeqertasussuk site have shown that a number of beetle species with presently more southerly distributions were common in the area at least till *ca.* 3100 BP (Figures 3.1 and 3.2). They indicate that the summers were generally warmer and moister than today throughout the period of human habitation at Qeqertasussuk (Böcher and Fredskild 1993).

The faunal material excavated from the midden layers at Qeqertasussuk contained bones of great auk (*Pinguinus impennis*). The northern limit of this, now extinct, bird's historical range seems to have been several hundred kilometres to the south of Disko Bay, thus indicating more boreal conditions in the area at the time of habitation (Meldgaard 1988a). Great shearwater (*Puffinus gravis*) bones have also been identified at this northern limit of their present distribution. Bones of salmon (*Salmo salar*) and cod (*Gadus morhua*), both typical boreal species, add to the impression of warm marine conditions, at least during summer. On the other hand the occurrence of typically arctic species such as ringed seal (*Phoca hispida*) and polar cod (*Boreogadus saida*), that depend on the occurrence of sea ice, does indicate that the winters were reasonably cold and the bay was covered with ice on a regular basis. This is also supported by the occurrence of a sea ice associated diatom flora throughout the "warm period" (Jensen, K. G. 2003).

Palynological investigations have been undertaken in a lake three kilometres west of the site and on the site itself (Figure 3.3). They show a decrease in pollen frequencies of more xeric plants and an increase in the pollen frequencies of some mesic plants around 3500 BP. This corresponds with other pollen evidence from central West Greenland which shows the temperature decrease and precipitation increase that has been found to characterize the onset of the Neoglacial (Fredskild 1988, 1996; Böcher and Fredskild 1993). However, it is also evident that the climatic change,

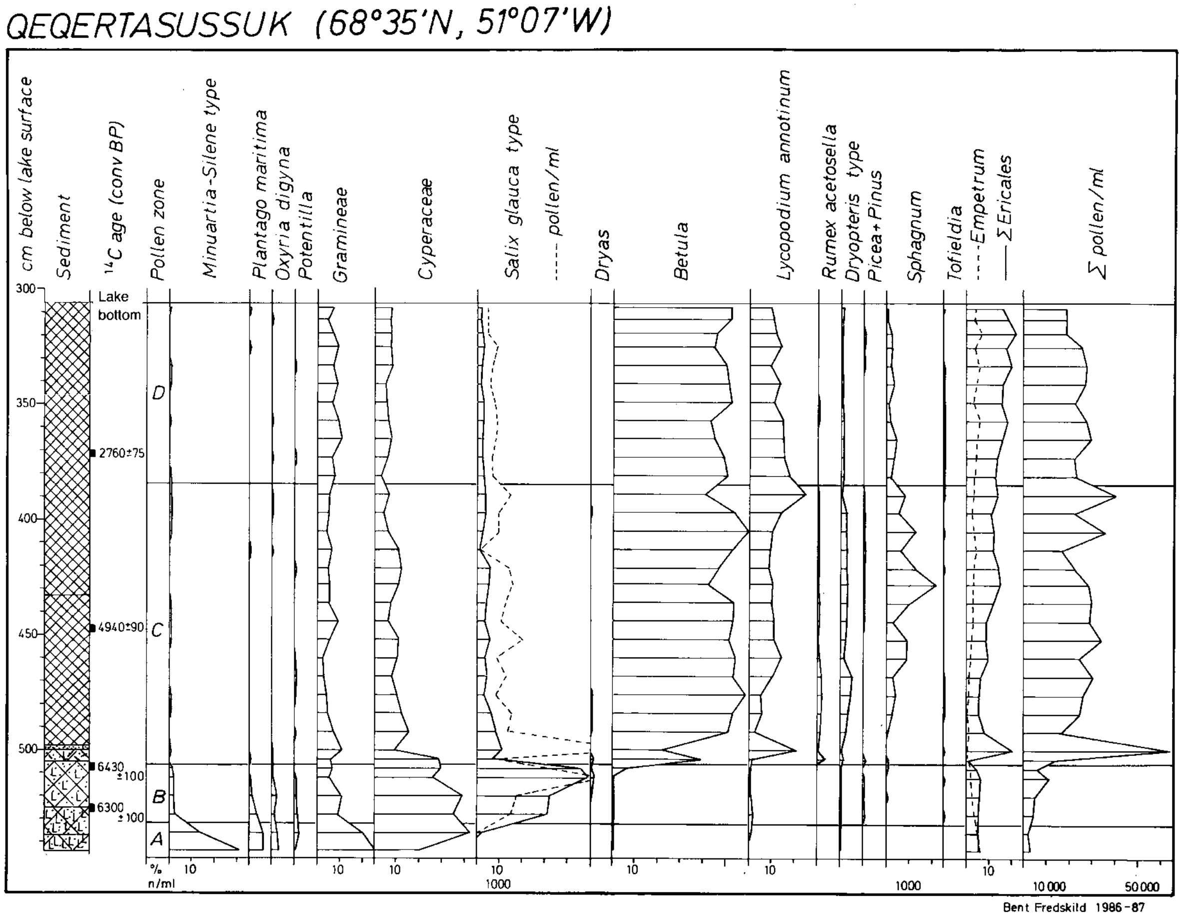


Fig. 3.3. Pollen diagram from a small lake adjacent to Qeqertasussuk (from Böcher and Fredskild 1993:16). It shows that the general composition of the plant communities at the time of habitation was quite comparable to the vegetation cover we know today. However, during the period Qeqertasussuk was inhabited, there was a small decrease in xeric plants and an increase in more mesic plants, indicating a shift towards a more moist summer climate. Also, exotic pollen from pine and spruce are more common, indicating more frequent southwesterly and westerly winds (Fredskild 1988, 1996).

towards a more cold and moist climate that took place around 2500 BP and prevailed until *ca.* 2000 BP, as documented at the two Saqqaq Culture sites Sermermiut and Qajaa in Disko Bay (Meldgaard 1958, 1983; Fredskild 1967, 1996), was even more drastic than the change around 3500 BP.

Funder and Weidick (1991) conclude that the Orpissooq beds near Qeqertasussuk, ranging from 5190 to 4870 years BP, may have persisted even longer and that they, together with other evidence, indicate sea surface temperatures 1-3 degrees higher than today.

Simulation models, subsurface mapping of the Greenland Inland Ice margin and datings of glacier transported animal carcasses from the present ice margin indicate that during the Holocene Thermal Maximum (5000-3000 BP) the Inland Ice margin had retreated to a position 15-20 km east of the present ice margin (Weidick *et al.* 1990) (Figure 3.4). In the research area the receded position of the ice margin would have left an ice free area much larger than the present one, which in turn could have resulted in access to significantly increased inland hunting grounds and resources (Weidick *et al.* 1990).

Combining the different paleoenvironmental indicators, there emerges a reasonably clear picture of the conditions under which the Saqqaq people at Qeqertasussuk lived for nearly a thousand years. Even though the Holocene Thermal Maximum came to an end around 3500 BP and the inhabitants experienced the first "cold and moist" interval of the Neoglacial, the summers throughout the habitation period were generally warmer and perhaps more rainy than at

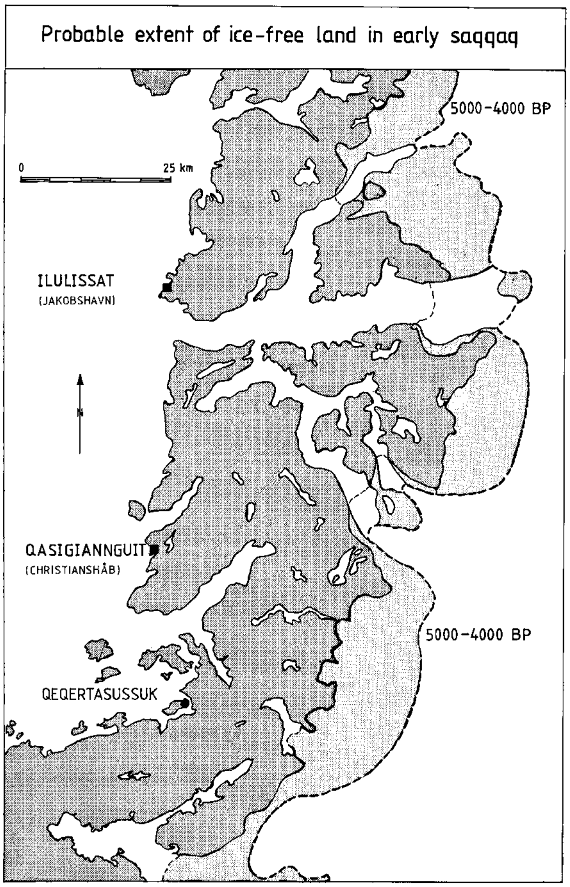


Fig. 3.4. At the end of the postglacial warm period the ice-margin had retrated to the stippled line, leaving a large area of land open for plants, and animals and the people of Qeqertasussuk to use. The present day ice-margin is indicated by the unbroken line (based on Weidick et al. 1990).

present. Also, southwesterly and westerly winds were more frequent, at least during summer. The sea temperature was probably 1-3 degrees higher than today, but the winters were generally sufficiently cold to allow the formation of an ice cover. Even though temperatures stayed above present levels throughout the period, there seems to have been a general cooling trend from start to end.

Speaking in general terms, the effects of the postglacial climatic changes in Disko Bay may not appear dramatic when compared to the Holocene vegetational development in more temperate regions. However, on a local scale the climatic changes may well have had quite drastic effects on resource availability.

Effects on the resources

The biological responses to the generally warmer climate during the habitation of Qeqertasusuk from 3900 to 3100 BP are comparable to the responses observed during the warm interval in the 1920's and 1930's. Thus the general density of more boreal species in Disko Bay must have been relatively high, while the general density of more arctic species was relatively low as compared to the present situation.

The more specific responses that could be expected are the following: (1) years and series of years with a substantial summer occurrence of cod, salmon, and harp seal have been more frequent than at present, (2) years and series of years with lower winter densities of ringed seals were more frequent, (3) years and series of years with higher densities of fall migrating birds (*e.g.* Brünnich's guillemot) and wintering birds (*e.g.* gulls) were more frequent, (4) years and series of years with lower fall, winter, and spring densities of white whales and narwhals were more frequent, (5) years and series of years with high densities of caribou were less frequent, and (6) boreal species previously distributed further south turn up in the area (*e.g.* great auk).

With these modifications, the model of seasonal, annual, and long term resource variations presented in the previous chapters, can be applied to the Saqqaq period, and may thus serve as model against which the resource exploitation patterns, as revealed by the faunal material from Qeqertasussuk, can be tested.

Chapter 4

Ethnography

Akulliit – a settlement in Sydostbugten

The description will focus on the subsistence pattern of the small settlement Akulliit, situated only 10 kilometres NNW of the excavated Saqqaq settlement at Qeqertasussuk. Regarding both geographical setting and access to natural resources, the two sites are highly comparable (Figures 4.3A and 4.3B). Historical Akulliit, though formed by people of a different cultural and technological background, provides very high resolution information on resources and exploitation patterns. Thereby it enhances our understanding of the interrelationship between man and the environment in Sydostbugten and sharpens our senses when studying the much more fragmented Paleoeskimo data from Qeqertasussuk.

Akulliit is known to have been inhabited in 1781, but was shortly thereafter abandoned for some years until resettlement in 1797. The settlement was then continuously inhabited until 1805. Following 45 years of abandonment, people started moving to Akulliit again around 1850, and by 1855 it was designated a "udsted" (a settlement with a trading post) (Ostermann *et al.* 1921:146). In 1963 Akulliit was shut down for the last time. The ethnographic data which is referred to in the following stems primarily from the late colonial period between *ca.* 1900 and *ca.* 1950.

In 1915 Akulliit had 93 inhabitants of which 47 were men and 46 women. A total of 25 were active hunters and 2 were designated fishermen. In 1915 the inhabitants possessed 5 tents, 3 umiaqs, 24 kayaks, 6 small dinghies, 14 sledges and 99 dogs (Ostermann *et al.* 1921:143-4) (Figure 4.1).

The subsistence settlement system

The traditional Thule Culture subsistence settlement system in Disko Bay had, at this time, been modified by more 200 years of colonial administration and systematic commercial trade. The changes in subsistence economy were, however, most evident at the colonies themselves, for example at Christianshåb, while the way of life in the smaller settlements such as Akulliit was to a much higher degree based on a local traditional subsistence economy (Steensby 1912:156; Birket-Smith 1924:376; Friis-Nielsen and Sveistrup 1944; Rosendahl 1961).

The difference between subsistence at the colony and at the trading posts is illustrated by Friis-Nielsen and Sveistrup (1944:65) who compare the caloric value and relative importance of procured seal meat at the colony Christianshåb and at the smaller trading posts (Akulliit, Ikamiut, Ilimanaq (Claushavn)) for the period 1915 to 1935. They found that at the colony itself

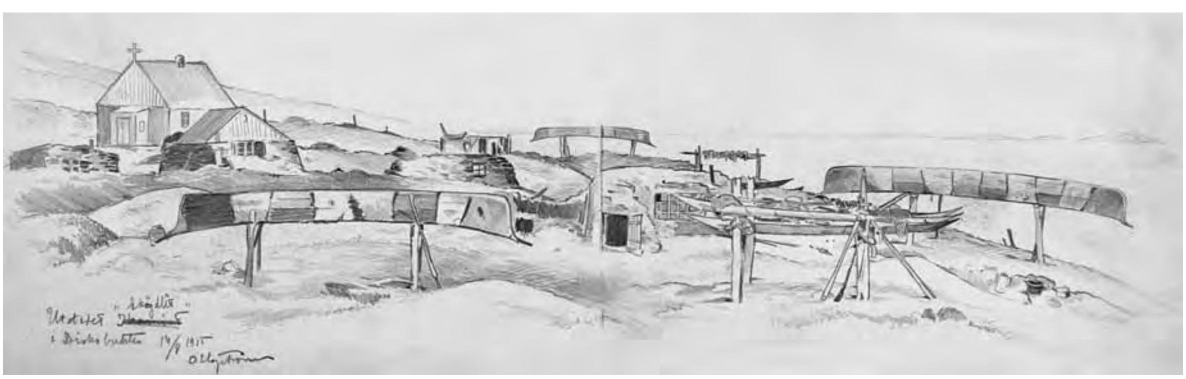


Fig. 4.1. The settlement Akulliit, April 1915 (from Elgström 1916:376, courtesy Folkens Museum, Stockholm). In 1915 Akulliit had 93 inhabitants of which 25 were active hunters and 2 were fishermen. These hunters and fishermen had at their disposal 24 kayaks, 3 umiaqs, 6 small dinghies, 14 sledges and 99 dogs (Ostermann et al. 1921:143-4).

Fig. 4.2. Akulliit in April 1987. The ice-cover is intact and with the sun out ringed seals can be found basking everywhere beside their breathing holes. The settlement was abandoned in 1963 and the houses are now used as field school and summer cottages (photo: Morten Meldgaard).

only ca. 10% of the calories required were provided by seal meat, while *ca.* 40% was provided at the trading posts. If meat from birds and whales is included in the calculation (Friis-Nielsen and Sveistrup 1944:62), the relative importance rises to *ca.* 20% and *ca.* 80% for the colony and the trading posts respectively.

Between 1900-1950's the subsistence settlement system became increasingly simple, with an annual cycle of decreasing geographical coverage. Thus there was a tendency for more people to become more sedentary and stay at the colony and at the trading posts throughout the year. Furthermore, the extended inter-regional trading and hunting expeditions that the inhabitants of Akulliit undertook before 1900, *e.g.* to Taseralik in the Sisimiut (Holsteinsborg) district (Ostermann *et al.* 1921:105; Birket-Smith 1924:237; Friis-Nielsen and Sveistrup 1944; Kramer 1992) now ceased.

The most important products that the hunters at Akulliit traded to their local representative of the Royal Danish Trading Company (KGH) were seal blubber, shark liver, fox skin, feathers and down (Ostermann *et al.* 1921:115,144). Most of these products were procured in connection with traditional subsistence activities.

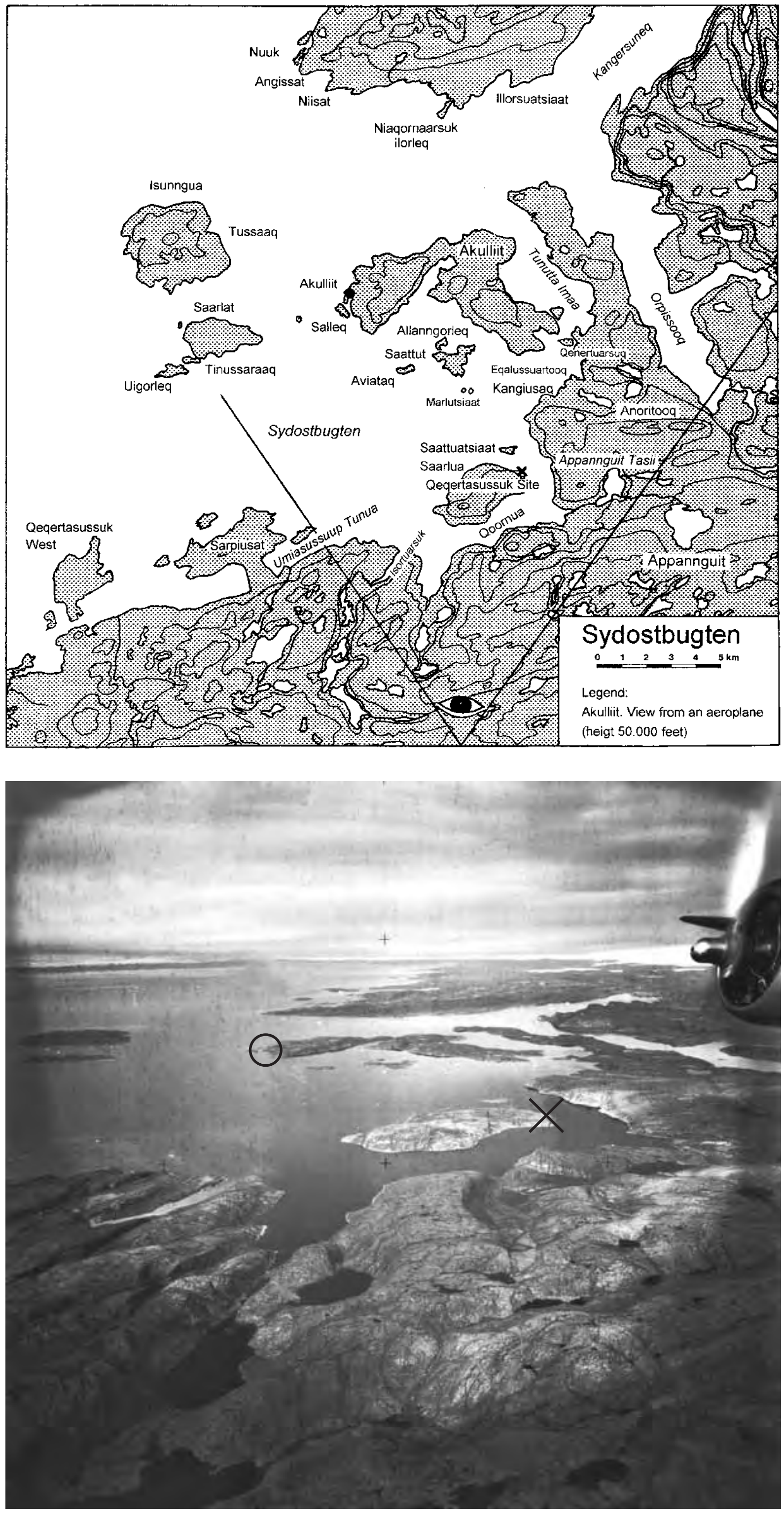
In 1915 trade at Akulliit consisted of 122 barrels of seal blubber, 157 barrels of sharks liver, 36 fox skins, 11 seal skins, 3.75 kilos of narwhal tusk and 98.5 kilos of birds feathers (Ostermann *et al.* 1921:144). In comparison the catch statistics show that Akulliit hunters, from April 1915 to March 1916, caught 15 white whales and narwhal, 2 harbour porpoises, 57 large seals (primarily adult harp seals), 696 smaller seals (primarily ringed seals and juvenile harp seals), 30 foxes, 1 polar bear, 6 caribou and 2195 char (Anon. 1916).

The traditional subsistence settlement system was modified by KGH's development of the trade in a number of ways. During the summer period a few hunters were becoming specialised fishermen, fishing sharks in the vicinity of Akulliit and not undertaking the traditional summer excursions. During winter, fox hunting was undertaken in areas the hunters would not traditionally have exploited.

Peat cutting in July was also an addition to the traditional annual cycle. With the advent of the stove it became necessary to cut peat, and this was done in July and August, preferably not too far from Akulliit so that transportation during winter would be easy (Ostermann *et al.* 1921:112, 143).

Finally, an important deletion from the traditional subsistence cycle was represented by the cessation of large whale hunting. Disko Bay was, in early colonial times, regarded as the most important whale hunting ground in West Greenland. Especially the bowhead population in the area had been exploited both by the Inuit and by European whalers (Friis-Nielsen and Sveistrup 1944). The importance of large whale hunting to the Inuit was exemplified in Niels Egede's account on the 1st of June 1743, where he described how the Greenlanders landed a large whale (probably a bow-

Fig. 4.3. A & B Map and aerial photograph (August 1948) showing the settlement Akulliit and its catchment area as well as the Qeqertasussuk site (courtesy of the National Survey and Cadastre).



head) on Jakobsholm close to Qasigiannguit, and how more than 1000 Greenlanders were gathered there on the 3rd of June to have a share in the bounty (Egede 1939:200) (Figure 4.4).

In the early 19th century, when the bowhead had become almost exterminated, hunting became unprofitable and both local and European whale hunting in Disko Bay came to a stop (Friis-Nielsen and Sveistrup

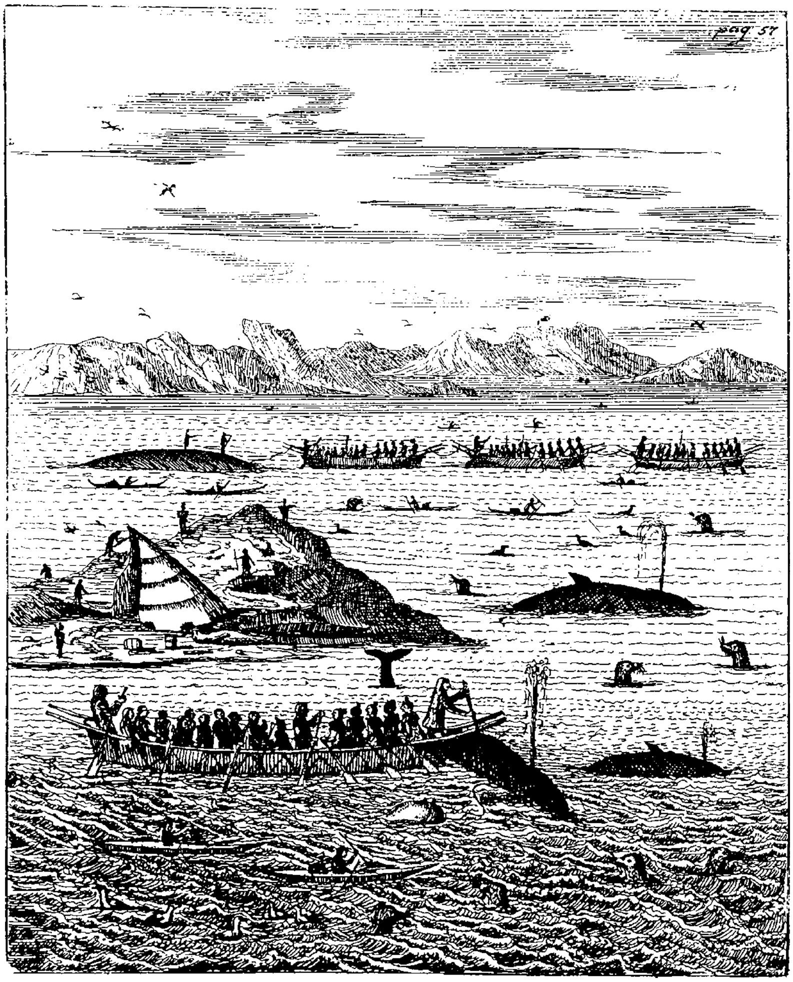


Fig. 4.4. Large whale hunting in 18th century West Greenland (From Egede 1741 in Petersen 1986). Traditional large whale hunting also took place in the Qasigiannguit district (Egede 1939).

1944:23-25; Hacquebord and Leinenga 1994). Thus, this very important element in the traditional subsistence settlement system is lacking in the annual hunting cycle of 1900-1950.

Fall and winter settlement

In the fall and early winter months of October, November and December Sydostbugten was generally free of sea ice and kayaks were used to reach the hunting and fishing grounds (Figures 4.10 and 4.21). The

Fig. 4.5. Fall: Harp seal hunting from kayak, West Greenland in the 19th century (drawing by Israil Nikodemus Gormansen (early 19th century) in Birket-Smith 1971:38).

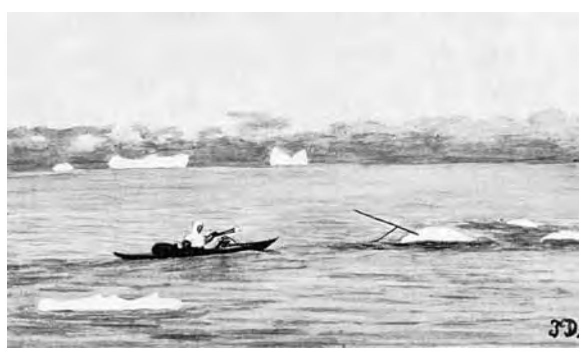


Fig. 4.6. Fall: White whale hunting from kajaq in Disko Bay (drawing by Jacob Danielsen (1888-1936) in Rosendahl 1967:185).

Fig. 4.7. Winter: Waiting for ringed seal at their breathing holes, Disko Bay (drawing by Jacob Danielsen (1888-1936) in Rosendahl 1967:305).

Fig. 4.8. Winter: Jigging for polar cod through the sea ice, Disko Bay (drawing by Jacob Danielsen (1888-1936) in Rosendahl 1967:243).

harp seals on their fall migration were important game (Krogh 1921:109; Porsild 1921:102; Kasper Didrichsen, inf. 1986) and were taken, among other places, north of Akulliit, at the mouth of Kangersuneq (Jens Vetterlain, inf. 1986) and north of Sarpiussat near the island Issorissoq (Kristian Jeremiassen, inf. 1986) (Figure 4.5).

Nets were also used to catch the fall migrating harp seals (Porsild 1921:102) and this is known to have taken place in the sound Tunutta imaa at least in the 19th century (Rink 1855:116; Johnstrup 1878:86). It was mainly the older harp seals that moved through shallow sounds and runs in groups that were caught in nets. The juvenile harps usually swim around in solitude and prefer more open waters (Müller 1906:163).

Groups of white whales also returned in fall and were taken either from kayak or with nets (Porsild 1921:103) (Figure 4.6). Frederik Jensen (inf. 1982) described netting for white whales at Pinguarsuks point (not located) and reports that in November and December 1929 he caught 24 whales in one net.

Fowling was significant during the months of October, November and December. Brünnich's guillemot and little auk, together with gulls, fulmar and other sea-birds were hunted in the open water in the fall and until ice started forming (Krogh 1921:109; Salomonsen 1967; Kasper Didrichsen, inf. 1986).

The hunting situation changed drastically in the period from January to May when the sea ice covered Sydostbugten. Ringed seal was the most important game in this period and was taken either through its breathing holes, while basking on the ice ("utoq"), at the ice edge, in tidal cracks or in leads in the sea ice (Krogh 1921:109; Kasper Didrichsen, inf. 1986) (Figure 4.7).

A number of places are mentioned by Akulliit hunters for their good ringed seal hunting:

(1) The inlet Umiasussuup Tunua and the ice off Sarpiusat and Issorissoq. The shallow water in Umiasussuup Tunua made it easy to see and harpoon the seals through the ice. There were also many basking seals on the sea ice both in the inlet and off Sarpiusat. (Frederik Jensen, inf. 1982; Kristian Jeremiassen, inf. 1986). The site was also known to the hunters from more western settlements who had their camps in the area (Frederik Jensen, inf. 1982).

(2) The sound Tunutta imaa was, because of its strong currents and many leads, a good place for

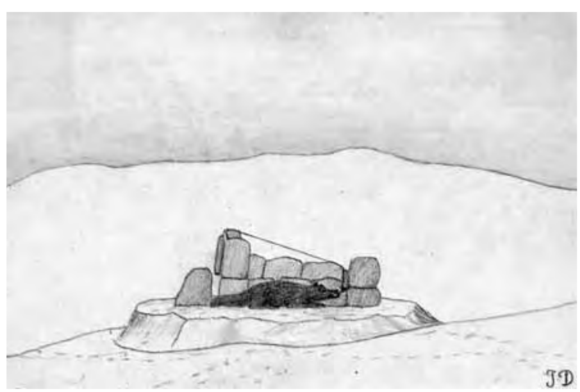


Fig. 4.9. Winter: Fox about to be trapped in stone trap, Disko Bay. Taking the bait, the fox releases the stone door at the rear (drawing by Jacob Danielsen (1888-1936) in Rosendahl 1967:239).

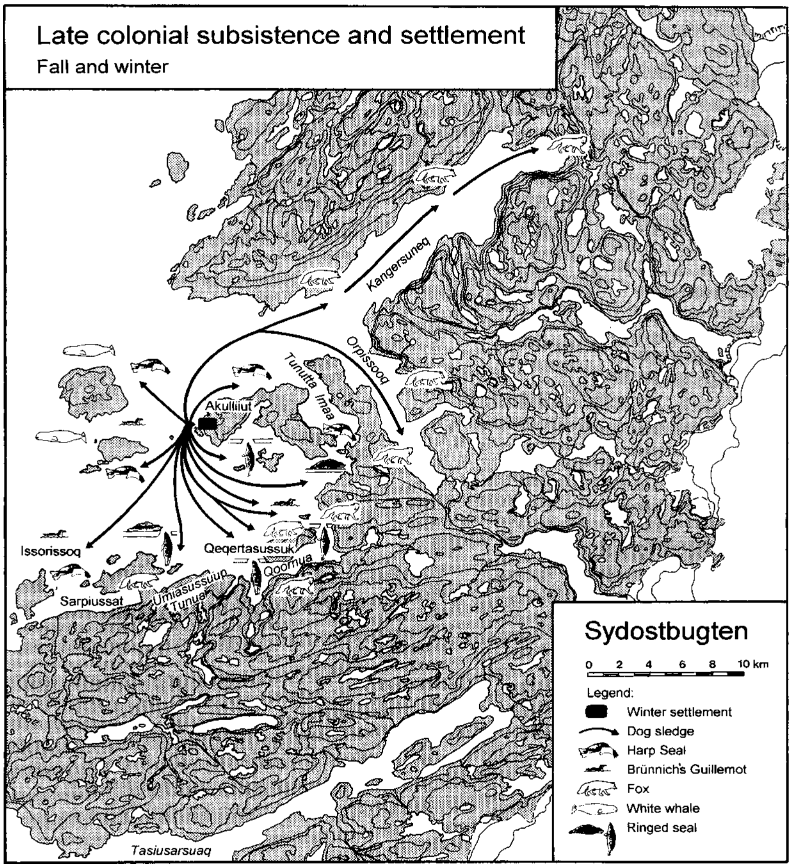


Fig. 4.10. The Akulliit subsistence settlement system of late colonial times (ca.1900-1963)): Fall and winter.

ringed seal hunting (Frederik Jensen, inf. 1982; Villads Olsvig, inf. 1986).

(3) The sound Qoornua around Qeqertasussuk was one of the best ringed seal hunting areas (Frederik Jensen, inf. 1982; Karl Olsvig, Villads Olsvig, Søren and Kathrine Thorning, inf. 1986).

(4) The sea ice between the island of Akulliit and Saattut provided a good hunting ground. Ice formed early in this protected area, and hunting in early winter from thin ice was excellent (Frederik Jensen, inf. 1982; Karl Olsvig, inf. 1986).

Throughout winter ringed seal hunting from the sea ice was supplemented by fishing for Greenland cod, sculpin, redfish, Greenland shark (Ostermann *et al.* 1921) and Polar cod (Rosendahl 1967) (Figure 4.8).

Trapping for arctic fox was an important winter occupation and the district had one of the finest fox populations in Greenland. The traps were set along the coasts of Sydostbugten and many of the informants mention that particular stretches of coast were reserved for particular hunters, for instance the peninsula Sarpiusat was trapped by Karl Olsvig (inf. 1986) and the head of Kangersuneq was trapped by Kristian Jeremiassen (inf. 1986). Good fox trapping was also present on the southern shore of Kangersuneq (Frederik Jensen, inf. 1982), on both sides of Qoornua Sound and all around Qeqertasussuk (Villads Olsvig, inf. 1986) (Figure 4.9).

As a curiosity it should be mentioned that there is an extensive fox denning area on the archaeological site "Qeqertasussuk" and that, accordingly, this place has been called "Sisikasiit" (the fox-holes) (Villads Olsvig, inf. 1986).

Spring camp

In late April – early May, most of the families at Akulliit loaded their dog sledges with umiaqs, kayaks, tents etc. and drove either 10 kilometres northwards to the three important hunting camps at Nuuk, Angissat, and Niisat or 8 kilometres towards the northwest to camps on the northern and western coasts of Tussaaq (Figures 4.11 and 4.13) (Ostermann *et al.* 1921:143;

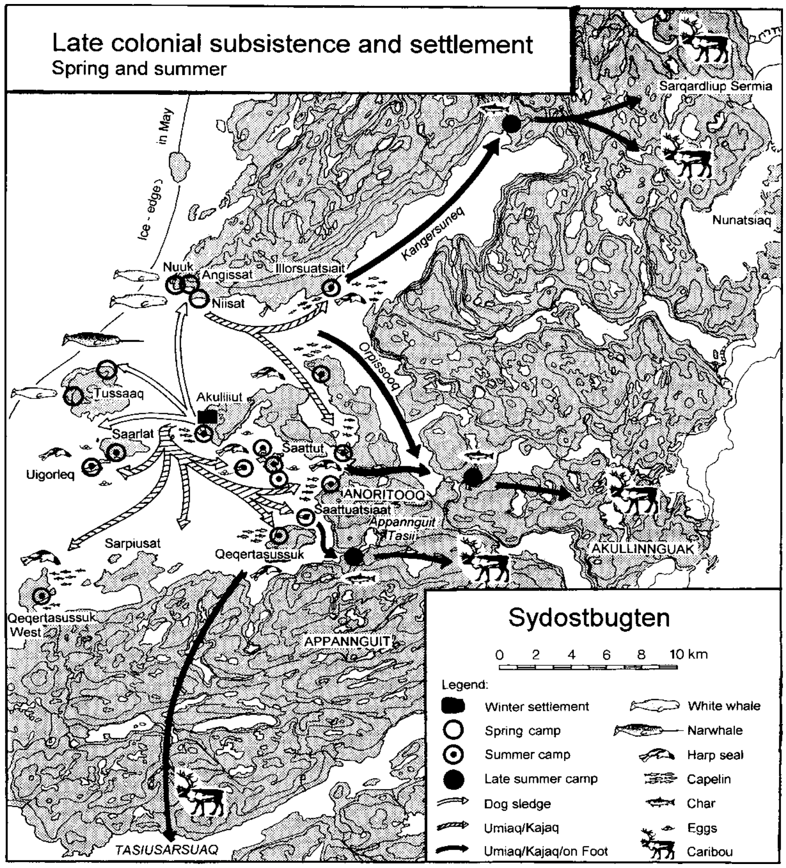


Fig. 4.11. The Akulliit subsistence settlement system of late colonial times (ca.1900-1963)): Spring and summer.

Frederik Jensen, inf. 1982; Søren Frederiksen, Karl Olsvig, Jens Vetterlain, Søren and Kathrine Thorning, inf. 1986). By around the first of May, the ice edge, moving still closer to Sydostbugten, is within easy reach of the hunting camps previously mentioned. Both white whales, narwhal and harp seals were hunted at the disintegrating ice edge and along developing cracks and leads in the sea ice. White whales and harp seals were the most important game species, while narwhal was taken only occasionally (Porsild 1921:103; Frederik Jensen, inf. 1982; Søren Frederiksen, Karl Olsvig, inf. 1986) (Figure 4.12). Bleached animal bones still litter the ground of these important spring hunting camps (Figure 4.17).

The spring camps were not only used by the local Akulliit hunters. Families from Aasiaat (Egedesminde) district came to the hunting camps at and near Nuuk to hunt white whale and harp seal (Søren Frederiksen, Søren and Kathrine Thorning, inf. 1986), as did the inhabitants of Ikamiut on the western fringe of Sydostbugten (Søren Frederiksen, inf. 1986).

Even though late summer was the most important caribou hunting season, some hunters left for the caribou hunting grounds in the interior in April and May (Ostermann *et al.* 1921:111).

Kasper Didrichsen (inf. 1986) mentioned that large whales were caught formerly from umiaq at Nuuk. This is the sole piece of information that we have of traditional large whale hunting in Sydostbugten.

Summer camp

In early or mid June the Akulliit families left the spring hunting camps in umiaqs and kayaks loaded with dogs, tents and other equipment. Next stop were the summer camps dispersed throughout the inner and eastern part of Sydostbugten between 5 and 15 kilometres away (Figure 4.11) (Ostermann *et al.* 1921:143; Søren Frederiksen, Villads Olsvig, Jens Vetterlain, Søren and Kathrine Thorning, inf. 1986).

Whaling, sealing and capelin fishing in May and June normally produced a surplus that was dried for storage and later consumption (Porsild 1921:104; Ostermann *et al.* 1921:105,148; Søren and Kathrine Thorning, inf. 1986) (Figure 4.14). Dried capelin were particularly important as winter provisions (Anon. 1944:663). Arctic char caught in July and August was also dried, smoked and salted for storage and later consumption (Krogh 1921:109; Ostermann *et al.* 1921:105).

Provisions were stored in caches either at Akulliit or at the camp site where the food was procured (Ostermann *et al.* 1921:236) (Figure 4.16). The informant Frederik Jensen (inf. 1982) mentioned a cache on the northeastern part of the island Saatttut, which was owned by the people of Akulliit, and that the inhabitants of the small winter settlement Niaqornaarsuk had caches of dried meat and capelin at the southwestern end of Akulliit island.

It is interesting to note that also the people from Aasiaat district owned caches in the area. Thus the informants Søren and Kathrine Thorning (inf. 1986) described how hunters from Aasiaat in the winter time, when transportation was easy, would return to Akulliit for provisions that had been cached there during the summer.

A huge cache visited by the author and informant Lars Johansen in April 1988 is situated a few hundred meters east of Illorsuatsiaat (Figure 4.15), see also Ostermann *et al.* (1921:236). Lars Johansen related that this cache was used by the people from Aasiaat district for eggs, capelin and dried seal and whale meat, and that they would return in winter to collect the cached provisions.

Eider-duck eggs were collected when possible, but most important was the collection of tern eggs (Ostermann *et al.* 1921:111). While eider eggs could be stored, tern eggs were not suitable for storage because their thin shells were easily broken (Lars Johansen, inf. 1986).

Sydostbugten was excellent for bird hunting and many gulls and eider ducks and some kittiwakes, black guillemots, Brünnich's guillemots, old squaws, fulmars, cormorants and geese supplemented the diet in summer (Krogh 1921:109). An occasional porpoise, bearded seal or hooded seal was also taken in the area (Krogh 1921:109).

Shark fishing was undertaken mostly in summer and mostly close to the settlement itself (Krogh 1921:109).

Sydostbugten's wealth of summer resources was known not only to the local inhabitants of Akulliit and Ikamiut, but also to the people in the northern part of the Aasiaat district. In June large numbers of umiaqs and kayaks thus left the settlements of Killiit (Vester Ejland), Kitsissuarsuit (Hunde Ejland), Kitsissunnguit (Grønne Ejland), Manermiut, Akunnaaq and Nivaaq to travel up to 100 kilometres to reach the summer camps in Sydostbugten (Figure 4.18) (Steensby 1912: 156; Ostermann *et al.* 1921:106; Birket-Smith 1924:375; Petersen 1986; Søren Frederiksen, Villads Olsvig, Kristian Jeremiassen, Søren and Kathrine Thorning, inf. 1986).

Ostermann (1921:105-106) paints a vivid picture of summer life in Sydostbugten:

"From Puagiarsuk's naes at the Nivaaq fjord west of Ikamiut to Nuuk south of Qasigiannguit tent stands by tent along the coast and on the islands. The ground

Fig. 4.12. Spring camp in the Disko Bay area. A hunter is on the look-out for harp seals while a woman is flensing newly caught harps on the ice-foot (drawing by Jakob Danielsen (1888-1936) in Rosendahl 1967:57).

Fig. 4.13. Tent at spring camp at Niisat (Fig. 4.11) (photo: H. P. Steensby 1909 from Steensby 1912:154).

Fig. 4.14. Drying capelin at the summer camp. Dried capelin was an important source of food for dogs and people during winter (drawing by Jakob Danielsen (1888-1936) in Rosendahl 1967:205).

Fig. 4.15. Lars Johansen in a cache beneath a huge boulder. Small stone walls prevent foxes from entering. The cache, situated at Illorsuatsiaat, was used for storing eggs, dried capelin, dried seals meat and other winter provisions by people from Aasiaat (photo: Morten Meldgaard).

is stained red with the blood from the butchered seals and the cliffs shine silvery from drying capelin. The otherwise so quiet Sydostbugt is teaming with life and in the evenings the fires glow and streams of smoke rise in all directions while visits are paid from camp to camp in the low light of the midnight sun. This custom can be traced back as far as the archives go..."

During this period of plenty the population seems to have doubled due to the presence of most of the inhabitants from Nuuk, Nivaaq, Kitsissunnguit (Grønne Ejland), Akunnaaq, Manermiut, Kitsissuarsuit (Hunde Ejland) and Killiit (Vester Ejland) (Ostermann *et al.* 1921:105-106).

If we take Ostermann's statement about a doubling of the population in Sydostbugten literally, this would mean that at least 350 people would exploit the *ca.* 35 kilometre wide bay during the summer (the resident population of Sydostbugten consisted in 1915 of Ikamiut's 82 and Akulliit's 93 inhabitants). If Niels Egede's (1939:200) statement about the gathering within 3 days of almost 1000 Inuit near Qasigiannguit in June 1743 can be taken literally, a figure of 350 for all of Sydostbugten seems quite reasonable.

Fig. 4.16. Storage house in front of a winter house at Napassoq. These small houses were used to store winter provisions such as dried capelin and dried whales meat (drawing by Ossian Elgström in Elgström 1916, courtesy: Folkens Museum, Stockholm).

Fig. 4.17. Bones of white whale, harp seal and dog surface collected at Niisat. They represent historical, probably 20th century hunting excursions (photo: Morten Meldgaard).

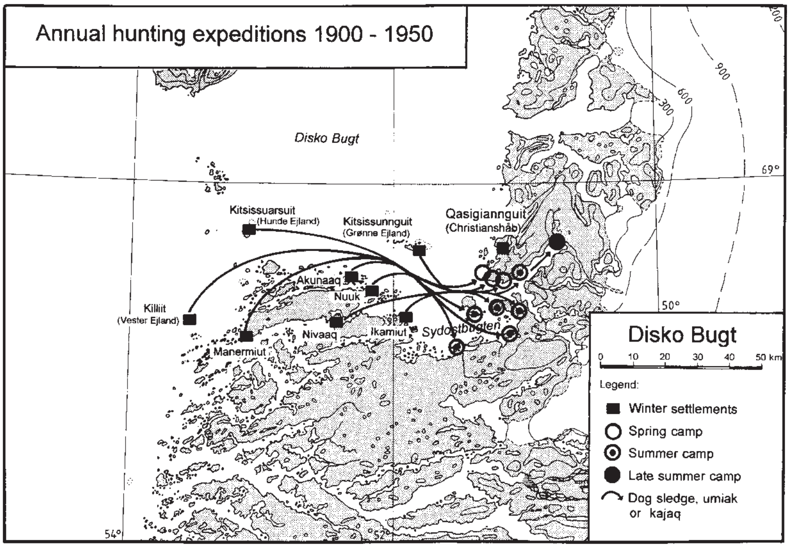


Fig. 4.18. Sydostbugten's wealth of summer resources attracted people from the whole district.

Late summer camp

In late July and August the Akulliit families left their capelin and sealing camps on the coast and islands of Sydostbugten to go peat cutting, char fishing and caribou hunting (Figure 4.11 and 4.22).

Peat for winter heating was cut on the small island Salleq, that protects the harbour of the Akulliit settlement, and on the small island Alianaatsoq 3 kilometres to the south (Ostermann *et al.* 1921:112,143; Jens Vetterlain, inf. 1986; Frederik Jensen, inf. 1982). From here some families went harp seal hunting at Tussaaq and Saarlat (Ostermann *et al.* 1921:143). Other families paddled their umiaqs and kayaks to the heads of the two large fjords Kangersuneq and Orpissooq, a journey of up to 25 kilometres, where the late summer camps were established (Frederik Jensen, inf. 1982; Karl Olsvig, Ane Møller, inf. 1986) (Figure 4.19).

Hunters from the capelin and sealing camps in the southeastern part of Sydostbugten often took a shortcut across the root of the Nuuk peninsula to and from the char fishing camp at the head of Orpissooq (Karl Olsvig, inf. 1986). A few families went char fishing at the head of Laksebugten north of Qasigiannguit (Ostermann *et al.* 1921:143) and at Appannguit Tasii (Villads Olsvig, Søren and Kathrine Thorning, inf. 1986). The catch of char was sufficient to produce sig-

Fig. 4.19. En route between camps (drawing by Ossian Elgström in Elgström 1916, courtesy: Folkens Museum, Stockholm).

Fig. 4.20. Late summer camp at the head of Kangersuneq in August 1987. Char fishing is the main occupation (photo: Morten Meldgaard).

nificant quantities of dried, salted and smoked fish meat for storage and later consumption (Krogh 1921: 109).

Caribou hunting was undertaken inland from the char fishing camps (Ostermann *et al.* 1921:110-11; Porsild 1921:101) and there were four main routes that the hunters took in August and September to reach the caribou hunting grounds:

(1) From the char fishing camp at the head of Kangersuneq (Figures 4.10 and 4.20) it was *ca.* 20 kilometres to the caribou hunting grounds at Nunatsialak and Anoritooq near the glacier Saqqarliup Sermia. This route was used both by Akulliit hunters and by hunters from Kitsissunnguit (Grønne Ejland), Nivaaq and Nuuk (near Nivaaq) (Ostermann *et al.* 1921:106; Frederik Jensen, inf. 1982; Søren Frederiksen, inf. 1986).

(2) From the char fishing camp at the head of Orpissooq, caribou hunting was undertaken in the inland towards the Ice Cap (Ane Møller, inf. 1986). The Orpissooq route was also taken by caribou hunters from Kitsissunnguit (Grønne Ejland), Nuuk (near Nivaaq) and Nivaaq (Ostermann *et al.* 1921:106).

(3) To reach the caribou hunting grounds on Akullinnguaq adjacent to the Ice Cap, the hunters from Akulliit took the route from Appannguit Tasii south of Anoritooq, a trip of up to 20 kilometres (Villads Olsvig, inf. 1986).

(4) The important caribou hunting grounds around Tasiusarsuaq, constituting the northeasternmost branch of a large fjord complex, were reached across land and lakes by Akulliit hunters using the small fjord Isortuarsuk as a gateway. This route, approximately 15 kilometres long, was used

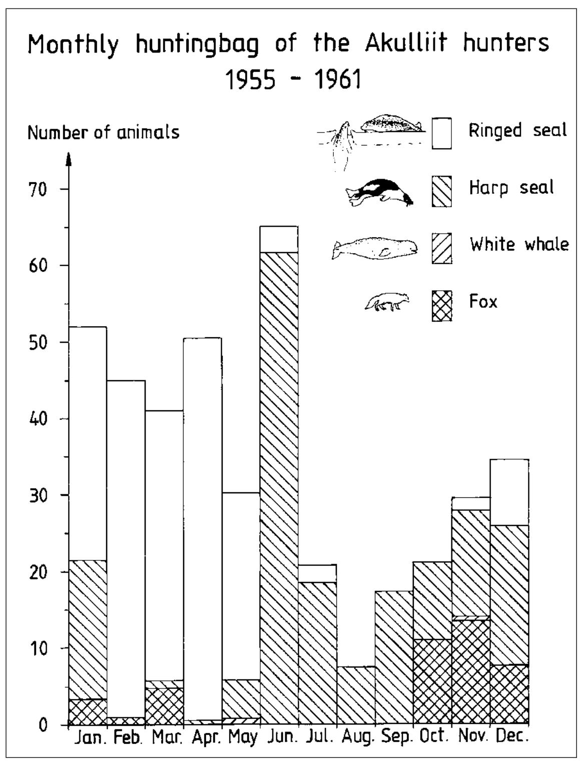
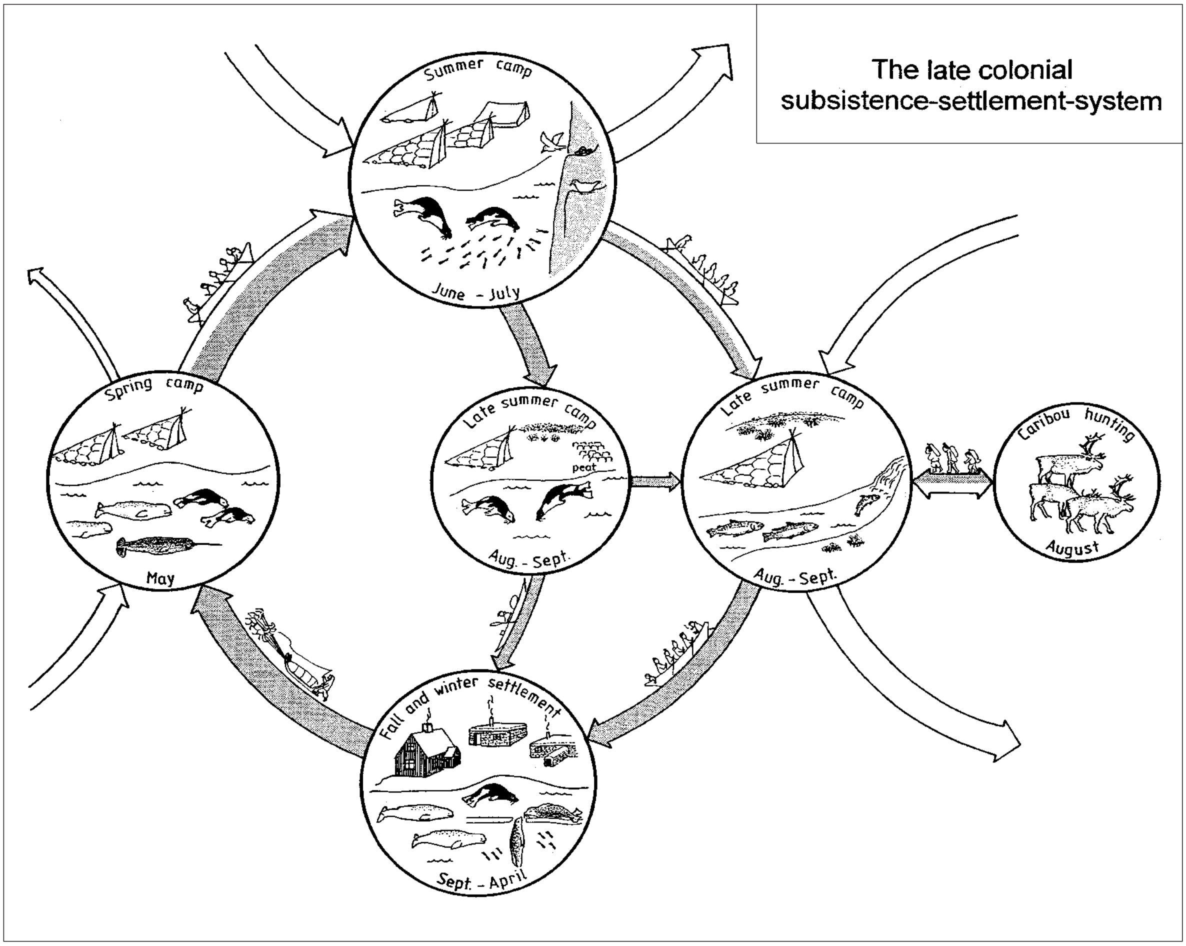


Fig. 4.21. The average number of animals taken per month by an average of 25 hunters over 6 years at the Akulliit settlement in Sydostbugten (data from Rigsarkivet: 0030 F05, proveniens:16-32,3 1954-69 Christianshåb 7705-22-1).



both by Akulliit hunters and by hunters from other places (Frederik Jensen, inf. 1982; Jens Vetterlain, Ane Møller, inf. 1986).

In connection with the inland journeys for char and caribou, it was customary to pick berries. In August and September when the crowberry, arctic blueberries and rock craneberries ripen by the millions, they are picked mostly for immediate consumption (Ostermann *et al.* 1921; Birket-Smith 1924:26; Ane Møller, Søren and Kathrine Thorning, inf. 1986). In September most Akulliit families returned to the settlement proper and here they stayed through fall and winter (Ostermann *et al.* 1921:143) (Figure 4.10).

The size of the catchment area

The seasonal camps in the annual subsistence cycle in Sydostbugten were situated within an area of approximately 40 by 40 kilometres. The distances between camps were thus relatively small, and transportation between even the most distant camps could usually be undertaken within a day or two by umiaq, dog-sledge or on foot.

This was not typical for West Greenland where there were large variations in the size of the catchment area. In Kangerlussuaq (Søndre Strømfjord) area for example, the distance between the inland caribou hunting sites and the coastal sites exceeded 150 kilometres (Grønnow *et al.* 1983; Meldgaard 1986).

Abnormal resource situations

The Akulliit hunters were described as skilled and industrious (Ostermann *et al.* 1921:108) and Akulliit, situated as it is in a protected bay with a relatively rich and diverse resource base, must be described as a comparatively well off community. Morten Porsild (1921:101) described it humorously as "... a district for pensioners".

Fig. 4.22. The late colonial subsistence settlement system – a summary. Dark arrows represent local people, white arrows represent "outsiders".
Spring camp. The May occurrence of white whales and harp seals was very localised and the availability was high due to stable weather patterns and good light conditions. The combination of both high and localised resource concentrations and good availability clearly determined the location of the spring camps on a few optimally situated sites on Tussaaq and at Nuuk, Angissat and Niisat. The resource concentration was important enough to attract hunters both from the local area (Akulliit and Ikamiut) and from a larger region (northern Aasiaat district).

Summer camp. In June and early July capelin, harp seals and breeding birds were available along all shores and on all islands in Sydostbugten. The whole bay was characterised by having a high resource concentration, and the stable weather and good light conditions provided excellent resource availability.

The situation with resources that were both geographically dispersed and occurring at high densities under excellent conditions of availability determined the relatively even distribution of hunting camps throughout the inner parts of Sydostbugten. The resource situation was so good that hunters were attracted from a large area probably resulting in more than a doubling of the human population in Sydostbugten.

Late summer camp. In late July and August capelin and migratory seals have for the most part left the inner parts of Sydostbugten and the resource concentration and density has fallen in general. Some harp seals were found in more open waters but the most conspicuous addition to the resource picture was the occurrence of arctic char runs at the river mouths in the area. The caribou in the interior were at this time in prime condition. The combination of running char available in high concentrations at the river mouths and caribou within easy reach determined the location of the late summer camps. However harp seals still occurred in numbers and concentrations that could provide the basis for feasible hunting. Thus while most Akulliit families seem to have chosen the inner fjord char fishing camps during this period, some families exploited harp seals from tent camps in the outer bay region.

Fall and winter settlement. In the fall and early winter months of October, November and December many of the migratory species of mammals and birds pass through the area. They were well dispersed and occurred at a relatively high density but, because of the much more adverse weather and deteriorating light conditions, the availability of these resources were relatively low. When winter ice covered the bay most mammals and birds left the district and only the ringed seal and different species of fish were present. Resource density declined drastically and they were relatively evenly distributed. Availability was poor because of the winter darkness. The Akulliit settlement was centrally situated with respect to the fall and winter resources of the area, and all families gathered here in September, while hunters from other areas headed back to their own winter settlements.

Despite the district's good living conditions, periods of need and famine occurred when hunting failed. This was the case even in the first half of the 20th century. Absence of key game species is easy to understand as a direct cause of failing hunting success, but very often hunting failure had to do with limited availability of game due to poor weather, ice or light conditions. The following presentation reviews the four most important causes for hunting failure and famine in Sydostbugten and in this part of Greenland in general.

1) Absence of game is often mentioned as the direct cause of difficult times. Even though hunting conditions could be excellent, with good weather and fine ice and light conditions, important game could fail to appear.

The harp seals have been known to be delayed on their spring migrations or they have appeared only in small numbers (Anon. 1907:106; 1924:61; 1928:597; 1938:690), often as a result of the presence of killer whales (Anon. 1928:597; 1933:13,226; 1938:690; Søren and Kathrine Thorning, inf. 1986). In some winters ringed seals have been almost entirely absent (Anon. 1901:132-3; 1918:414; 1933:33).

Fish, *e.g.* capelin, may in some years fail to appear at the usual places (Ostermann *et al.* 1921:235; Anon. 1928:722, 1933:33) or at the usual time (Anon. 1933: 433).

2) Adverse winter weather conditions were very often blamed for failing hunting success and famine. In the fall months of November and December, which are generally looked upon as the poorest in terms of fish and game, windy and adverse weather could prevent kayak hunting at sea for extended periods of time (Krogh 1921:109; Ostermann *et al.* 1921:65,233, 235).

The sea ice, a prerequisite for successful ringed seal hunting and which normally covered the bay from late December to Late May, was easily broken up by winter storms. In winters with frequent storms winter ice formation could be almost non-existent, with severe consequences for the Inuit in the area.

Many examples of these difficult hunting conditions and resulting low game availability can be found in the annual reports of the Royal Danish Trading Company (KGH) (*e.g.* Anon. 1884:9; 1888:34; 1896:8; 1901:39; 1907:157; 1924:8,358, 467,469; 1928:219).

Many of the examples of poor winter weather situations with storms and very little or no winter ice come from a period with higher than normal winter temperatures, and there seems to be a high correlation between high winter temperatures, unstable and stormy weather, short duration of winter ice cover and poor winter hunting success (Porsild 1921:161; Friis-Nielsen and Sveistrup 1944:9,11,22).

3) Very cold winters may also severely influence hunting success and result in famine (Birket-Smith 1924:45). This is primarily a consequence of the disappearance of the ringed seals due to the steadily increasing thickness of the sea ice (anon. 1885:6; 1896:92).

4) Rainy summer weather could influence the success of drying meat, especially capelin. Capelin were dried on cliffs and on dwarf shrub vegetation in June, and if rain prevailed in this period the fish were destroyed (anon. 1885:7; 1888:35; 1924:116). A good description is given in the following report from The Greenland Government (Grønlands Styrelse): "The supply (of capelin) that the weather in the drying season permits the people to collect, determines the degree of security with which they face the winter season" (Anon. 1944:663).

When forced by failing hunting success and empty caches, people resorted to food sources that were not normally eaten in any quantity. Sculpins, crabs, mussels, sea-urchins and sea-weed that could be caught or collected in the tidal zone were among the most important emergency foods in the area (Rink 1852:134-5; Ostermann *et al.* 1921:269; Porsild 1921:104, 228-9; Birket-Smith 1924).

If the period of unsuccessful hunting extended for some time, the sledge dog population was also reduced to reduce competition for the limited food sources available (Anon. 1924:9,360; 1928:486).

Summary

The annual hunting cycle, the location and importance of the hunting camps, and the storage strategy were very closely linked to seasonal and geographical changes in resource diversity, density and distribution (Figure 4.22). The enormous seasonal differences in resource diversity, density, concentration and availability meant that measures had to be taken to secure survival during winter. The collection and preparation of food during periods of plenty, for storage and consumption during periods with food deficit was the rational response to the dynamics of Sydostbugten's resources, as it has been throughout the circumpolar region (Eidlitz 1969).

The correlation between subsistence and settlement patterns and resource patterns can be formulated in a few statements:

- The size of the hunting Inuit population in Sydostbugten in any given season was adjusted according to resource availability. In fall and winter, when resource density and availability was at its lowest, the resident Inuit population made up *ca.* 175, while in summer, when resource availability was at its highest, the population rose to more than 350.
- The resources of Sydostbugten were of regional importance in spring and summer, but only of local importance in winter.
- The geographical position of the spring, summer and late summer camps were closely correlated to resource distribution and density in any given season.
- The hunters followed the "wave" of animal resources that proceeded from the ice edge in May, to the inner bay and islands in June and to the head of the fjords and into the interior in July and August.
- The harvest of a surplus of food in May, June, and July for storage and fall and winter consumption was a prerequisite for survival.

At a higher level, the adaptive strategy in Sydostbugten can be formulated in four basic principles, which are also applicable to Inuit subsistence strategies in general: (1) a high degree of mobility, (2) a highly developed storage strategy, (3) dependence on a broad range of resources, and (4) a highly flexible hunting strategy. By adhering to these principles, the Inuit maximised their chances of long term survival in an ever changing and unpredictable environment (Meldgaard 1995).

Chapter 5

Archaeology

Survey work and excavations

Prior to 1982 only 8 Thule sites and one Saqqaq site were registered in the eastern part of Sydostbugten (Mathiassen 1934:13-17; archives at the National Museum of Greenland). In 1982, 1983, 1987 and 1988 Qasigiannguit Museum undertook systematic archaeological surveys of all of Qasigiannguit municipality (Grønnow 1983; Møhl 1983; Hansen and Petersen 1989; Hansen *et al.* 1989). These surveys were aimed at providing an overview of the historical resources of Qasigiannguit municipality. These reconnaissances were supplemented by surveys done in connection with the Qeqertasussuk Project in 1987 (Meldgaard 1987a) with the specific aim of elucidating the prehistoric and historic use of the Qeqertasussuk catchment area. In addition, Qasigiannguit Museum and Aasiaat Museum have continued by surveying the southwestern part of Disko Bay in 1990 and 1995 (Hansen 1990; Jensen *et al.* 1995; Andreasen 1998; Jensen 1996; Jensen and Petersen 1998; Olsen 1998). These surveys focused on mapping and excavating Paleoeskimo sites. The southern part of Disko Bay is thus one of the most thoroughly investigated regions in Greenland and during these more than 10 years of surveys and excavations our knowledge of the location of prehistoric sites have improved considerably.

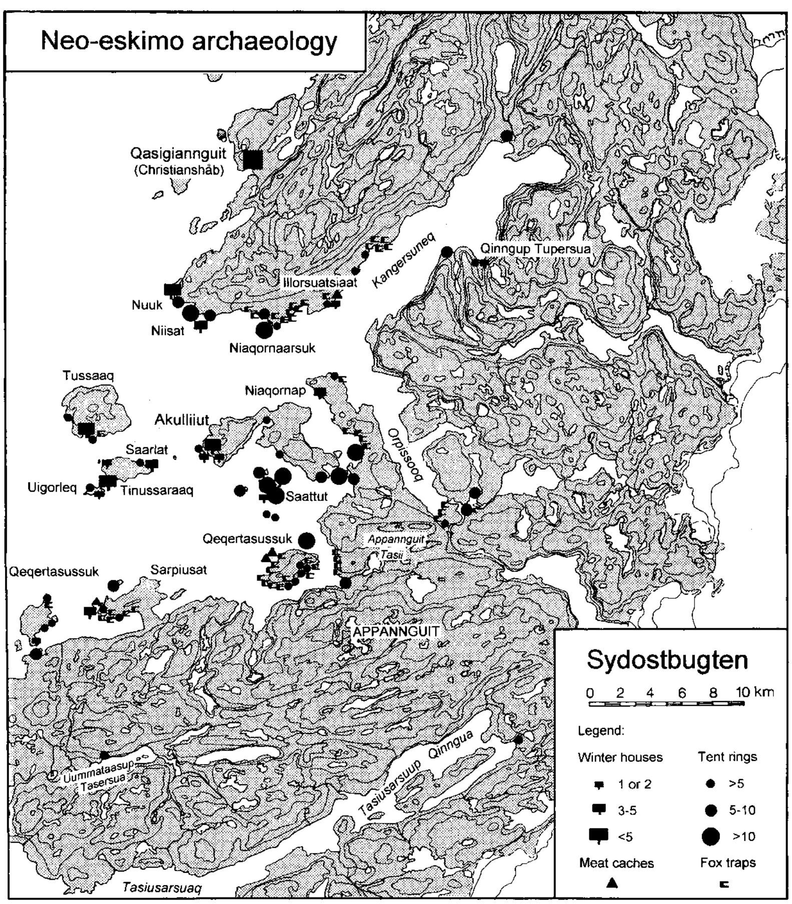


Fig. 5.1. Location of late Inuit sites and structures. The winter houses are generally situated facing the outer and open parts of Sydostbugten while the summer tents primarily are located in the more protected inner parts of the bay.

Neoeskimo settlements

Representativity

Keld Møller Hansen (Hansen *et al.* 1989) concluded a report on the 1988 surveys with the statement that by now the whole area, except the inland areas of Sydostbugten, had been surveyed. This is largely true, but highly detailed surveys of selected smaller areas (study areas I-VI) (Figures 5.6 and 5.7) have shown that it can be expected that stone structures with low relief *e.g.* tent rings, especially when more or less overgrown with vegetation, have eluded the eye of several surveyors. Also, special structures such as caches and graves, that are often found on elevated ground some distance from the shore and that are often difficult to identify, are likely to be overlooked. Based on these observations the representativity of winter houses is judged to be excellent, that of tent rings and fox traps to be good and that of caches to be poor (Figure 5.1).

Dating

No excavations have been made in connection with the surveys in the study areas, and dating especially of tent rings, caches and fox traps is consequently difficult.

However, according to the survey reports, none of the presented tent structures from the research area show Paleoeskimo features such as mid-passages or central hearths and none of them have been associated with Paleoeskimo artefacts. On the other hand many have shown distinct Neoeskimo features such as sleeping platforms and there has often been association with Neoeskimo artefacts.

Based on these observations, it seems reasonable to assume that the majority of the registered tent rings are of Neoeskimo origin.

No attempt has been made to date the meat caches, but acknowledging that the majority of dated stone structures in the area are Neoeskimo, it seems reasonable to assume that the caches too are mainly Neoeskimo.

The fox traps are of the Neoeskimo stone built type (Fabricius 1788) and many of them still have wood and bone parts intact. It seems safe to assume a Neoeskimo and primarily post colonial origin of these traps (Figure 5.2).

Turf houses and winter settlements are more easily datable (Gulløv 1983), and the historical or ethnohistorical information on these more visible structures is quite good.

Fig. 5.2. Fox trap in use, Aasiaat 1918. The trap door is held in place by a string which in turn is attached to the bait fixed to the release mechanism (see also Fig. 4.9) (photo: Kaj Birket-Smith, courtesy of the Danish National Museum; see also Hansen 1976).

Fall and winter settlements

The archaeological record gives us a more diverse picture of the location of fall and winter settlements than is revealed by the ethnographic analysis of the situation between 1900 and 1950. A total of 14 winter settlements have been located in the study area (See list below) (Figure 5.1). Most of them are small, with one to three houses, and they are found in both the inner and outer part of Sydostbugten and in the fjords.

List of winter settlements

Nuuk, 7 winter houses. Poul Egede (1939:87) relates that in 1739 there were two houses inhabited by 10 families at Nuuk. In 1793 there were 48 inhabitants and in 1811 there were still people living there (Mathiassen 1934:34).

Niisat, 3 winter houses. Known to have been inhabited in 1805 and in 1811 (Mathiassen 1934:16-17).

Illorsuatsiaat, 1 winter house. Not known to have been inhabited since colonisation.

Qinngup Tupersua, 1 winter house. Qaqà Jeremiassen (pers. comm. 1987) relates that his aunt on his father's side was born in this house (ca. 1930).

Niaqornaq, 4 or 5 winter houses. Known to have been inhabited in 1835 and in 1846 (Mathiassen 1934:16).

Fig. 5.3. Summer camp site on the south coast of Qeqertasussuk. The tent rings are placed so they overlook Qoornua Sound where packs of harp seals swim by in summer (photo: Morten Meldgaard).

Tussaaq, 9 winter houses. Known to have been inhabited between 1777 and 1783 (Mathiassen 1934: 14).

Saarlat, West, 1 winter house. The local tradition says that the house was inhabited in the 19th century (Frederik Jensen, inf. 1982).

Saarlat, East, 3 winter houses. Not known to have been inhabited in colonial times.

Tinussaraaq, 9 winter houses. Not known to have been inhabited in colonial times, and judging from the house types (that include long houses (Gulløv 1983)), this site is probably pre-colonial.

Uigorleq, 1 winter house. Not known to be inhabited in colonial times.

Akulliit, There are winter house ruins at several locations in the vicinity of the settlement, but most of them are badly disturbed by turf cutting and later building activities (Ostermann *et al.* 1921; Mathiassen 1934:14). Akulliit is known to have been inhabited in 1781, but was then abandoned for some years until resettlement in 1797. The settlement was inhabited from 1797 and till 1805, but abandoned again. Finally people started moving back to Akulliit around 1850, and by 1855 it was designated a "udsted" (a settlement with a trading post) (Ostermann *et al.* 1921:146). In 1963 Akulliit was shut down for the last time.

Saattut, 2 house ruins. Not known to have been inhabited in colonial times (Mathiassen 1934:16).

Sarpiusat, 3 winter houses. Known to have been inhabited from 1835 to 1855 (Mathiassen 1934:34). The settlement had 14 inhabitants in 1850 (Rink 1855:117). It was also inhabited *ca.* 1900 and *ca.* 1940 (Jens Veterlain, inf. 1986) and it was here Jørgen Brønlund (1877-1907) was born.

Qeqertasussuk (western one), 1 winter house. Not known to have been inhabited in colonial times.

The small winter houses located along the inner coast of Sydostbugten i.e. Sarpiusat, Qeqertasussuk (west) and Niaqornaq, all have access to narrow runs where leads and openings in the sea ice are created by strong tidal currents. These are places favoured by migrating harp seals and white whales in fall and by ringed seal in winter. But apparently these good hunting conditions could only sustain a small number of people.

The majority and, at the same time, the largest of the fall and winter settlements are situated in the outer part of Sydostbugten on islands providing easy access to large expanses of sea ice and the open sea. The sites at Tussaaq, Tinussaraaq, Nuuk and probably Akulliit all have close to 10 house ruins. It is likely that several houses were inhabited simultaneously at any given time. An example is given by Poul Egede (1939:87) who relates that two houses with 10 families were inhabited at Nuuk in 1739.

It is interesting to note that several of the winter settlements were inhabited simultaneously. Around 1781 Nuuk, Akulliit and Tussaaq were inhabited. The same goes for Nuuk, Akulliit and probably Niisat around 1811 and for Akulliit, Sarpiusat and probably Niaqornaq around 1850.

If we look at the 1781 situation and use Poul Egede's figures and assume that two houses at each site was inhabited by five families each consisting of *ca.* five individuals, we would arrive at a winter population of 150 persons in the first half of the 19th century – almost double the winter population in the study area in 1915.

Spring and summer camps

The location and size of the archaeologically registered tent sites (Figure 5.1) seem to be in general concordance with the ethnographical information:

(1) Tent camps were located on Tussaaq and especially on the coastal stretch from Nuuk over Niisat to Niaqornaarsuk, where spring sealing and whaling at the ice edge was an important activity in May.
(2) Tent camps were located along all coasts and islands of Sydostbugten, especially along the inner parts of the bay and on the bay's many small islands (Figure 5.3). Places where capelin fishing and harp seal hunting were typically undertaken in June and early July. The high number of tent camps, and the fact that many of them are quite large, underline the importance of the activities undertaken here.
(3) Tent camps were located at the heads of Orpissooq and Kangersuneq, and at Appannguit where char fishing was an important activity in August. These camps were also used as base camps from which caribou hunting was undertaken.

Archaeological remains from inland activities are rare, but a few sites with inugsuks are known, and a single site at the western end of the lake Uummataasap Tasersua can be characterised as a genuine caribou hunting camp with several dwellings and caches in relation to minor systems of hunting blinds and inugsuks (Jensen *et al.* 1995).

Meat caches

Only 4 meat caches have been located archaeologically (Figure 5.4). As mentioned earlier, this is probably because of the difficulties encountered with the identification of these structures, and because the archaeological surveys are most intense right along the shore line, while the caches often are found at some distance inland. In this case the ethnographic data is of higher value and has much better resolution than the archaeological data.

Fig. 5.4. Meat cache at the head of Kangersuneq. Such caches were used for storing e.g. dried caribou meat and seal meat (photo: Jens Fog Jensen).

Fox traps

The stone fox traps are interesting because they indicate "in situ" hunting in Sydostbugten (Figure 5.5). They occur along most shores, both on the mainland and on the islands, and they are even found at the head of Orpissooq. They give an impression of the extent of the hunting trips undertaken and correlate well with the information given by the informants from Akulliit about winter hunting for arctic fox in the inner parts of the bay and in the fjords.

The Neoeskimo subsistence settlement pattern

The pattern shown by the archaeologically registered sites and structures represents superimposed annual

Fig. 5.5. Fox traps on the southern shore of Qeqertasussuk. Sydostbugten was renowned as one of the best fox districts in Greenland (photo: Morten Meldgaard).

hunting cycles of many generations of hunters. The data is generally consistent with the ethnographic and ethnohistoric record, but there is archaeological and historical evidence of a larger and geographically more dispersed winter population in Sydostbugten in early colonial and probably also pre-colonial times.

Paleoeskimo archaeology

Only the Saqqaq site at Illorsuatsiaat in Sydostbugten was known prior to the discovery of the Qeqertasussuk site in 1983 (Figure 5.8). In Helge Larsen's contribution to "Paleo-Eskimo Cultures in Disko Bay" (Larsen and

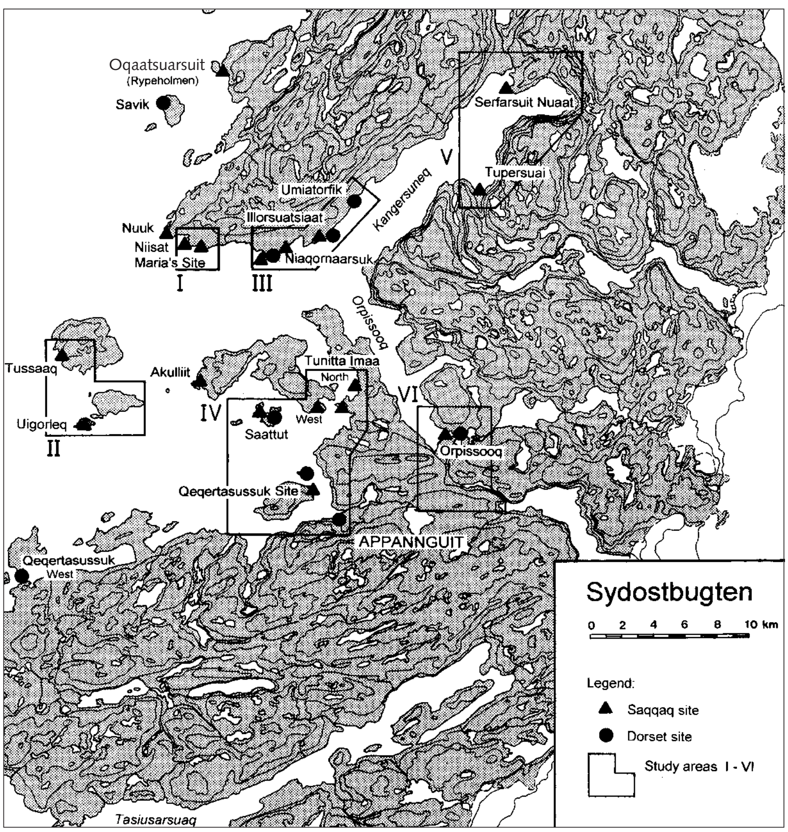


Fig. 5.6. Map showing the location of Paleoeskimo sites in Sydostbugten and the position of six study areas that were selected for focussed and detailed surveys for Saqqaq sites.

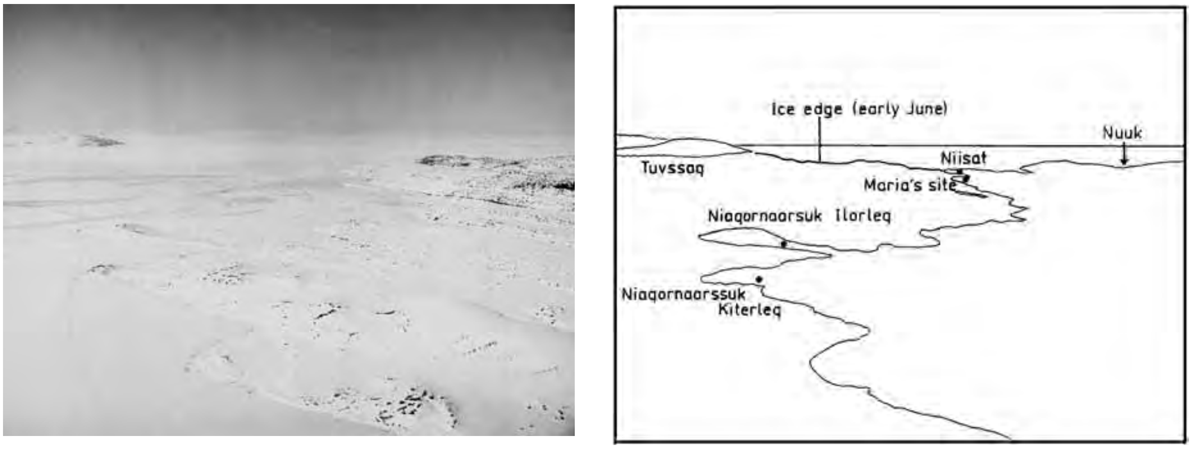


Fig. 5.7. Helicopter photo taken in April 1987 of the outer and northern coast of Kangersuneq in early spring (seen to the west). The line drawing indicates the coast line and location of Saqqaq sites in study area I (see Fig. 5.6). The normal ice edge situation in early June is also indicated. This is where white whales usually appear in spring (photo: Morten Meldgaard).

Meldgaard 1958) this site is given a special status because it was the first Paleoeskimo site Glob and Larsen came across on their reconnaissance trip: "The significance of this site is ... that we for the first time in West Greenland were confronted with remains of Paleo-Eskimo dwellings" (p. 32).

During the excavations at Qeqertasussuk, and during a number of excavations in the southwestern part of Disko Bay, the picture presented by Larsen and Meldgaard has changed considerably, so that today we have knowledge of a broad range of different dwelling structures used by Dorset and Saqqaq people.

Survey work 1983-1988

As part of the "Qeqertasussuk Project" a detailed survey was undertaken in 1987 with the specific aim of locating Saqqaq sites in the eastern part of Sydostbugten. Seven study areas were selected so that a good coverage was obtained of the different resource zones defined in Sydostbugten (Figures 2.16 and 5.6).

Study area I and II represents the outer fjord zone where access to spring and summer resources was good, study areas V and VI represent the inner fjord and inland zone where access to late summer resources was good, study area III represents the outer bay zone where access to spring, fall and winter resources was good, and finally study areas IV, V, and VI represent an inner fjord zone where access to summer resources was good.

The study areas were traversed on foot. The surveys concentrated on the coastal zone (i.e. a *ca.* 200 meter wide band of land closest to shore), however raised beaches and potential habitation areas at greater distances from the shore were also inspected. All localities where eroding beach profiles, blowouts or other non-vegetated areas allowed it were searched for stone debitage. The inland study area VI was traversed following the paths of "least topographical resistance" (Grønnow *et al.* 1983) and all possible habitation areas were inspected.

Fourteen Saqqaq sites, five Dorset sites and two unidentified Paleoeskimo sites were located during

Fig. 5.8. The Saqqaq site Illorsuatsiaat, which was the first in West Greenland where remains of dwelling structures were located, is situated on a promontory on the northern shore of Kangersuneq (Fig. 5.6). The outline of Helge Larsen and P. V. Globs excavations in 1953 (Larsen & Meldgaard 1958) can still be seen (photo: Morten Meldgaard).

the survey conducted by the Qeqertasussuk Project (Figure 5.6). In addition, a few sites located during recent years outside the selected study areas have been added to the map. The registration of the Saqqaq sites found during the 1987 surveys was limited to an estimation of artefact density and site extent. No test-excavations were undertaken and consequently no C-14 datings have been made (Meldgaard 1987a).

Survey work 1988-1995

In 1988 Qasigiannguit Museum surveyed the western part of Sydostbugten and the part of study area VI that lies north of Akullinnguup kuua. Several Paleoeskimo sites were located in the western part of Sydostbugten (Hansen *et al.* 1989) and in study area IV a Saqqaq and a Dorset site were located adjacent to the river. Detailed excavations were carried out in 1989 (Hansen and Jensen 1991).

The surveys carried out in 1990 and 1995 focused on the areas west of the research area. However, on occasional trips to the research area, one Dorset site and 3 Saqqaq sites were discovered.

Representativity

During the surveys in 1983 and 1987 and 1988 very few Dorset sites were registered. This may to some degree result from the fact that test-pitting was not conducted, but it also reflects the fact that during these years focus was on elevations between 4 and 10 m a.s.l. where the Saqqaq sites are located. Not until the 1988 survey was it acknowledged that the Dorset sites were situated at levels between 0 and 4 m a.s.l. (Hansen *et al.* 1989; Hansen 1990; Jensen *et al.* 1995).

Through the systematic surveys for Paleoeskimo sites in 1990 and 1995 it has become clear that in the southwestern part of Disko Bay there are generally half as many Dorset sites as there are Saqqaq sites. The relatively low number of Dorset sites may reflect several factors. 1) The Dorset culture only existed for half as long as the Saqqaq Culture, 2) many Dorset sites are located at such low elevations that it is reasonable to believe that some have been eroded away (Hansen and Petersen 1989; Jensen *et al.* 1995; Rasch and Jensen 1997). In the Qeqertasussuk research area only 7 out of 25 Paleoeskimo sites are from the Dorset culture. This relatively low number of Dorset sites is probably a bias that results from differences in survey methods, but generally there appears to be only a third or up to half as many Dorset sites as there are Saqqaq sites.

Based on the abovementioned taphonomic factors it is reasonable to believe that more Dorset sites than indicated on the map (Figure 5.6) exist or have existed in the research area. In the more recently surveyed areas in the western part of Sydostbugten, the largest Saqqaq and Thule sites often have Dorset components, or Dorset sites located in the immediate vicinity (Hansen 1990; Jensen *et al.* 1995), indicating that no major changes in environment and land use occurred between Saqqaq and Dorset.

Dorset sites

Savik, The site is situated approximately 1 m a.s.l. on a low point on the western shore of the island Savik. A few biface fragments, microblades and flakes have been collected from the eroding turf. There is good access to the sea and a nice sandy beach just by the site.

Umiartorfik. The site is located on a small, low point with many blowouts cut into a vegetation of crowberry, willow and lyme grass. A selection of killiaq and chalcedony flakes were found in blowouts over an area of about 25 by 25 meters. There may be dwelling remains hidden beneath the turf, but the extent of the site was probably not large. The site might be a Dorset site, but based on available information, dating is not possible.

Orpissooq. A Dorset site at the head of Orpissooq fjord is located on the northern shore of the river Akullinnguup Kuua, just where it empties into the fjord (Hansen and Jensen 1991). The site is located on a partly transgressed promontory within the tidal zone and it is almost completely eroded away. Large amounts of debitage and several tools have been collected from eroding turf layers constituting the foreshore. Combined archaeological and geological fieldwork was carried out in 1995 in order to establish the onset of the transgression (Rash and Jensen 1997). A caribou bone from a cultural layer 25 cm below surface has been dated to 2200 ± 65 BP.

Saattut. Two Paleoeskimo sites are situated respectively north and south of the small inlet on the eastern side of Saattut. Based on the elevation, the northern one is judged to be a Saqqaq site (see below). Whereas the southern one presumably is a Dorset site.

Saattut South is situated on a level gravel terrace *ca.* 3 m a.s.l. and close to the Neoeskimo winter houses. Only a few killiaq flakes were collected here, but in the eroding profile just in front of the Neoeskimo houses a microblade was found.

Saattutsiaait. A very small and flat sandy island vegetated with lyme grass and some dwarf shrubs and grass. Several killiaq (silicified slate) flakes and a few artefacts were collected in blowouts in the central part of the island. Some of the many stone structures on the island may be of Saqqaq origin, but based on the available information exact dating is not possible.

Appannguit. The site is situated at or below the high water mark in the central part of a small bay. A brook with running char empties into the bay *ca.* 50 meters north of the site.

A number of killiaq and chalcedony flakes were found in the eroding turf, but because of dense vegetation, nothing can be said as to the extent of the site. The low elevation as well as high percentage of chalcedony in the collected flakes, suggest that this is a Dorset site. (Rasch and Jensen 1997)

Qeqertasussuk "Vest". A single Dorset endblade was collected close to the high water mark on a small skerry in the run between Qeqertasussuk (the western one) and the mainland.

Dorset site location

Dorset sites are fewer and less well documented than those of earlier and later periods (Fig 5.6). However, Dorset sites have been documented from both the inner fjord summer/fall zone, from the inner bay and island summer zone and from the fall/winter zone (Figure 2.16). It thus appears that Dorset people also exploited most parts of the bay.

Saqqaq sites

Study areas I and II, the outer bay zone (Figure 5.6)

Niisat. Niisat is a *ca.* 170 meter wide and 250 meter long flat promontory (Figure 5.7). The promontory is vegetated by crowberry, willow and grasses, and in many places small ridges of rounded bedrock protrude through the vegetation cover. The promontory offers excellent opportunities for landing in rough seas during the summer and fall seasons and the level ground is attractive as a campsite.

Many Saqqaq stone tools and flakes were identified in blowouts, especially along the middle part of the ridge, right from the tip of the promontory and 180 meters towards its base. Because of the vegetation cover, it was not possible to determine the actual extent of the site. It is very likely that permafrozen midden deposits with organic preservation are hidden beneath the turf.

Maria's Site. Maria's Site is situated on a promontory *ca.* 300 meters east of Niisat (Figure 5.7). The promontory drops off steeply towards the southeast but rises slowly and evenly from the protected bay that separates it from Niisat. The promontory is dissected by ridges of bedrock and in between those there are large level areas with some vegetation of crowberries and willow and with large non-vegetated blowouts. The protected bay makes a fine harbour and from the somewhat elevated site there is an excellent view of the sea.

Many Saqqaq artefacts were found in blowouts over an area *ca.* 75 meters wide and 175 meters long, stretching from one meter above sea level to about eight meters above sea level. Because of the vegetation cover, the absolute extent of the site can not be determined. Artefact concentrations were smaller than on Niisat and no potential midden deposits could be located.

Tussaaq. The site is situated near the tip of Niaqornarnaarsuk on a raised beach that connects a knoll with the island. From the site there is a good view of the sea ice and fine landing possibilities in summer.

Saqqaq artefacts were found in an approximately 25 centimetre thick layer of turf that was being eroded by the sea. It is not possible to get an impression of artefact concentration or site extent. Both habitation structures and midden layers may be hidden beneath the turf.

Uigorleq. The site is situated on a gravel ridge approximately 8 m a.s.l. near the eastern tip of the island. The scant vegetation is dominated by crowberry and grasses and there are many blowouts and bare gravel terraces. From the ridge there is an excellent view of sea and ice, and there are good landing possibilities under all conditions.

Fig. 5.9. The Saqqaq site Tunutta Imaa North (Fig. 5.6) is located with a fine view of the sound Tunutta Imaa and with well protected landing possibilities (photo: Morten Meldgaard).

Saqqaq artefacts were found on the ridge itself and *ca.* fifty meters away in the southern erosion profile. The potential for finding midden deposits is low, but there may be some structures hidden below the turf. Artefact concentration is relatively low.

Study areas III and IV, the inner bay zone (Figure 5.6)

Niaqornaarsuk Ilorleq. Niaqornaarsuk Ilorleq is a characteristic ca. 500 m long peninsula jutting out from the coast (Figure 5.7). On the peninsula there are several blowouts with patches of turf and sporadic lyme grass. In the turf layers a few killiaq flakes have been collected, and in a little depression surrounded by bedrock, there is a two by three meter large boiling stone concentration adjacent to a well defined circular fireplace bounded by large stones and filled with boiling stones. The structures as well as the lithic raw material and height above the high water mark (7-10 meters) suggest a Saqqaq dating (Jensen *et al.* 1995).

Fig. 5.10. The Saqqaq site Tunutta Imaa West (Fig. 5.6) is located at the southern entry of the sound Tunutta Imaa (photo: Morten Meldgaard).

Niaqornaarsuk Kiterleq. The site is located on a small point protected by Niaqornaarsuk Ilorleq (Figure 5.7). It sticks out 300 meters further east. A small knoll (18 m a.s.l.) rises at the tip of the point and the site is situated on the saddle (5 m a.s.l.) that connects the knoll with the mainland. There is a good view of sea and sea ice both from the knoll and from the site itself, and at the same time there are excellent landing opportunities for small boats.

Blowouts along the saddle were littered with Saqqaq artefacts, and many flakes were collected along the eastern erosion profile. The site covers an area of approximately 70 by 100 meters. Turf along the sides of the saddle may well seal off stone structures and midden deposits with organic preservation.

Illorsuatsiaat. The site is situated on a low and level sandy promontory with a rocky tip (Figure 5.8). Most of the promontory is covered with a lush vegetation of crowberry, willow and grass but closer to the tip, dense stands of lyme grass dominate.

In blowouts approximately 30 meters from the western beach line and near the middle of the point, H. Larsen and P. V. Glob excavated three stone pavements with associated Saqqaq and Dorset artefacts (Larsen and Meldgaard 1958), and in 1987 a flake was found in the western erosion profile. It is difficult to evaluate the extent of the site but other stone structures and possibly midden deposits are, no doubt, preserved beneath the vegetation.

Tunutta Imaa North. The site is situated at the base of a flat promontory with a vegetation of crowberry, willow and grass (Figure 5.9). From the site there is an excellent view of the sound Tunutta imaa, and the landing possibilities are fine.

Tunutta Imaa West, Saqqaq Culture. The site is situated near the tip of Akulliit southeastern point (Figure 5.10). Crowberry, willows and grasses, including lyme grass, dominate the vegetation. From the site there is a fine view of the entrance to the sound Tunutta Imaa.

Saqqaq artefacts were found along a *ca.* 25 meter long erosion profile and in blowouts up to 20 meters from the profile (Figure 5.11). Most of the site is covered by vegetation that may conceal thin midden deposits and structures. The artefact concentration appears to be relatively low and site extent more than *ca.* 400 m^2.

Tunutta Imaa East. The site is situated on an elevated terrace *ca.* 4 m a.s.l. adjacent to a very narrow run separating the small island Qenertuarssuk from the mainland. The site is for the most part covered with dwarf shrubs and grass. There is a fine view both ways through the run, which is very sheltered and offers ideal landing spots.

Saqqaq artefacts were exposed in a few blowouts over *ca.* 100 meters, and it is likely that habitation structures are hidden by the turf.

Saqqaq artefacts were found in blowouts a few meters above sea level covering an area of approximately 50 by 50 meters. There may be some structures hidden beneath the turf, but probably no midden deposits are preserved. Artefact concentration appeared relatively low.

Saattut North. Two Paleoeskimo sites are situated respectively north and south of the small inlet on the eastern side of Saattut (Figure 5.12). The inlet is shallow and there are sandy beaches with good landing possibilities.

Saattut North is situated *ca.* 7 m a.s.l. Three killiaq flakes were found in association with a very overgrown tent ring. Judging by the elevation, this site is probably a Saqqaq site.

Qeqertasussuk, Saqqaq Culture. See p. 68 ff.

Study areas V and VI, the inner fjord and inland zone (Figure 5.6).

Serfarsuit Nuaat. The site is located on the tip of a rocky peninsula that protects the inner northeastern part of Kangersuneq (Figure 5.14). A small char river empties into the fjord furthest in. The point is dominated by exposed, rounded bedrock, but there are many "pans" and larger areas densely vegetated with crowberry, willow and grasses.

Saqqaq artefacts were found in two blowouts measuring 21 by 7 and 10 by 20 meters. It is not

Fig. 5.11. Adze of killiaq in situ at Tunutta Imaa West (the match is 4.8 cm long) (photo: Morten Meldgaard).

possible to delimit the site further, but stone structures and possibly shallow midden deposits may be hidden beneath the vegetation cover.

Tupersuai. The site is located in the bay Qinngup Tupersua, next to a small stream. A lush vegetation of grass and shrubs covers a thick midden deposited in historic and probably Thule times. The local topography only allows habitation within a relatively small area.

Along the eroding midden, over a distance of approximately 20 meters, a collection of Saqqaq artefacts was made (Figure 5.13). It is very likely that Saqqaq dwelling remains and permafrozen midden deposits are preserved beneath the younger layers.

Fig. 5.12. Saattut North is a Paleoeskimo site (probably Saqqaq) situated on the small island Saattut (Fig. 5.6) with excellent capelin breeding localities along the sandy beaches and colonies of terns in the grassy hinterland (photo: Morten Meldgaard).

Fig. 5.13. Qaqa Jerimiassen holding a Saqqaq burin spall found at the Saqqaq site Tupersuai (Fig. 5.6). The site is located by a small stream in lusch vegetation (photo: Morten Meldgaard).

Orpissooq. During an archaeological survey in 1988 four Saqqaq Culture fireplaces were located in blowouts at the head of Orpissooq. In 1989 an area

Fig. 5.15. Several char rivers empty into the head of Orpissooq fjord and form a large silty and shallow delta (Møhl 1987). A well preserved Saqqaq site was located here and excavated by Hansen & Jensen (1991) (Fig. 5.6) (photo: Jeppe Møhl).

Fig. 5.14. Serfarsuit Nuaat is a Saqqaq site situated at the tip of a cape that protects the inner parts of the Kangersuneq fjord, well known for its char river (Fig. 4.20 & 5.6).

of *ca.* 100 m² was excavated around these stone structures (Hansen and Jensen 1991).

The site is situated where several large rivers merge and empty into the Orpissooq fjord (Figure 5.15). The water in the river and the inner parts of the fjord is milky from suspended silt and completely opaque. Much of the material is deposited in the fjord which, especially in the inner parts, is very shallow, and at ebb large tidal flats are exposed (Larsen 1989).

A total of 800 flakes, 24 stone tools, and eleven different stone set features were uncovered. Most of the features were fireplaces, but there was also a mid-passage structure and a possible slab floor (Hansen and Jensen 1991).

Unfortunately, the faunal sample excavated at the site is very small and poorly preserved, consisting of a handful of bone fragments all of which, except one (a piece of whale bone), were caribou (Hansen and Jensen 1991).

Saqqaq sites outside the study areas

Akulliit. A few killiaq flakes have been collected from the eroding midden in Akulliit. A Saqqaq settlement may very well be located underneath the massive Thule Culture deposits and recent sediments covering the entire settlement, but the flakes could just as well originate from peat carried here from elsewhere (Figure 5.16).

Oqaatsuarsuit (Rypeholm). A few killiaq and chalcedony flakes has been collected on the eastern side of the narrow strait separating Qeqertasussuk

(Rypeholm) from the mainland. The site is located approximately 8 m a.s.l. which, according to sea level curves (Rasch and Jensen 1997), could indicate a Saqqaq age of the site.

Nuuk. On a blowout a few hundred meters north of the south-facing tip of Nuuk, several killiaq flakes, one burin and an abundance of boiling stones litter an area of approximately 10 by 5 meters.

Fig. 5.16. Akulliit, a living settlement until 1963, was also used by the Saqqaq people (Fig. 5.6) (photo: Morten Meldgaard).

Saqqaq Culture site location

Comparing Saqqaq site location as documented in six study areas (Figure 5.6) with the resource zone map (Figure 2.16), it is apparent that the Saqqaq people set up camp in all major resource zones of Sydostbugten. Saqqaq sites appear to be largest and most numerous in the inner bay and island summer (and fall/winter) zone while the sites in the inner fjord and inland summer/fall zone are fewer and smaller. Sites in the outer island spring (and fall/winter) zone are well represented and relatively large.

Qeqertasussuk, which appears to be the most heavily used Saqqaq site in the area is situated at the convergence of three zones: summer, summer/fall and fall/winter. Thus resource availability in the immediate surroundings of the site is excellent throughout most of the year, making it a good choice for near year-round habitation.

Chapter 6

Excavations

The Qeqertasussuk site

Qeqertasussuk is situated in the southeastern corner of Disko Bay. The island, which covers six square kilometres, is to the south and the east separated from the mainland by a one to two kilometres wide sound, Qoornua (Figure 6.1). Towards the north and northeast, a number of smaller and larger islands act as wave breakers against the swells from the open bay. The excavated Saqqaq site, named after the island, is situated on a small promontory near the eastern end of the island (Figure 6.2).

The promontory is composed of a series of raised beaches that connect a small knoll with the steep cliffs of the main island (Figure 6.3). The raised beaches form a ridge at 10 m a.s.l and to the north and south they slope gently towards the erosion profiles that are presently being carved by the sea. The northern sandy beach is fairly well protected from wave action by a reef that is laid dry at ebb, and between the reef and the beach there is a shallow lagoon with sandy bottom. The southern beach is more exposed and composed entirely of boulders, and here the rocky sea bottom drops off steeply. The raised beaches represent the only fairly level and habitable part of the promontory, and they cover a total area of approximately 5000 m^2, divided between a northern slope of 3000 m^2 and a southern slope of 2000 m^2.

The northern slope is covered by a comparatively luxuriant vegetation consisting mainly of dwarf shrubs such as crowberry (*Empetrum nigrum*), dwarf birch (*Betula nana*) and willow (*Salix herbacea*) and a few grasses and flowering plants. These plants and their

Fig. 6.1. The Qeqertasussuk site (circle) is situated on the island of Qeqertasussuk in the southeasternmost corner of Disko Bay (photo: Morten Meldgaard).

debris form a thick, cohesive and insulating peat, one of the prerequisites for the occurrence of permafrost just 30 centimetres below the vegetated surface. Large mats of peat overhang the erosion profile and from time to time big lumps slide down on to the beach. Parallel to the eroding profile and near the edge, cracks are formed in the peat as a result of the pull exerted by the overhanging vegetation.

The southern slope, which is only sparsely vegetated, is dominated by patches of lyme grass (*Elymus arenarius*). There is no peat formation here, and the grass grows directly on the old raised beaches. Blowouts are common and moving towards the ridge itself, which is almost devoid of vegetation, they become dominant.

The difference in vegetation on the northern and southern slope reflects differences in insolation and wind exposure. The southern slope has very high insolation and accordingly snow-melt in spring is quick and evaporation in summer is high. At the same time this slope is exposed to the frequent and very strong southeasterly föhn-winds which are typical for the area. These winds amplify the sun's desiccating effect, and they sweep the area clean of loose plant material and other effects, including, as experienced by the excavators, poorly pitched tents and all items not properly weighed down. Thus the southern slope offers poor conditions for plant growth and peat formation.

The northern slope has lower insolation and it is less windswept. This means that snow-melt is slower and evaporation reduced and accordingly dwarf shrub heaths, grasses and flowering plants thrive. The western part of the north slope lies in the shadow of the cliffs above and the area is consequently so moist that mosses also grow well.

In winter the snow cover is fairly shallow on the windswept southern slope and towards the ridge it may almost disappear, but on the lee side snow accumulates relatively undisturbed, and large drifts form on the northern beach (Figure 6.4).

On the ridge itself, between patches of lyme grass, a family of foxes have excavated a den with interconnected tunnels and several entrances. The Qeqer-

Fig. 6.2. The Qeqertasussuk site is located on a series of raised beaches connecting a small knoll to the mainland. Notice the white tents at the site (photo: Morten Meldgaard).

Fig. 6.3. The northern slope of the Qeqertasussuk site. The excavations were concentrated around three areas, A: the ridge with outdoor fireplaces, B: the midden area, and C: the dwelling area (photo: Geert Brovad).

tasussuk site was earlier known by the local name "Sisikasiit" meaning "the place with foxes", thus indicating that foxes have used the den perhaps for centuries. A pair of nesting snow buntings in the rocks above the site, and a few pairs of black guillemots nesting in crevices just south of the promontory add to the life around the site.

But life in the sea surrounding the site is much richer. Standing on one of the ledges just above the tidal line on the eastern side of the knoll on a day when the sea is smooth as a mirror, a wealth of life reveals itself in the forests of seaweed below. Schools of small Greenland cod swim by, and from time to time a slight movement unveils the whereabouts of one of the many sculpins that live among the seaweed. In cracks mussels sit densely packed well protected from the violent action of the winter ice and crawling up and down on the bare cliffs, hoards of sea urchins follow the sea's tidal movements.

Excavation strategy

In 1983, during a systematic archaeological survey of Qasigiannguit municipality, Saqqaq Culture remains were located in different areas of the site. On the sparsely vegetated upper parts of the slopes and along the ridge, hearths and other stone structures were apparent. Lying on the surface and associated with these structures were many stone tools of Saqqaq type and numerous flakes and other stone refuse. Saqqaq stone artefacts were also found in blowouts on the eastern part of the south slope and in the gravel on cliff ledges east of and just above the site. Along the northern beach profile, especially the western part, thick midden layers had been exposed by the eroding sea with well preserved bones, baleen, feathers and worked wood sticking out, still partly imbedded in permafrost.

Five C-14 dates were made to confirm the Saqqaq provenience of the culture layers, and to give an approximate time range of the habitation at the site.

Fig. 6.4. The Qeqertasussuk site in winter. Back dirt from excavation area C can be seen mid-slope (photo: Morten Meldgaard).

They confirmed that the well preserved culture layers were of Saqqaq origin, and that the site had been inhabited for approximately 600 years from *ca.* 2100 BC to *ca.* 1600 BC.

There were no traces of later occupation by people of the Dorset or Thule Culture on the site itself, and only one modern tent-ring situated on the north slope was registered. However three poorly preserved graves, of which one has been C-14 dated to the late Thule Culture, were found near the shore in a scree slope *ca.* 100 meters northwest of the site.

The grid layout

A grid system with an east-oriented X-axis and a north oriented Y-axis was established, with origin X = 100 and Y = 200 on the ridge of the site (Figure 6.5). Each unit within the grid was given the co-ordinates of the southwestern corner. For practical reasons a local grid system was established around the western part of the erosion profile where the thick midden deposits were exposed. The X-axis was oriented parallel to the erosion profile pointing to the southeast and the Y-axis towards northeast.

Test pits

In 1984 systematic excavations were initiated. In order to evaluate the distribution and character of the cultural deposits on the site, the whole northern slope was sampled by sixteen 1 m^2 test pits laid out at five meter intervals along two parallel lines. These were later supplemented by a net of 43 smaller test pits (25x25 centimetres) laid out in a five by five meter grid (Figure 6.5).

The depth of the deposits increased from the upper part of the slope towards the erosion profile and from the eastern side of the slope towards the steep cliffs to the west, and the organic preservation improved along the same gradients.

Midway down the northern slope the western row of 1 m^2 test pits revealed stone structures and artefact associations that indicated the existence of a habitation area, and, further down towards the erosion pro-

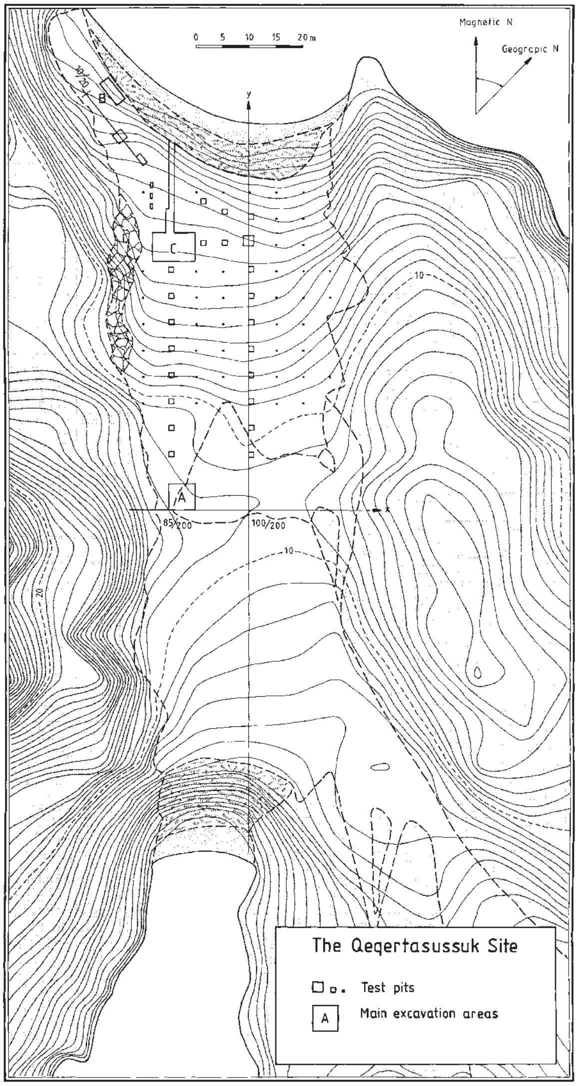


Fig. 6.5. Topographic map of the Qeqertasussuk site. The grid system is indicated. Note that a local grid system was established for practical reasons around excavation area B.

file, possible midden deposits with few traces of habitation structures were located.

Stones suspected to be part of a habitation structure were found in test pit 99/250 which was subsequently enlarged into a 2 by 2 meter pit. However no structures were found and the test pit was not enlarged any further.

Main excavation areas "A", "B" and "C"

Based on test pit results and on a survey of the exposed structures on the ridge and of the northern erosion profile, three main areas were chosen for excavation (Figures 6.3 and 6.5).

Area A: On the highest part of the ridge approximately 25 square meters were excavated around a fireplace with associated structures and stone artefacts. The remains were only partly covered with sediment and there was no organic preservation.

Area B: Ten square meters were excavated immediately adjacent to the erosion profile in what was assumed to be midden deposits.

Area C: Fifty-six square meters were excavated in a level area half way between Area A and Area B, where test pits had revealed traces of habitation.

Trench C and test pits 19/20, 20/20, 25/20 and 26/20: In order to connect the stratigraphy in "Area C" with the stratigraphy in "Area B", a fifteen meter long profile trench was excavated from "Area C" to the erosion profile. The four test pits were excavated in order to obtain the same goal.

Through the excavation of these areas, units and test pits it was hoped that all aspects of the prehistoric settlement would be elucidated.

In areas A and C we expected to find dwelling structures, activity areas and related tool inventories, and in Area B we hoped to obtain a well preserved bone inventory, elucidating the economy during the long period of site use documented by the initial C-14 datings.

Excavation of Area A

Area A is located on the gravel blowout on top of the ridge. Centrally in the excavated area, there was a stone-lined fireplace or cooking feature with boiling stones (Figure 6.6). There was no clear periphery and only few tools and little debitage surrounded this structure. No organic material had been preserved in this area and therefore this excavation will not be described any further.

Excavation of Area B

In July 1984 an area of two by five meters was stripped of turf with spade and shovel, and the section along the erosion profile was cleaned. The permafrost level was situated at a depth of approximately 25 centimetres and provided a natural lower limit for the de-turfing activities. A small wooden platform was erected on the beach

Fig. 6.6. Excavation of hearth feature on the ridge of the site. No faunal remains were found in this area. The hearth is now on exhibit at Qasigiannguit Museum (photo: Bjarne Grønnow).

in front of Area B, and it was now possible to excavate the area from a convenient position (Figure 6.7).

This procedure was continued in 1985 and 86 as new square meters were opened. Excavation was carried out with trowel in 1 m^2 units (Figure 6.8). The permafrozen soil melted at a rate of one to five centimetres per day depending on insolation, and the area was excavated in these arbitrary "daily layers". The more exposed outer parts of Area B melted faster than the inner parts, and it was the melt rate of these inner parts that determined the thickness of the "daily layer".

Fig. 6.7. Excavation Area B was situated by the eroding midden layers at the northern slope of the site. Wooden platforms were erected to provide a better working position and sand bags were used to prevent erosion by the sea (photo: Geert Brovad).

Fig. 6.8. The excavation of the midden area was carried out in one square meter units (photo: Geert Brovad).

For each excavated daily layer, bones, worked wood and stone debitage were bagged separately. The position of all artefacts was plotted in three dimensions. Articulated bones were kept together in separate bags, as were also jaws with teeth in situ. Stones larger than 10 centimetres in diameter were drawn and plotted in three dimensions. Smaller stones were discarded. However, in one unit all stones were weighed and counted.

In each of the five 1 m² units 10-12/23 and 13-14/24 all sediment from ¼ m² (the 1st quadrant within each square) was collected layer by layer and brought back to the laboratory for sieving and analysis.

The excavations were quite time consuming. It took two excavators three field seasons, each of approximately 40 days, in all *ca.* 240 man-days, to complete the excavation of 10 m² in Area B.

Stratigraphy

The section 10-15/23 was carefully prepared with trowel and scalpel and subsequently recorded and drawn according to the system developed by Jørgen Troels-Smith (1955) (Figure 6.9 and 6.11). The description of the profile and the soil characterisation was carried out by geologist Charlie Christensen from The National Museum, Copenhagen (Christensen 1990). C-14 datings are presented in table 6.1.

Organic preservation

Partly due to the lack of permafrost in the uppermost layers, bones were only present from layer 5 and downwards.

Layers 5 and 5a to 5g. The condition of the bones improved from top to bottom. In the uppermost layers the bones were often preserved only as light, fragile shells, while further down they were heavier and harder. Feathers, hair and other keratinous material were not preserved. However, both wood and the exoskeleton of arthropods were well preserved throughout the layer, probably due to the fact that they contain the strong structural polysaccharides cellulose (in wood) and chitin (in the exoskeleton).

Layer 6. Preservation was excellent (Figure 6.10) and the bones often had a fresh yellow colour with a nice

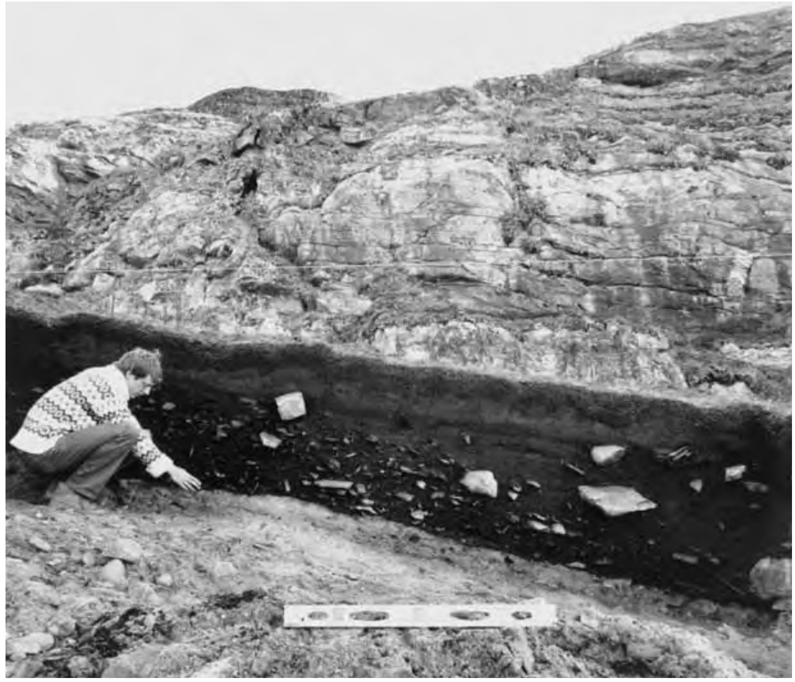


Fig. 6.9. Section 10-15/23 of area B (photo: Geert Brovad).

hard ring to them (Figure 6.12). In a few cases sinew could still be found attached to the bones, and distinct stained encrustations on many bone surfaces may well represent freeze-dried fats or other proteins.

Keratinous materials such as feathers, hair, claws and the periostrachum and operculi of molluscs were well preserved (Figures 6.13, 6.14 and 9.23). This was also the case with the calcium carbonate part of the mollusc shells, with wooden objects and with arthropod exoskeletons.

Cultural remains

Stone tools such as scrapers, knife blades, burins and harpoon endblades were recovered throughout the

Fig. 6.10. The concentration of faunal remains, twigs and other organic remains in layer 6 was massive, as can be observed in this midden surface prepared by Erik Brinch Petersen in 1985 (photo: Bjarne Grønnow).

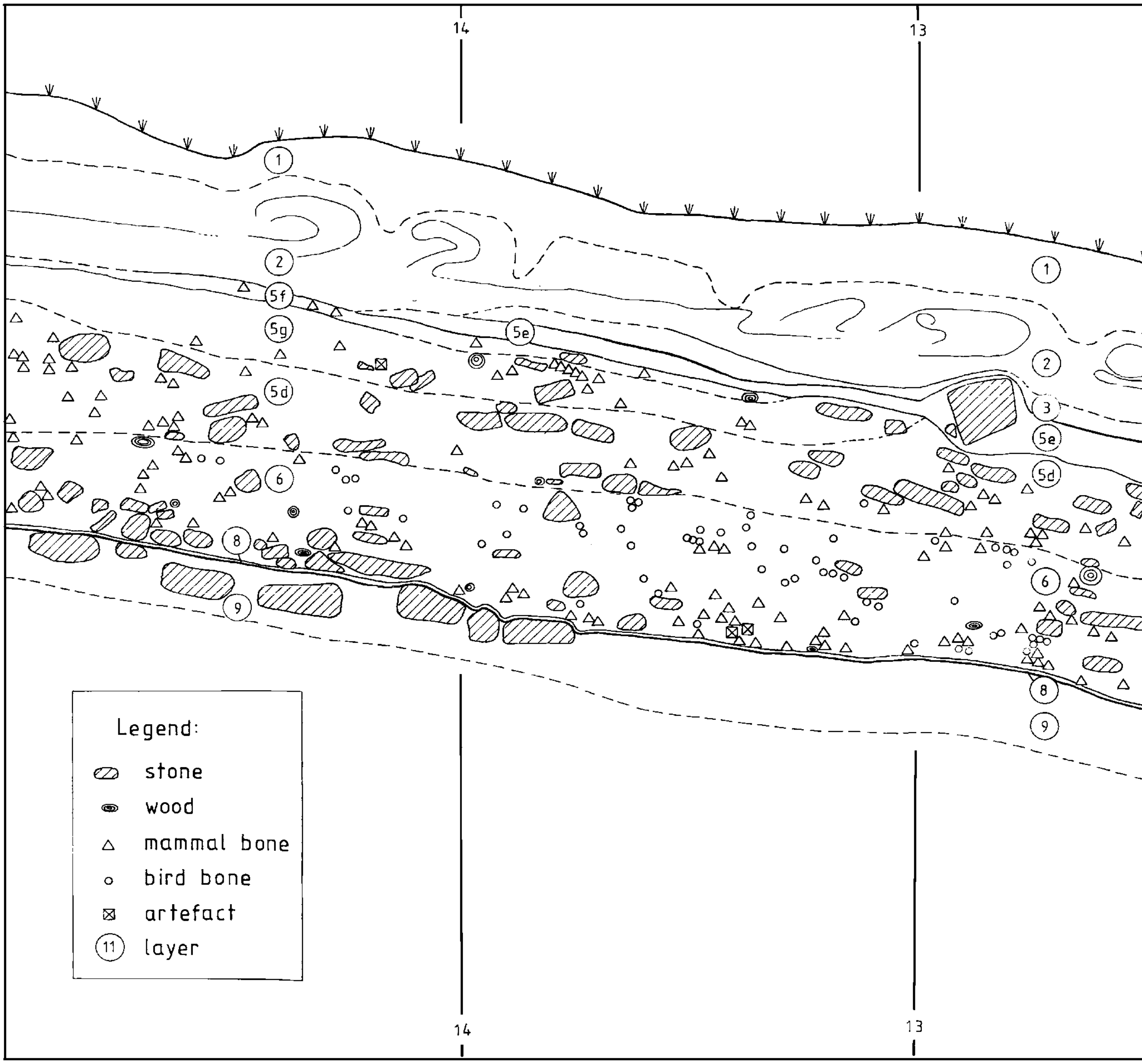
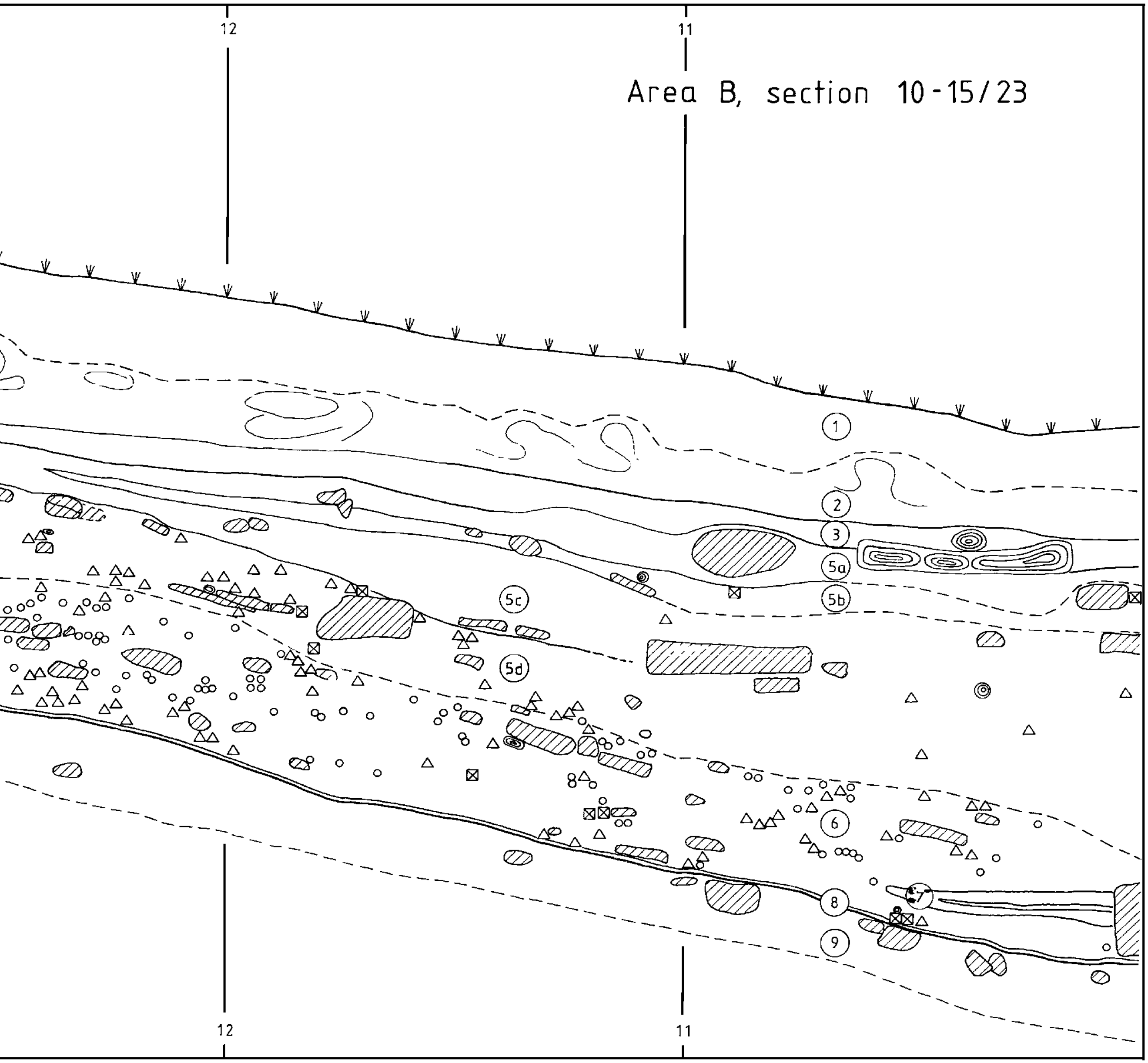


Fig. 6.11. Section 10-15/23 of Area B was recorded and drawn by geologist Charlie Christensen of the National Museum, Copenhagen and Morten Meldgaard using the system of J. Troels Smith (1955). The detailed description of the section is presented in Appendix 1.

midden from layer 3 to layer 6. However, only relatively few flakes and other refuse from stone tool fabrication were found.

The permafrozen soil provided excellent conditions for the preservation of wood throughout layers 5 and 6. Several knife blades, burins and microblades were found hafted with wooden handles (Figure 6.15), as well as bowls, fragments of arrow shafts, bows, paddles etc. Chips from the fabrication of these wood implements were quite numerous.

Bone and antler implements were excavated in layer 5 and 6, but the preservation was relatively poor in the upper parts of layer 5. Harpoons made from caribou antler and walrus ivory, whale bone foreshafts for harpoons and a dog bone needle case provide some examples. Baleen cordage was commonly found as



single strands, sometimes tied up in loops, or as several strands tied together with knots. Fragments of skin garments were also preserved.

Fire-cracked rocks, slabs with crusts of burnt blubber and bone, twigs and charcoal pieces were also important components of the midden deposits (Fig 6.16). Approximately 1500 kilos of fire-cracked rocks less than 10 centimetres in diameter were found in Area B. The twigs, mainly crowberry and dwarf birch (Fredskild 1991:80), were commonly broken off, and most of them had the bark intact and some still carried their leaves. The charcoal fragments were all very small (less than 1 centimetre) and their even size indicated that they had been sorted, perhaps by the wind, before deposition. The relative concentration of these cultural components was much higher in layer 6 than in layer 5 and, at the same time, it was higher in the uphill parts of the excavated area.

Many large rocks and slabs 10-40 centimetres in diameter were found throughout the midden deposit. But only in one case were rocks found in an association that could indicate that they were part of a "structure".

Faunal remains

Mammal and bird bones were by far the most common faunal remains in the midden deposits, but also mol-

Fig. 6.12. Organic preservation was excellent in layer 6. The bones were fresh, hard and yellow. An important preserving factor was the permafrost which often appeared as small clear ice-lenses in the cultural layers (see lower right corner of photo) (photo: Geert Brovad).

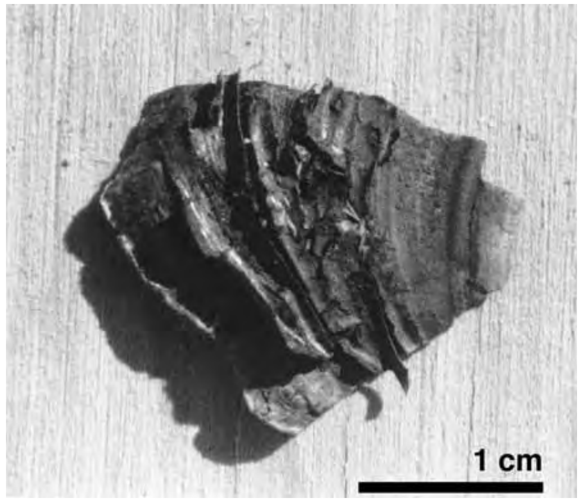


Fig. 6.13. The keratinous periostrachum of excavated mussel shells was well preserved. When it dried up, it raised itself from the shell and became brittle (match: 4.8 cm) (photo: Morten Meldgaard).

Fig. 6.14. A tuft of hair still flexible exemplifies the generally fine preservation of hair, feathers, claws and other keratinous materials in layers 5 and 6 (photo: Geert Brovad).

Fig. 6.16. Cultural remains from one "day-layer" (ca. 10 centimetres) in one square meter in excavation Area B. The lower piles were excavated by trowel, the upper five plastic boxes and the pile of fine debris were found by sieving 1/4 of the square meter through a 4 mm sieve. Clock-wise from person: 1) Fire-cracked rocks, 2) plastic bags with jaws to keep the loose teeth with the jaw, 3) pile of seal bones, 4) pile of bird bones, 5) plastic box with wood chips, 6) plastic box with char coal, 7) plastic box with bones, 8) plastic box with twigs, 9) smaller plastic box with flakes, and 10) pile of organic debris. Note also the small plastic lid in center with artefacts (photo: Geert Brovad).

Fig. 6.15. The permafrozen soil preserved several hafted tools such as this knife with a drift wood handle and the killiaq blade in situ (photo: Geert Brovad).

luscs and fish were represented. In all 171.5 kilos representing approximately 60,000 bones and bone fragments were systematically excavated in the 10 m² of main excavation Area B.

Both during excavation and during mapping of

Fig. 6.17. Column samples were taken for arthropod analysis. Entomologist Jens Böcher, Zoological Museum, Copenhagen, at work on column 19,5-20,0/19,75-20,0 (photo: Morten Meldgaard). The preservation of arthropod remains was remarkably good. The condition of the inserted head of Nysius groenlandicus with well preserved compound eyes is a case in point (width: ca. 1 mm.) (photo: Jens Böcher).

the section (Figure 6.11), distinct changes in the composition of the faunal material were observed. The lower part of layer 6 was relatively rich in seal bones while the middle and upper part of the layer seemed to be dominated by bird bones. Layer 5 was completely dominated by seal bones and in the narrow layer 5f, caribou bones were relatively common.

Arthropod remains

Samples for arthropod analysis were taken as intact columns. In test pit 19/19 a column of 50 by 25 centimetres was taken at 19.5-20.0/19.75-20 (Figures 6.17 and 6.18) (Böcher and Fredskild 1993).

The samples have produced remains of species of mites, spiders, butterflies, dung-flies, parasitic wasps, ground bugs and beetles. Some species of mites, beetles and fly pupparia occur in enormous numbers. An estimate of fly pupparia numbers in approximately 7 litres of sediment from the upper part of layer 5 in 12/23 gave *ca.* 9200 fly pupparia.

The remains of beetles are particularly interesting because they can be identified to species level and because they are sensitive environmental indicators. More than 10 species of beetles have presently been identified, several of them at or north of their present northern limit.

There are stratigraphic differences in the occurrence and diversity of the arthropod remains. In the lower cultural layers (layer 6), where there are high concentrations of bones and other refuse, the arthropod remains are almost solely represented by fly pupparia. The upper cultural layers (layers 5 and 3), on the other hand, show an arthropod fauna which is much richer and more diverse even than that of the present day.

This change in diversity may reflect a change in the intensity of the use of the site from an early period with much human activity to a later period with less. However the fertilisation of the area which occurred through the first centuries of habitation may also, in

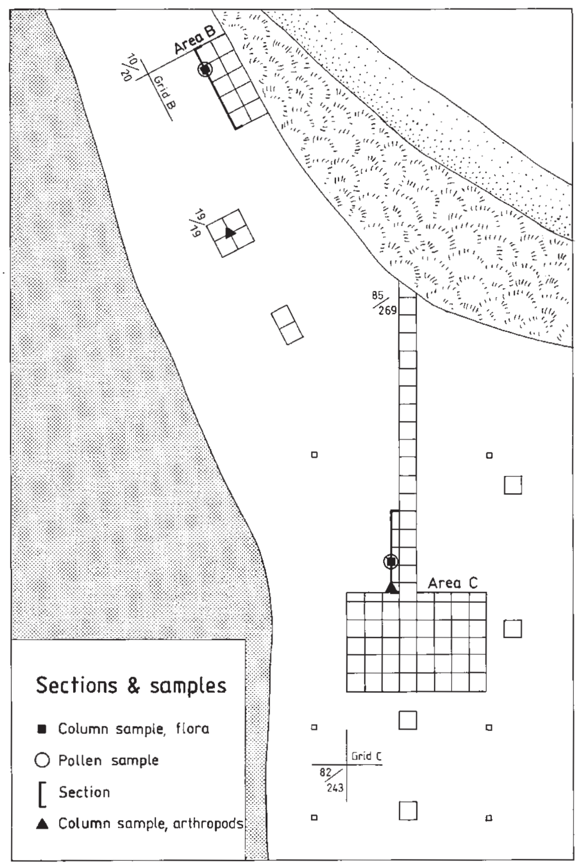


Fig. 6.18. Map showing the position of the sections and samples discussed in the text.

Fig. 6.19. Pollen samples were taken by geologist Charlie Christensen, National Museum, Copenhagen, at 85/254,18 in excavation Area C (photo: Geert Brovad).

itself, have provided suitable habitats for a larger number of arthropod species.

Pollen and plant macrofossil remains

Pollen samples were taken every four centimetres at 11.15/23 in section B, and an intact column of 11 by 10 centimetres was removed from the section at 11.13-11.24/23 for plant macrofossil analysis (Böcher and Fredskild 1993) (Figures 6.18 and 6.19).

Layers 2 and 3 have quite low grass pollen percentages, while dwarf shrub pollen increases drastically. Species sensitive to traffic reappear and charcoal disappears from the samples.

Layers 5a, 5b, 5c, 5d and 6 have lower, but still high, grass pollen percentages and higher percentages of dwarf shrub and other dicotyledon pollen. Species sensitive to traffic have disappeared and charcoal is extremely common.

Layer 8 is completely dominated by grass pollen, and plant species sensitive to traffic are present. Charcoal is practically absent from the layer.

Seeds, fruits and other plant macrofossils were numerous in the deposit. Especially tens of thousands of *Empetrum* seeds dominated the samples. Often they were found in concentrations approximately 10 centimetres in diameter, probably representing human faeces.

Absolute dating of the stratigraphy

The material chosen for C-14 datings was selected 15 years ago. At the time both twigs (of local origin) and seal bones (with appropriate corrections) were found to be acceptable for dating. Today, with the option of using very small sample sizes, the approach is more cautious and bones or artefacts of terrestrial animals are preferred for C-14 dating. In the coming years a new series of C-14 dates will therefore be carried out on the Qeqertasussuk material. However, we find it acceptable to use the existing series of C-14 dates for internal stratigraphical interpretation and, with due caution, for absolute calendar-dating.

Seven C^{-14} datings have been made on turf, twigs and seal bone from section B. Three datings of the lower part of layer 6 (K4563, 4566, 5125) indicate an age of *ca.* 2300 BC (cal.) with an early dating of *ca.* 2400 BC, two datings of the lower part of layer 5 indicate an age of *ca.* 2100 BC (cal.) (K 4562, 4565), and two datings of the upper part of layer 5 indicate an age of *ca.* 1700 BC (cal.) (K 4561, 5124) (Table 6.1).

Cultural layer 5 (a-f) thus seems to have been deposited over a period of about 400 years from *ca.* 2100 to 1700 BC and cultural layer 6 seems to have been deposited over a period of about 300 years from *ca.* 2400 to 2100 BC (Table 6.1 and Figure 8.3).

Layer 3, which contains stone artefacts but no organic remains, is correlated with layer 11 in Area C (Figure 8.3). The upper limit of this cultural layer, also assumed to represent the termination of occupation at Qeqertasussuk, is tentatively dated to 1400 BC.

Stratigraphic interpretation

The first traces of habitation in the area have been C-14 dated to *ca.* 2400 BC (cal.). The early inhabitants settled on gravely beach terraces covered by lyme grass. This vegetation was quickly trampled down forming a mat together with a few bones and wood chips that became included in the "lyme grass layer".

During the first 300 years, human activity in the area was intense and cultural refuse such as bones, fire-cracked rocks, broken tools, twigs and faeces accumulated rapidly. At the same time, plant species sensitive to traffic disappeared and grass growth and peat formation was hampered by the rapid rate of deposition and by the traffic.

Around 2100 BC. (cal.) human activity became less intense in the area and for the ensuing 400 years,

Table 6.1. C-14 datings from area B and area C. K-numbers are registration numbers for datings produced by the Carbon-14 Laboratory, Copenhagen. All datings have been calibrated according to Pearson and Stuiver 1986.

K-no.	Position of sample	Material dated	Conventional C-14 years BP	Calibrated years BC	Calibrated years BC±1 std.dev.
4561	Area B, 10.5-11.0/23.0 layer 5, upper 3 cm	Turf & twigs	3390 ±80	1680	1750-1530
4562	Area B, 10.5-11.0/23.0 layer 5, lower 3 cm	Turf & twigs	3690±80	2110-2040	2190-1940
4563	Area B, 10.5-11.0/23.0, layer 6, lower 3 cm	Turf & twigs	3720±80	2130-2050	2200-1980
4564	Area B, 13-13.25/24.0 layer 5, upper 3 cm	Turf & twigs	3730 ±80	2140-2060	2270-1980
4565	Area B, 13.0-13.25/24.0 layer 5, lower 3 cm	Turf & twigs	3750±80	2140	2280-1990
4566	Area B, 13.0-13.25/24.0 layer 6, lower 3 cm	Turf & twigs	3880±85	2390-2340	2470-2200
5124	Area B, 13.5-14.5/23.0. layer 5f.	Seal bones	3460±80	1750	1880-1680
5125	Area B, 14.0/23.0. layer 6, lower part	Seal bones	3820±60	2280-2210	2390-2140
4816	Area C, 84.5/249.5 layer 15, upper part	Turf & twigs	3310 ±80	1600-1530	1680-1510
4817	Area C, 84.5/249.5 layer 15, lower part	Turf & twigs	3680 ±85	2040	2190-1930
4818	Area C, 84.5/249.5 layer 16	Turf & twigs	3650 ±85	2020-1980	2140-1890
4819	Area C, 84.5/249.5 layer 15a.upper part	Turf & twigs	3780 ±85	2190-2150	2320-2040
4820	Area C, 85/253 layer 11	Turf & twigs	3150 ±80	1410	1510-1320
4821	Area C, 85/253 layer 16, upper part	Turf & twigs	3760±80	2180-2140	2290-2030
4822	Area C, 85/253, layer 16, lower part	Turf & twigs	3640±75	2010-1980	2130-1890
4823	Area C, 85/253 layer 18, lower part	Turf & twigs	3980±85	2470	2580-2350
5126	Area C. layer 14/14a. upper part	Seal bones	3500±80	1870-1780	1910-1690
5127	Area C. layer 14/14a. lower part	Seal bones	3570±80	1890	2020-1770
5128	Area C. layer 14/14a. upper part	Seal bones	3400±80	1680	1850-1540

grass grew well in the fertilized soil. A rich arthropod fauna flourished on the vegetated midden. Cultural remains kept accumulating in the area, but at a slower rate.

The deposition of cultural remains in the area ceased around 1700 BC (cal.), and plants sensitive to traffic recolonized the area.

Several lines of evidence indicate that the area was used as a dump throughout the period of habitation. The refuse primarily consists of discarded material such as marrow-cracked bones, twigs, fire-cracked rocks, slabs with crusts of burnt blubber and bone from dismantled cooking places and fragmented implements that occur in a haphazard manner within the deposit.

None of these elements have been found in associ-

Table 6.2. Dating of cultural layers based on the carbon-14 datings presented in Table 6.1. The datings are given in calibrated years BC. u stands for upper, l stands for lower.

		Cal. years BC	Cal. years BC
Area B			
layer 5	1700-2100	K4561	1690-1730 u
		K5124	1850-1760 u
		K4562	2045-2130 l
		K4565	2145-2190 l
layer 6	2100-2400	K4563	2140 l
		K5125	2290 l
		K4566	2400-2455 l
Area C			
layer 11	– 1400	K4820	1430
layer 14/14a	1700 – 1900	K5128	1695-1735
		K5126	1790-1880
		K5127	1925
layer 15	1900 – 2100	K4816	1615
		K4817	2040-2120 l
layer 16	2100 – 2200	K4818	2035
		K4821	2145-2195 u
		K4822	2030 l
layer 15a	2200 – 2400	K4819	2200 u
layer 18	2400 – 2500	K4823	2495-2555 l

ation with stone alignments, slab arrangements, "in situ" tent pole ends or other indicators of habitation. Only once in test pit 19/19 were rocks found in an association that could be part of a larger structure. The lack of traces of habitation structures is not surprising considering that the slope has an inclination of more than 10°.

There are only few positive indications of domestic "in situ" activities in the area. A small number of stone flakes indicate that stone tool fabrication occasionally took place here. Small wood chips occur in larger numbers but do not necessarily express local activities. They may just as well have been blown down from other parts of the site.

The highest relative concentrations of refuse were found in the up-slope part of the excavation, indicating that the main habitation areas are to be found in this direction.

It seems reasonable, then, to conclude that the deposits can be viewed as a kitchen midden, and that the excavated bones and other faunal remains included in the kitchen midden reflect the same type of activities relating to the economy of the site's inhabitants throughout approximately 600 years.

Excavation of Area C

The primary objective of this excavation was to find and expose a Saqqaq habitation structure with associated organic and inorganic remains and to produce well stratified samples of artefacts.

Surface peat material was removed from an area of 5.5 x 7.5 meters and the upper cryoturbated layers (9, 10, and 11) excavated with shovel in 1 m^2 units (Figure 6.20). The middle and lower layers, known to contain undisturbed complex stone structures, were excavated with trowel in natural layers in $^1/_4$ m^2 units. For each unit and natural layer bones, debris from wood working and debris from stone tool processing was bagged separately. All artefacts were registered independently and mapped in three dimensions, as were all stone structures and all stones with a diameter greater than 10 centimetres (Grønnow 1988, 1990).

Within every square meter all sediment from $^1/_4$ m^2 (first quadrant) was bagged layer by layer and brought back to the laboratory for sieving and analysis.

Stratigraphy

The stratigraphy was complicated and, even though permafrost posed no problem in this area, excavation was time consuming. It took an average of 4 persons four field seasons, from 1984 to 1987, each of approximately 40 days, or a total of 640 man-days, to complete the 56 square meters.

The section 85/252-255 was prepared with trowel and scalpel and subsequently described and drawn according to the system developed by Troels-Smith (1955) (Christensen 1990). The shown section serves as a "type section" for Area C (Figures 6.21 and 6.22).

All C-14 datings are presented in table 6.1.

Comments on the stratigraphy

Layers 10 and 11 were easy to excavate because of their high degree of decomposition and the relatively high content of silt. Layer 14, however, was very hard and, in places, also sticky and almost impenetrable with a trowel. The sticky patches often continued downwards into the layer and were interpreted as blubber.

Fig. 6.20. Excavations in the main excavation Area C were undertaken with a primary objective of documenting Saqqaq habitation structures. The photo shows the excavation nearing its end as two mid-passage structures are registered (photo Geert Brovad).

There was a clear structural shift between the gravel and sand dominated layer 14 and the more organic layers below. Layers 15, 16, 15a and 18 all had a high content of peat and, depending on their content of twigs and bones, they had a more or less loose composition. In places the layers separated nicely and it was possible for example to pull layer 15 off the underlying layer 16 as a well defined mat of peat. This made stratigraphic interpretation easier and made it possible to trace the natural layers throughout Area C.

Organic preservation

Area C is situated in a relatively level part of the site. The vegetation is dominated by crowberry, grasses, sedges and equisetum. Despite a permafrost level at approximately 25 centimetres, the upper layers are well drained.

Organic preservation improved from top to bottom. In layer 11 there is no organic preservation, in layer 14 the bones are somewhat decomposed, and in layers 15, 16, 15a and 18 the bones are perfectly preserved.

Cultural remains

Only stone tools and stone debitage have survived in layer 11, but from layer 14 and downwards, artefacts of bone, antler and wood have been recovered. Layer 14 contained a few organic artefacts and was dominated by fire-cracked rocks, bones, slabs with crusts of burnt blubber and larger stones, probably from former habitation structures, fireplaces etc. There were no "in situ" remains of habitation in this layer. In many areas layer 14 was saturated with large quantities of blubber which acted as a solidifier and made excavation quite difficult. The blubber was probably deposited during layer 11 activities and had subsequently seeped into layer 14.

Layers 15, 16, 15a and 18 produced many complete artefacts of wood, bone and stone, including wooden bowls, hafted knives, hafted scrapers, harpoon heads and other implements for hunting and domestic use. Also refuse from wood-working and flint-knapping was widespread in these layers. Stone structures were found in all four layers, but especially layer 16 was characterised by the remains of several mid-passage structures, by wooden tent-pole ends still "in situ" and by concentrations of "cooking stones". Many implements were found clearly associated with the habitation structures.

Faunal remains

A total of 195 kilos of bones were excavated in Area C, and 82 kilos were found in trench C. Mammal and bird bones dominated in Area C and only few fish bones and no molluscs were recovered.

Arthropods, pollen and plant macrofossils

Samples for arthropod analysis were taken as an intact column at 85/252.5-253. Pollen series were taken at 85/249.25 and at 85/254.18. The results of the arthro-

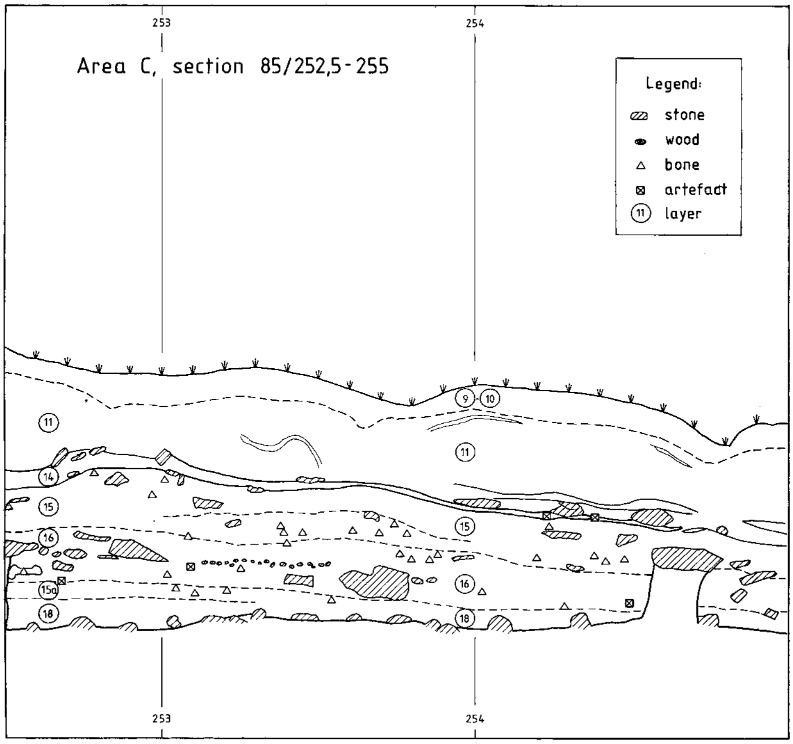


Fig. 6.21. Section 85/252,5-257,0 of Area C was recorded and drawn by geologist Charlie Christensen, National Museum, Copenhagen using the system of J. Troels-Smith (1955). The details of the soil characterization and interpretation are presented in Appendix 1.

pod analysis and pollen diagrams have been published by Böcher and Fredskild (1993)

Pollen and macrofossil analysis was not carried out on layer 9 and 10.

Layer 11 is highly decomposed but the pollen spectra indicate that a *Betula* heath with ericaceous plants covered the site. Later on this was replaced by a *Ledum* dominated heath with other ericaceous dwarf shrub and *Betula*.

Layer 14. Macrofossils as well as pollen samples give a rather confusing picture illustrating the heterogeneous composition of the culture layer. A seed of *Arabis alpina* and willow shrubs must have been brought in by man.

Layer 15 and layer 16 share similar pollen contents, but there is a markedly smaller content of twigs in layer 15 than there is in layer 16. There are many seeds and macrofossils which must have been brought to the site by man. Dwarf birch and crowberry seem to have been the most eagerly gathered shrubs, but also bog whortleberry, *Ledum decumbens, Salix glauca* and *Cassiope tetragona* were used. *Cassiope tetragona* is commonly used as fuel, due to its ability to burn even when fresh.

Grass pollen is dominated by pollen of Poa type, probably representing *Puccininellia vaginata* which is very common at inhabited places around Disko Bay (Böcher and Fredskild 1993).

Layer 18 rests directly on the raised beach. It corresponds to layer 8 of Area B. The sandy humic soil with *Cenococcum sclerotica* was formed under a fairly dry mossy *Empetrum* heath with grasses and *Cerastium alpinum/arcticum*, *Luzula sp.* and *Saxifraga* growing locally.

Absolute dating of the cultural layers

Eleven C^{14} datings have been made on peat, twigs and seal bone from the five main culture layers in Area C. The results are interpreted as follows (calibrated dates): layer 18: *ca.* 2400 BC, layer 15a: *ca.* 2400-2200 BC; layer 16: *ca.* 2200 – 2100 BC; layer 15: *ca.* 2100 – 1900 BC; layer 14/14a: *ca.* 1900 – 1700 BC (Table 6.1) (Figure 8.3) (Grønnow 1994).

Stratigraphic interpretation

The earliest traces of human activity in Area C date to *ca.* 2400 BC. Remains of habitation structures and traces of domestic and workshop activities indicate that Area C was primarily used as a living area with tents/houses, fireplaces etc. during the following *ca.*

Fig. 6.22. Section 85/252,5-257,0 of main excavation Area C (photo: Geert Brovad).

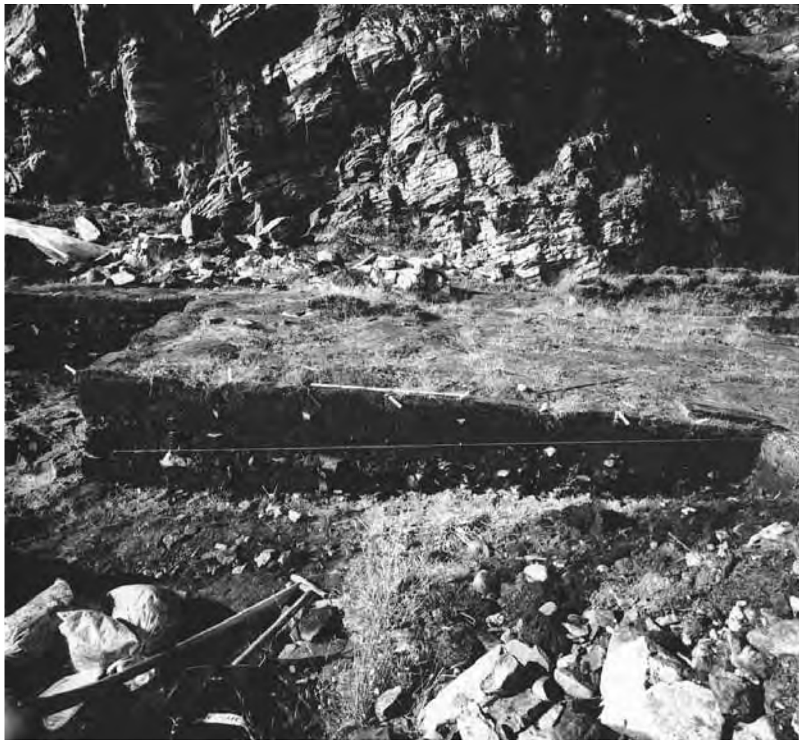


Fig. 6.23. The conditions of preservation and the concentration of artefacts and faunal remains were often surprising. Appa Magnussen excavating in the northeastern corner of Area C with fragments of wooden bowls, killer whale shoulder blade, leister prong, whale bone spoon, wooden shaft fragments etc. (photo: Geert Brovad).

500 years. However, horizons of peat and local occurrences of lyme grass mats within the layers show that the intensity of human activity changed somewhat in this period. Perhaps a result of small shifts in the location of the living structures or a result of changes in the use of the site as such.

Around 1900 BC there is a change in the use of Area C. "In situ" structures are no longer found, only discarded stones, fire-cracked rocks, slabs, blubber etc. all giving the impression that the area was used primarily as a refuse area. Probably the main living area was now found further up the slope, from where it gave rise to the refuse heap. There are very few traces of peat formation in this layer, and it seems that activity was quite intense here for approximately 200 years until *ca.* 1700 BC.

The high level of activity continues. Large quantities of stone artefacts are deposited in the area but, due to poor preservation, no faunal remains are present. The termination of activity in this area is tentatively set at 1400 BC, at which time the site is abandoned.

Summary

To summarise the depositional history of Area B and C, it can be concluded that the Qeqertasussuk site was occupied by the first group of hunters around 2400 BC (Figure 8.3). During this early period of habitation (2400-2100 BC), refuse accumulated rapidly. In Area C the refuse accumulation was accompanied by the construction of several hearths and dwelling structures, not seen in Area B, where habitation and other activities probably were impractical due to the steepness of the sloping ground.

Between 2100 and 1900 BC the deposits in Area C change character. Elaborate and well preserved stone structures are not present, but cultural remains are still common even though preservation has only favoured the survival of a few organic artefacts. In Area B the deposition of cultural material continues, but at a lower rate.

Around 1700 BC, the accumulation of cultural remains cease in Area B whereas the deposition of artefacts, debitage and boiling stones continue in Area C. The termination of occupation at Qeqertasussuk seems to have occurred around 1400 BC.

Chapter 7

Man, dog and material culture

The hunter

Four human bones (two fibulae, one humerus and one tibia) were found in the midden deposits (Figure 7.1). They probably represent two individuals, one middle aged and one more elderly. The height of the two adult individuals has been calculated to be approximately 155 centimetres (Frölich *et al.* 1991). Hair samples from Qeqertasussuk have also been analysed and two most likely represent human hair (Rørdam and Jensen 1991).

Apart from the human remains from Qeqertasussuk, the only other known contemporaneous remains are represented by the nearly complete skeleton of a foetal infant from the Rocky Point Site on Devon Island (Helmer 1991).

Based on the bones from Qeqertasussuk, Frölich *et al.* (1991) conclude that the height of the two individuals from Qeqertasussuk is quite comparable to the height of the Thule Culture Inuit. So it seems that the hunters of Qeqertasussuk 4000 years ago had the same physical stature and capabilities as the hunters of the Thule Culture (Figure 7.2).

The dog

The presence of the domestic dog in a Saqqaq/Pre-Dorset context was first documented from Igloolik in Arctic Canada (Meldgaard 1960), and Møhl (1986), Grønnow and Meldgaard (1991), and Godtfredsen (1992, 1996), have described finds of Saqqaq dogs

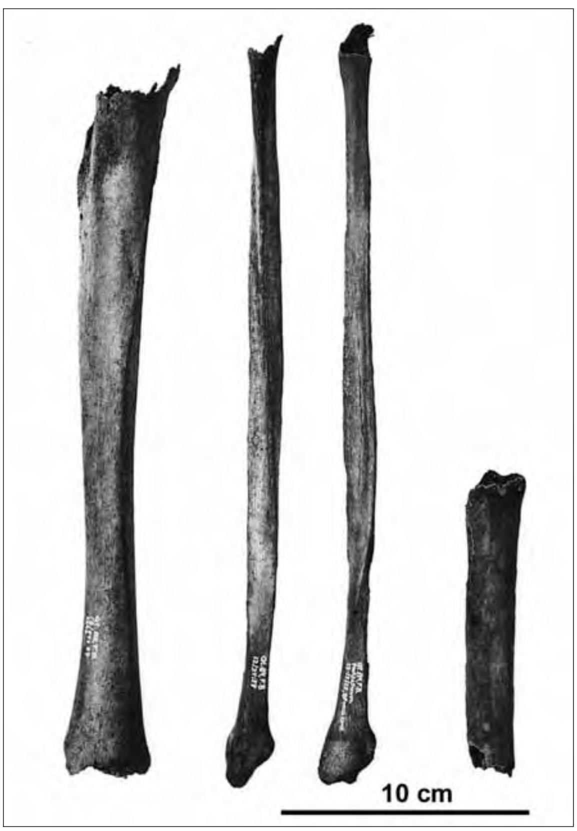


Fig. 7.1. Four human bones: a tibia, two fibulae and a fragment of a humerus. The bones originate from at least two individuals (photo: Geert Brovad).

Fig. 7.2. Face of a Saqqaq shaman? This is about as close as we can get to the image of the hunter. Reconstruction based on two fragments of miniature masks carved in walrus ivory, 6.5 cm. high. Found in a house dating to the last phase of the Pre-Dorset Culture (1200-900BC) (photo: Jørgen Meldgaard).

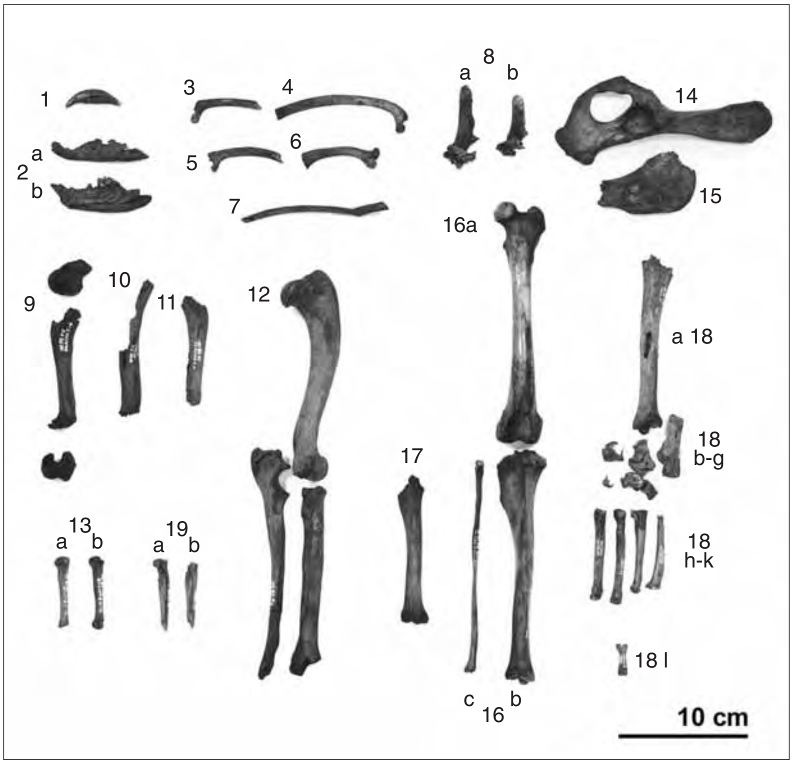


Fig. 7.3. Total dog bone sample from Qeqertasussuk (needle case of dog limb bone not included). The following abbreviations are used below: A.B and A.C = Area B and Area C, f.comp. = faunal component (for dating of faunal components see Fig. 8.3).
(1) Canine (A.C., f. comp. II), (2a-b) Mandibles, two, juvenile, articulated (A.C., f. comp. II), (3-6) Costae (A.B., f. comp. II), (7) Costa (A.B no f. comp.), (8a-b) Vertebrae, two, articulated (A.B., f. comp. III), (9-10) Humeri, juvenile (A.C., f. comp. II), (11) Humerus, juvenile (A.C., f. comp. I), (12a-c) Humerus, radius, ulna, articulated (A.C., f. comp. II), (13a-b) Metacarpi, articulated (A.C., f. comp. II), (14) Pelvis (A.B., f. comp. III), (15) Pelvis (A.B., no f. comp.), (16a-c) Femur, tibia, fibula, articulated (A.B., f. comp. III), (17) Tibia, juvenile, (18a-l) Tibia, tarsals (six), matatarsals (four), phalanx, articulated (A.B., f. comp. III), (19a-b) Metacarpals, articulated (testpits) (photo: Geert Brovad).

from the West Greenlandic sites Qajaa, Qeqertasussuk and Nipisat I. All these finds have recently been summarized and analysed by Morey and Aaris-Sørensen (2002).

Fig. 7.4. Articulated femur, tibia and fibula of dog (no.16 a-c in Fig. 7.3). For comparison the hind leg of a modern sledge dog that drifted a shore on Qeqertasussuk in 1986 is shown (photo: Geert Brovad).

The Qeqertasussuk site yielded a total of 41 canid bones. (Figure 7.3). As stray wolves do occur in West Greenland (Dawes *et al.* 1986), the possibility of wolf bones in the sample must be considered. Møhl (1986) showed that the Saqqaq dogs from Qajaa were significantly smaller than both male and female wolves and that their size was comparable to recent Greenlandic sledge dogs, a finding that has been confirmed by Morey and Aaris-Sørensen (2002).

A comparison of the Qeqertasussuk material with skeletons of Northeast Greenland wolves and with recent sledge dogs revealed that all the excavated adult canid bones were smaller than and outside the size range of wolves and could clearly be assigned to *Canis familiaris* within the size range of modern Greenlandic sledge dogs (Figure 7.4). Also, the dog mandibles from the Saqqaq Culture site Nipisat I were compared to modern and Thule Culture dogs and found to be of comparable size (Godtfredsen 1996; Morey and Aaris-Sørensen 2002).

Morphologically, the Saqqaq dog appears to be of a type very similar to the present Greenlandic sledge dog, which is part of the circumpolar husky dog complex (Figure 7.4 and 7.6).

The two articulated juvenile mandibles and the two humeri represent puppies. Approximately 60% of the dog bones were articulated when excavated (Figure 7.5). Apparently whole forelegs, whole hindlegs, paws and parts of the vertebral column were discarded while sinew, and possibly muscle tissue, still kept the bones in place. At the Saqqaq site Qajaa, the majority of the dog bones found represented the articulated parts of a puppy skeleton (pelvis, femur, tibia, calcaneus, 4 vertebra, and 8 ribs) (Møhl 1986).

Cut marks were found on the articulated hindleg and analysed in detail by Morey and Aaris-Sørensen (2002). They conclude that the hindleg was disarticulated with a knife and the meat subsequently filleted from the bones. Cut marks were also found on a rib and on a thoracic vertebra and they are consistent with filleting of the tenderloin from the vertebral column. From Qajaa similar evidence of butchering has been documented (Morey and Aaris-Sørensen 2002). It thus seems that dogs were on rare occasions eaten by their people. Morey and Aaris-Sørensen (2002) sum up that an occasional dog ".... may have provided a handy and expendable backup food source while more standard fare was being sought".

Morey and Aaris-Sørensen (2002) do not find any cut marks that result from the skinning of the dogs. However, there is an unusually high degree of bone articulation indicating that the dogs were treated differently than typical "food animals" such as ringed seals and harp seals. The pattern is more comparable to the articulation pattern found among the arctic fox bones. Based on these observations, it would seem reasonable to assume that the dogs were flayed and the skins used *e.g.* for garments. However, the articulated limbs may also simply have been left intact on the midden following filleting.

I agree with Morey and Aaris-Sørensen (2002) that the low number of dog bones in the Saqqaq faunal materials as compared to Thule Culture material probably reflects a small and limited dog population. This is confirmed by the fact that only very few dog-bitten bones were found on the Qeqertasussuk site. However, I do not agree with Morey and Aaris-Sørensen's conclusion that the Saqqaq people were "...only occasionally accompanied by one or a few dogs. For years at a time, maybe decades or even centuries, they did not have dogs".

In order to sustain a viable dog population within a region there must have been dogs present on most inhabited sites of the Qeqertasussuk type in numbers that prevented inbreeding and extinction. Saqqaq people must also have had traditions for breeding, feeding and tending the animals and a complex of ideas and rules for man-dog interaction.

Fig. 7.5. Articulated hind leg of dog in situ in midden deposits (no.18 a-l in Fig.7.3) (photo: Morten Meldgaard).

Fig. 7.6. Modern Greenlandic sledge dogs, Qasigiannguit in April 1987 (photo: Morten Meldgaard).

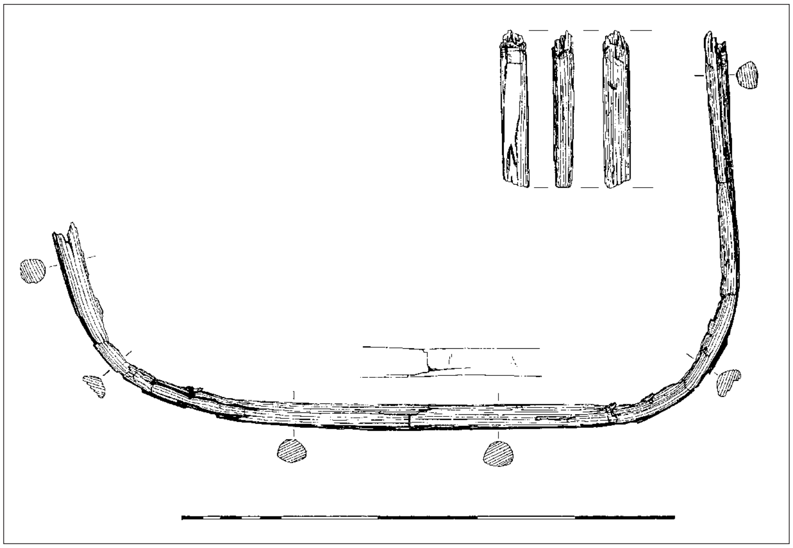


Fig. 7.7. Wooden rib from a slender kayak or canoe type of boat. Fragments of heavier ribs indicate that the inhabitants of Qeqertasussuk also possessed larger boats probably of umiaq size class (From Grønnow 1988:36).

What type of interaction are we then talking about besides using dogs for food and skin? There is only limited evidence of sledge remains from Saqqaq Culture contexts (see below) and no direct evidence for the use of dog harnesses. However, the early use of dogs for pulling and carrying has been indirectly documented by Arnold (1979, 1981) and Morey and Aaris-Sørensen (2002) who describe abnormally shortened spinous processes on dog vertebrae from the Lagoon Site on Banks Island and from Qajaa. Such deformations may result from pack load stress and thus indicate that the dogs carried or pulled loads.

If sledges pulled by dogs were used, the apparent small dog population probably excluded dog team sledging as we know it from the historic period. Rather we should imagine a few dogs pulling alongside humans.

Other uses of dogs, for example tracking, are very difficult to document archaeologically, but can not be left out as an option. It should also be kept in mind that prehistorically in many cultures dogs have had a special status. The low incidence of Saqqaq dog bones in the middens may thus have its root in a special man-dog relationship which is difficult to demonstrate archaeologically.

Means of transportation

The importance of dog sledge, kayak and umiaq is well documented among all ethnographical and historically described Eskimo societies. The presence or absence of these means of transportation in the Paleoeskimo societies is much less well understood. Based on the geographical situation of many Saqqaq sites *e.g.* on small islands in the open water area along the central West Greenland coast, the inference has often been made that the Saqqaq people must have had boats (*e.g.* Kramer and Jones 1992). But not until the Qeqertasussuk excavations were carried out did we obtain direct proof of their existence. Among the many wooden artefacts are several fragments from the wooden frame of a slender kayak-like skin boat. The finds consist of the main part of a wooden rib (ca. 35 centimetres wide) (Figure 7.7) and fragments of heavier ribs. The small rib probably comes from a slender kayak or canoe type of boat used by the Saqqaq hunters for sea-hunting. The larger rib fragments may originate from a larger umiaq-type of boat primarily used for transportation and/or large whale hunting. In addition, a couple of oar fragments have been found in the deepest layers (Figure 7.8). These remains represent two large fragments of the earliest known watercraft in the Arctic. The documentation of the use of a “kayak-like means of transportation” has huge implications for the understanding of the settlement, since the use of a watercraft is essential for humans settling on relatively small islands during the open water period.

Sledges are not well documented from the Saqqaq Culture in West Greenland. However, combining evidence from contemporary Canadian Pre-Dorset sites where sledge runners have been reported (J. Meldgaard pers. comm.) with West Greenland evidence represented by a sledge runner of the same type recently found in the "Porsild collections" that originate in the Disko Bay area (J. Meldgaard pers. comm.) it seems plausible that the Saqqaq people were well acquainted with sledge technology.

Boats and sledges gave the Saqqaq people a high degree of mobility. This meant that *e.g.* Sydostbugten (ca. 30 kilometres wide) could be crossed by boat or sledge within a day and that the whole of Disko Bay and the rest of the West Greenland coast for that matter was within easy reach of the inhabitants at Qeqertasussuk.

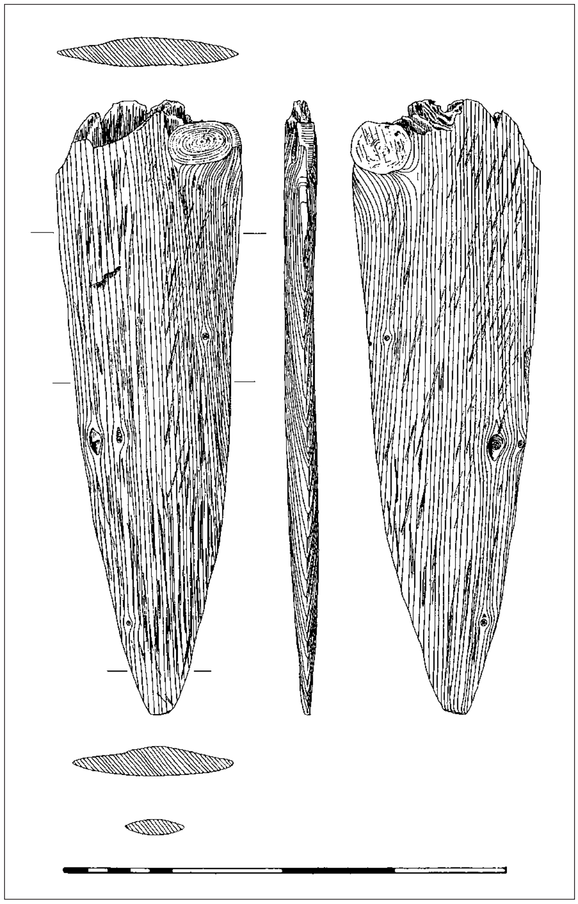


Fig. 7.8. Tip of a paddle or doublebladed oar made from drift wood. Both the rib fragments and the oar tip represent the earliest known documentation of arctic watercraft (From: Grønnow & Meldgaard 1991:129).

Hunting gear

In the Qeqertasussuk material there are well preserved specimens of many different kinds of hunting gear. Of course we can only guess at the exact use and original combination of these tools. However, many types are so closely related to modern equivalents that there can only be little doubt to their original use. In the following section, the three most common and evident categories of hunting tools will be discussed briefly, thereby illustrating Saqqaq man's adaptation to the local game species and resource variability (Figure 7.14).

Harpoons

Harpoons as well as the wooden shafts interpreted to be harpoon shafts are all remarkably light and slender compared to the historically documented hunting gear from Western Greenland. The harpoon heads are of the "male" as well as "female" type, even though the most common appear to be the "male" type displayed in Figure 7.9. The mean length of the recovered harpoon heads is 6.5 cm. (Grønnow 1994). These harpoons reflect the importance of seal hunting, but their slender and fragile nature is nevertheless strange when compared to the harpoons from the later Thule Culture. The only ethnographical parallel to the Saqqaq harpoon is the slender, light harpoon types used by the Bering Eskimo in the 1800's. Unfortunately, definite foreshafts for harpoons have not been found, but judging from the average size of the harpoon heads, the harpoon shafts probably had a diameter of 12-17 mm, corresponding to the size of the leisters and bird darts.

Large barbed male harpoons are known through a few specimens from Kronprinsens Ejland in Disko Bay, from Qajaa and from Itinnera (Günther and Meldgaard 1983). They are of a size that makes them suitable for large sea mammal hunting.

Very important is the presence of the throwing stick, documented both at Qajaa (Meldgaard 1983) and at Nipisat (Møbjerg 1998), which was probably used for launching both harpoons and bird darts.

Analysis of the shaft diameters (Grønnow 1994) has documented that the wooden shafts can be divided in two or three size categories corresponding to 1) the diameter of arrows (7-10 mm), 2) leisters and bird darts (and probably also harpoon shafts) (12-16 mm in

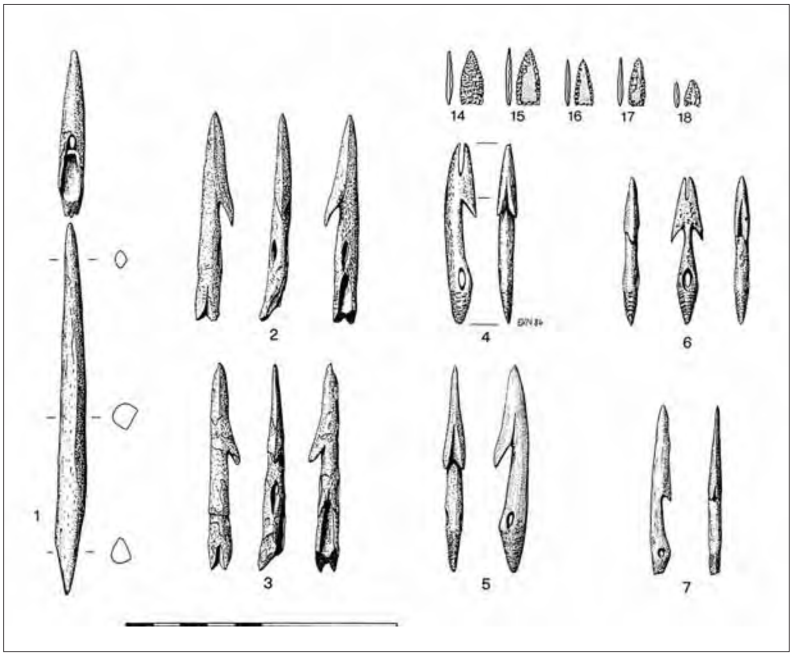


Fig. 7.9. Harpoon gear for seal hunting. 1: female harpoon head and foreshaft of whales bone, 2 & 3: variations over the same type, 4 to 7: male harpoon heads of which two are selfbladed and two are with slits for endblades (from: Grønnow & Meldgaard 1991:127; see Grønnow 1997 for typological study). A selection of stone endblades is also shown.

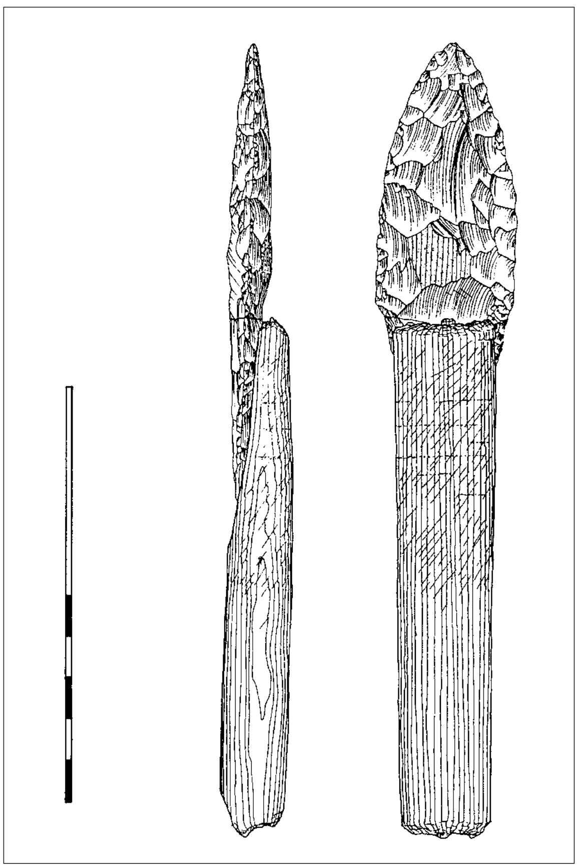


Fig. 7.10. Lance with blade found in situ. Together with two "oversized" harpoon heads found at other Saqqaq sites this lance may have been used for large whale hunting (from Grønnow 1988:31).

diameter), and 3) lances (12-27 mm in diameter). Of these categories, the only weapons that seem heavy enough for whale hunting are some of the lances in the size category around 22-27 mm. (Grønnow 1994) (Figure 7.10). Such heavy hunting gear has also been documented from Nipisat in the Sisimiut area (Kramer and Jones 1992; Møbjerg 1998).

Even the well documented harpoon gear raises questions on the understanding of how seal hunting was carried out. Nozzles and plugs from seal skin floats are occasionally found on Thule Culture sites (Mathiassen 1934), but in spite of the good conditions for organic preservation, such implements are not known from Qeqertasussuk or Qajaa. The light harpoons at Qeqertasussuk may thus have their closest parallel in the ethnographically documented material from Alaska. In this area the slender bladder harpoons were used without floats, but with the harpoon line fastened to the shaft in two places, so that the harpoon would drag sideways through the water, thus slowing down and exhausting the prey (Grønnow and Meldgaard 1988; Grønnow 1994).

Bird darts

Several unilaterally barbed bird darts and/or leister end-prongs of whale bone were found (Figure 7.11). These were lashed three at a time to the end of a slender wooden shaft. These darts were most probably

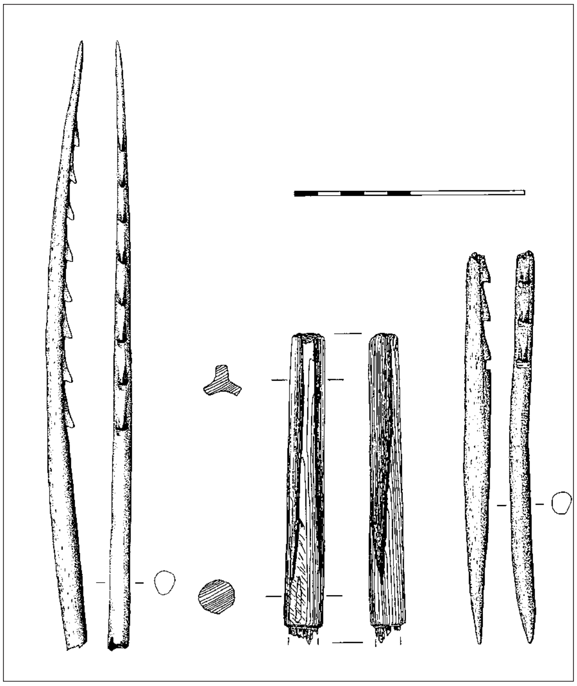


Fig. 7.11. Bird hunting was probably often undertaken with barbed spears. The slender wooden shaft in the middle has three grooves probably for mounting barbed end prongs like the ones shown made from whales bone (from Grønnow & Meldgaard 1991).

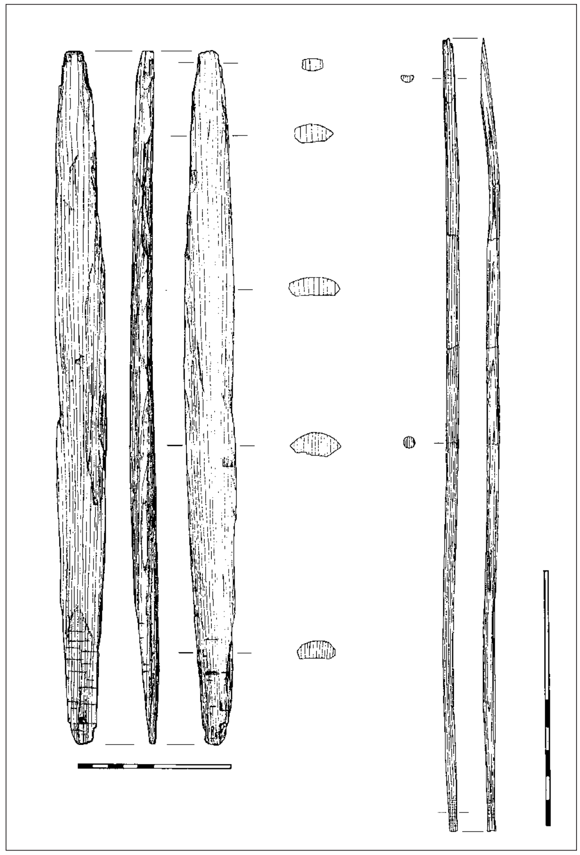


Fig. 7.12. Bow and arrow was probably the most important caribou hunting equipment. The bow fragment to the left seems unfinished. Other similar pieces carry a groove along the back, probably for sinew reinforcement of the brittle driftwood. The arrowshaft, which is approximately 70 centimetres long, has traces of lashings for guiding feathers and a slot for the stone arrow-head (from Grønnow: 1988).

used as bird darts, but could also have served as fishing implements (Grønnow 1994).

The bow and arrow

The bow is represented by several fragments of a composite bow which originally must have been equipped with a back reinforcement. The arrows, which were about 75 cm long, were often made up of several parts lashed together (Grønnow 1994, 1996) (Figure 7.12). The arrow foreshafts are furnished with a blade bed for a tanged point of killiaq. At the other end, traces of the lashing for feathers can be seen.

Nets

The Saqqaq hunting gear was highly diverse, allowing the inhabitants of Qeqertasussuk to take advantage of most available games species (Grønnow 1996). The implements excavated on Qeqertasussuk allow us to reconstruct a hunting tool kit as illustrated in Figure 7.14. However some animals, such as fox, hare, ptarmigan, gulls, fish and even seals may also have been caught by means of passive hunting implements such as traps, snares and nets. The use of snares and nets is difficult to demonstrate, but as shown by Porsild (1915:178), nets of baleen may very well have been in use in pre-colonial times. Nets have not been positively documented in Saqqaq contexts, but the presence of baleen strings tied together with knots known to be suitable for making fishing or sealing nets (Grønnow 1994:219) and Larsen's belief that notched stones from Saqqaq sites in Disko Bay are net-sinkers (Larsen and Meldgaard 1958:59), suggest that the Saqqaq people had both the raw material and the technological knowledge necessary to produce and use nets. Outside Disko Bay net-sinkers are known from the Saqqaq Culture site Nipisat in the Sisimiut area (Møbjerg 1998).

Among the finds from Qeqertasussuk are several

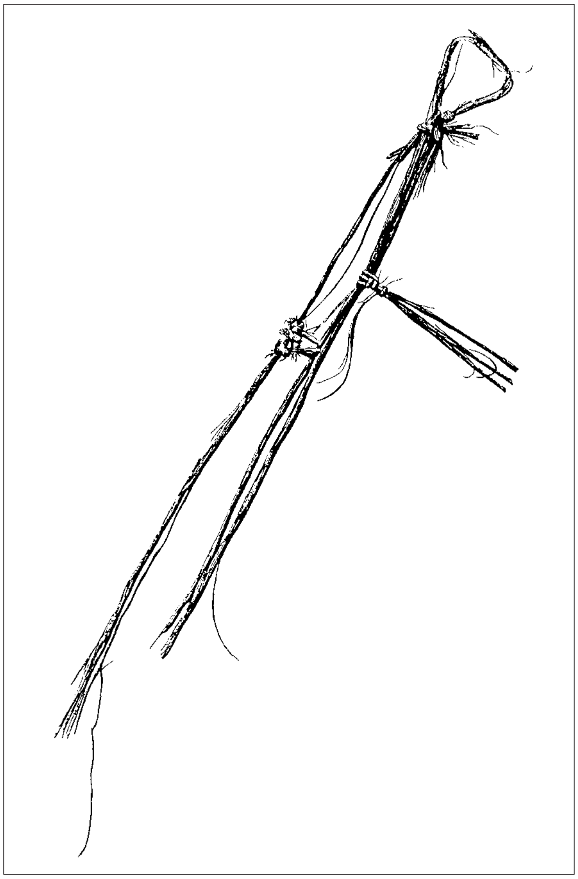


Fig. 7.13. Net, noose or...? (From Grønnow 1996). Several baleen strings with knots and loops were found. They may have been used for many purposes, two of which are netting and snaring.

baleen strings with loop knots, which may represent snares used for small game hunting. Other pieces of baleen could possibly be parts of nets (Grønnow and Meldgaard 1988, 1991; Grønnow 1994, 1996).

Fishing

Fishing could also have been done by means of jigging, but neither hooks nor sinkers have been found at Qeqertasussuk. However, at Nipisat a soapstone artefact interpreted as a sinker for a jig (Møbjerg 1998) indicates that Saqqaq people may well have employed this fishing technology. Archaeologically such small, intricate and composite gear is difficult to document and may, although present, pass undiscovered. For example, a number of finely ground bone points made from bird wing bones found at Qeqertasussuk might well have been parts of composite jigs (Grønnow and Meldgaard 1988, 1991).

Dwelling structures

In Area A, a presumed outdoor hearth with boiling stones was excavated. In association with this structure there were a limited number of lithics, supporting the impression of an outdoor or at least temporarily used structure. Most evidence of domestic life was retrieved in Area C, layer 16, where a large number of presumed outdoor hearths as well as larger dwelling structures were found superimposed (Figure 7.15).

Analysis of this fossil living surface has revealed

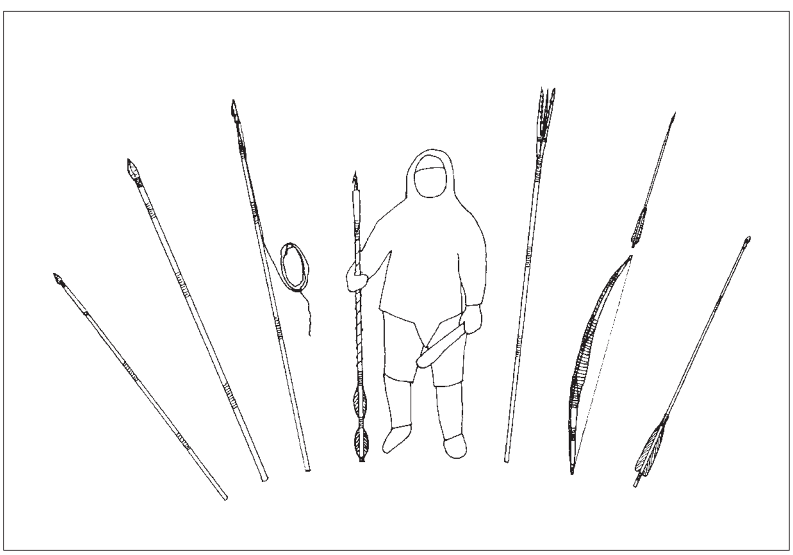


Fig. 7.14. A Saqqaq hunter and his hunting equipment. The reconstructions are based on the finds from Qeqertasussuk, Qajaa, Nipisat and on historically used hunting implements, especially from Alaska. From left to right: small lance, large lance, harpoon with toggling head, mainly for ringed seal hunting through the sea ice, light throwing harpoon mainly for open water harp seal hunting, bird dart, sinew-backed bow and arrow, light throwing spear. In his left hand the hunter holds a throwing board for light harpoons and spears (from: Grønnow & Meldgaard 1991:126).

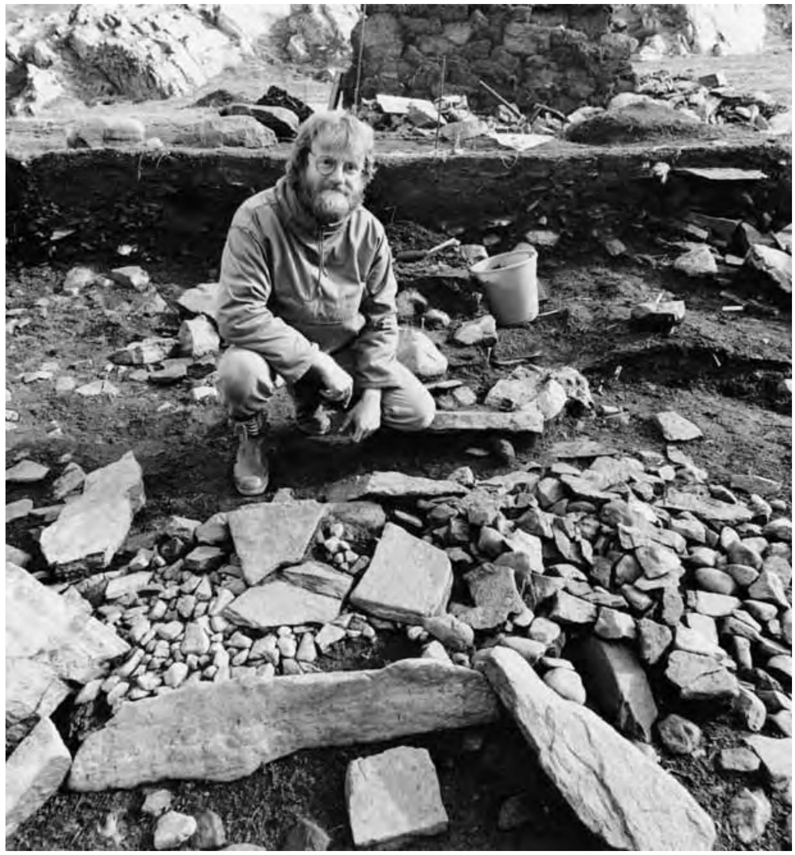


Fig. 7.15. The mid-passage structure A 8 formed the central part of what was probably a skin tent (Grønnow 1988:28), Bjarne Grønnow acts as scale (photo: Geert Brovad).

that it was probably formed during a short period of intensive use between 3900 and 3700 BP (Grønnow 1994:204). Stratigraphic evidence suggests that the many stone structures represent several episodes of habitation. Several features may thus be disturbed by later reuse of stones, and the living floors as such may have been subjected to severe "smearing" obstructing the separation and analysis of the different depositional units. However several structures are well-defined: A3, A8 and A9 are mid-passage structures (Figure 7.16).

The mid-passage structure A8 has been interpreted as the central part of a dwelling measuring 7 by 4 meters (Grønnow and Meldgaard 1991). Along the perimeter of A8, there was a stamped down floor area consisting of a compact layer of birch brushwood and heather. On either side of this floor were slightly raised platforms, of which the western one consisted of alternating layers of grass turf and heather. Within and in the immediate vicinity of the mid-passage there were several tools and household utensils such as spoons, ladles and trays made from driftwood, caribou antler and sperm whale teeth. In the perimeter of the eastern platform there was a cache containing a complete hafted double scraper and a couple of burins (Figure 7.17).

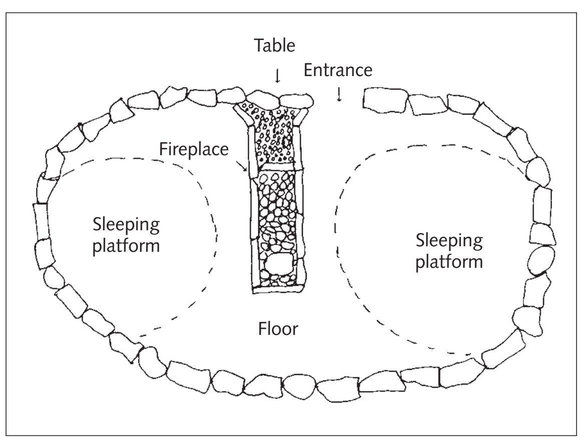


Fig. 7.16. Reconstruction of A8 tent plan. The hearth was placed in the mid-pasage and on both sides there were raised sleeping platforms (Grønnow & Meldgaard 1991).

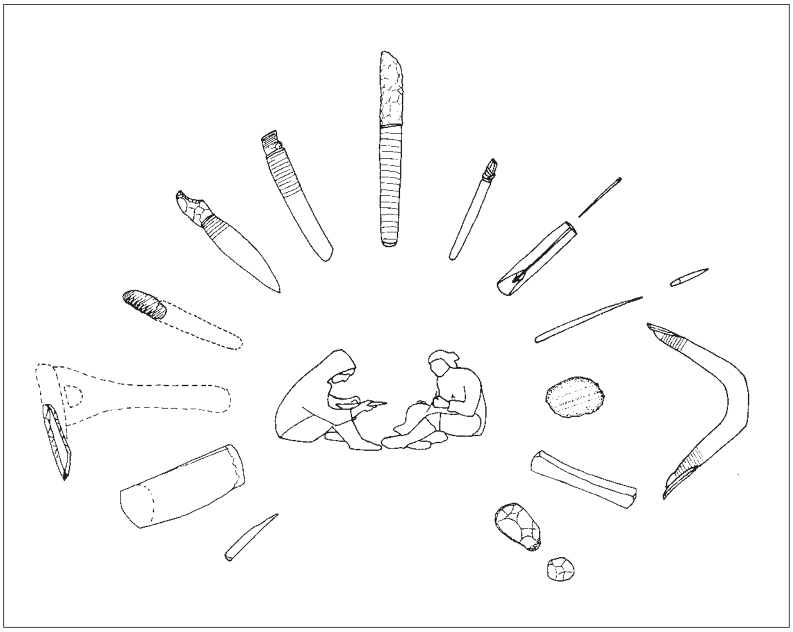


Fig. 7.17. The Saqqaq tool-box was well stocked with specialized tools for wood working, sewing, skin scraping etc. The drawing presents a selection of the most important tools. Clockwise from bottom left: pressure flaker, wedge, adze, saw, side scraper, burin, knife, small knife, needle case and needle, awls, pumice grinding stone, double-blade scraper, grinding stone and "strike-o-lights" (from: Grønnow & Meldgaard 1991).

Household utensils and other tools

Among the household utensils the most spectacular objects are the many hafted lithic hand tools and finely crafted trays and spoons. Most of the hafted lithics are knives, but hafted scrapers, burins and microblades were also found. Hafts for the knives are made of driftwood split into halves which hold the proximal end of the blade. Traces of lashing were seen on all knife handles, and one knife was recovered with a complete baleen lashing. Spoons, ladles, bowls and trays are made from whalebone or tooth, caribou antler or driftwood. Characterising all spoons and ladles as household utensils might not be correct. Several spoons might very well more correctly be seen as part of ice hunting technology, where spoons and ladles (ice-scoops) are traditionally related to breathing hole hunting.

Clothing

Another unusual find category from Qeqertasussuk are skin fragments, some being clothing. The foot of a kamik-stocking appears to have been made in the same fashion as more recent inner boots: a sole and a tube, sewn together with very fine thin twisted sinew. Within the inner boot there was some plant material believed to be the remains of a lining (Møller 1991), which in more recent times was usually made of lyme grass. Among the other pieces of skin, several are cut into strips or sewn together, the largest piece being a 150 x 50 cm piece of sealskin sewn with a heavy cord of twisted sinew. This piece of skin is believed to be the remains of a tent skin or sleeping blanket (Møller 1991).

Chapter 8

Faunal material

A total of 633 kilos of bones, representing approximately 220,000 bone fragments, have been excavated at Qeqertasussuk. Area B produced 171 kilos, Area C 277 kilos, and the test pits and the preparation of sections produced 136 and 49 kilos respectively.

Based on dry bone weights from all excavated square meters and test pits, a contour map of the whole site showing bone distribution and bone concentration with 2 k/m² equidistance curves was constructed (Figure 8.1). The area covered by each contour interval was then calculated and multiplied by the relevant bone weight and finally all calculated bone weights were added up giving a minimum total bone weight for the Qeqertasussuk site of 4,705 kilos.

This means that the excavated faunal sample from areas B and C, which has a weight of 448 kilos, represents *ca.* 10% of the total faunal material calculated to be present at the site.

Representativity and taphonomy

It is of fundamental importance for the interpretation of the faunal material from Qeqertasussuk, that the excavated material is representative of the bone assemblage deposited there by the Saqqaq inhabitants. It is therefore necessary to give a detailed evaluation of the specific taphonomic processes that have influenced bone composition from the time of deposition to the time of retrieval and identification.

The three factors considered to have had a significant influence on the deposited faunal sample at Qeqertasussuk are (1) scavenger activity, (2) physical and chemical decomposition, and (3) excavation technique.

Scavenger activity

The district has a large population of arctic foxes and ravens are quite numerous, and both animals are represented in the midden. No doubt these animals, when given the chance, exploited and disturbed the refuse heaps left by the site's inhabitants. Dog bones found in the midden show that the effect of the domestic dog must also be considered.

The influence of scavengers on bone composition can, to some extent, be evaluated by an analysis of the frequency of bitten and gnawed bones. The faunal material from unit 13/24 in Area B was chosen for a detailed investigation of bite marks and gnawing (Figure 8.4). Out of a total of 6423 bones only 29 fragments, or less than 0.5%, carried bite marks or traces of gnawing. This frequency corresponds well with observations made on the faunal material from the rest of Area B and Area C.

The bite marks and traces of gnawing from the test unit were registered on full scale bone drawings, and were characterised following Binford (1981).

Twenty eight bones comprising 20 seal bones (12 limb bones, 7 ribs, 1 vertebrae), 3 fox bones (limb bones), 3 Brünnich's guillemot bones (wing bones), 1 ptarmigan humerus, and 1 glaucous gull humerus had circular "puncture marks" of which 9 perforated the bone (Figure 8.2). 37% of 60 puncture marks had a diameter of 0-1 millimetre, 42% were 1-2 mm, 12% were 2-3 mm, 3% were 3-4 mm, 5% were 4-5 mm, and 2% were 6-7 mm in diameter. Only one bone, a seal tibia, exhibited "pitting" covering an area of approximately 2.5 by 0.5 centimetres.

The circular nature of the puncture marks indicate that they were primarily made by the canines of carnivores. The diameter of moderately worn Greenlandic sledge dog canines just above the occlusal surface is 3.5 to 4.5 mm. Moderately worn arctic fox canines are approximately 2.5 mm in diameter just above the occlusal surface.

The major part of the puncture marks registered (91%) thus seem to have been made by foxes or possibly dog puppies with deciduous teeth, while the remaining 9% seem to have been made by adult dogs. It is significant that only one bone has traces of gnawing; most just bear witness of grasping. This could indicate that the refuse areas were scavenged by foxes and dogs that went elsewhere to eat and gnaw the bones. In this respect, the situation is comparable to a wolf kill site, where only very few bones with bite marks and traces of gnawing are found at the kill site itself, instead the gnawed and bitten bones are found

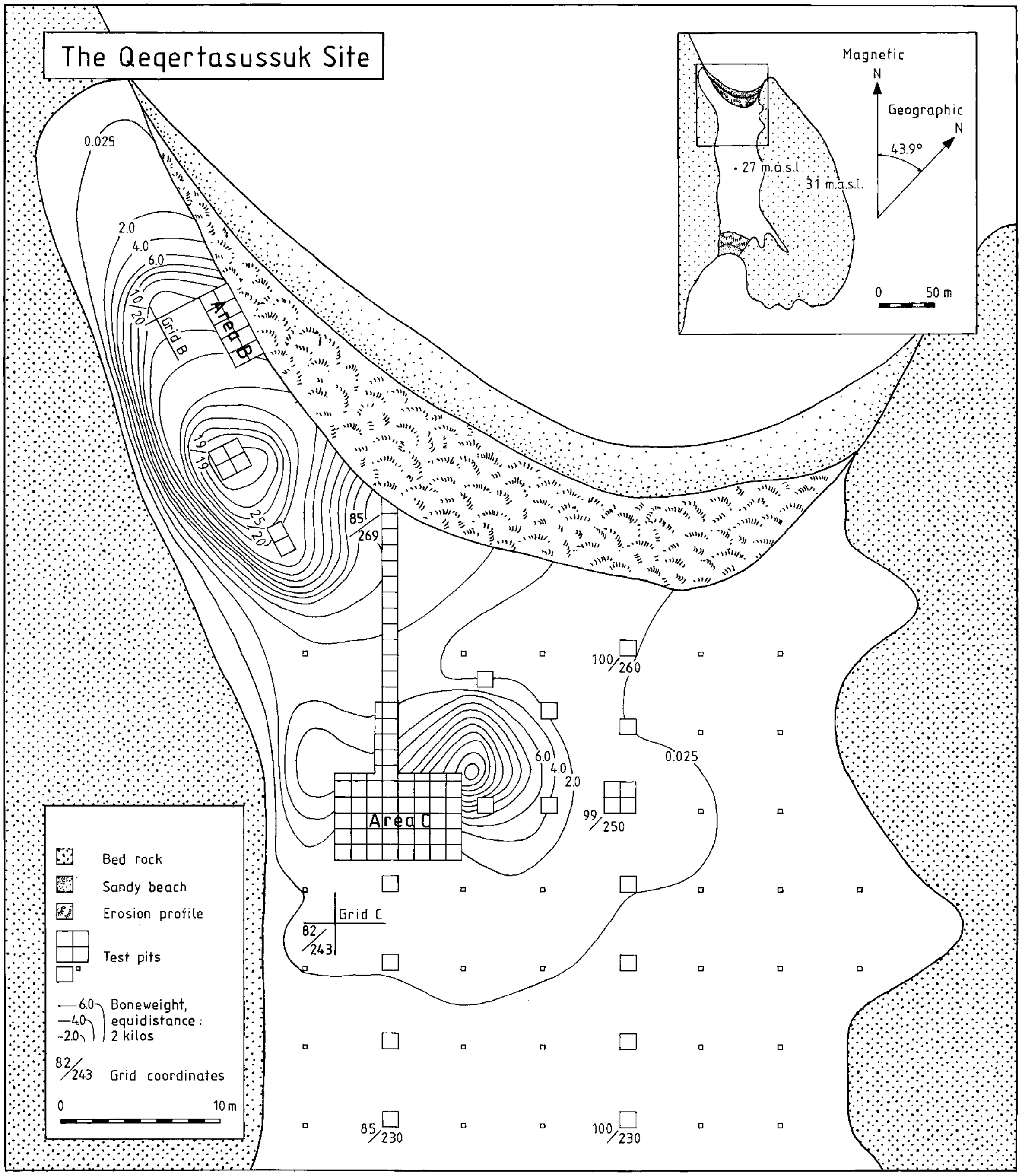


Fig. 8.1. Contour map showing the distribution by weight of preserved faunal remains on the site. Based on the map it is estimated that ca. 10% of the preserved faunal material has been excavated.

primarily in the periphery of the kill site (Binford 1981:209) or at the denning site (Binford 1981:46).

Even though there must have been some transport of bones away from the site, the very low overall percentage of bones with bite and gnaw marks indicates that scavenger activity generally must have been low, and their influence on the faunal assemblage must therefore be considered small.

Adding to the low impact of scavengers on the material could be that the fox population on the island, which probably only consisted of a couple of fox families, was quickly exterminated by the local hunters. This would mean that summer scavenging by foxes was almost non-existent when the midden material was easiest to get at. In winter, when foxes potentially had easier access across the sea ice, the refuse was deep-frozen and imbedded in the midden and consequently more difficult to scavenge. Also, the faunal material indicates that these winter foxes were actively pursued for their winter fur.

Fish bones, especially of smaller species such as capelin and sculpin, pose a special problem. They are likely to be completely ingested by scavenging dogs and experiments show that only a very small percentage of the bones survive the passage through their digestive tracts (Jones 1986). It can thus be expected that, even though the general scavenger activity appears to be limited, fish bones may be underrepresented in the material.

Physical and chemical decomposition

Bone preservation in the upper cultural layers was relatively poor. Bone preservation in the middle and lower layers was, on the other hand, excellent. The difference in preservation is partly due to differences in accumulation rate and partly due to the position of the permafrost level.

The lower and middle layers accumulated rapidly and the faunal remains were therefore quickly covered and protected from direct exposure to rain, sun and other destructive agents. At the same time the permafrost level rose, providing perfect conditions for the preservation of organic remains.

The upper layers accumulated more slowly, especially in Area B, and the bones therefore stood a greater chance of being exposed to the decomposing effect of weather before they were covered by other refuse and natural vegetation. At the same time, the preserving effect of the permafrost was less marked in the upper layers than in the lower. In summer the permafrost table moved downwards into layer 11 in Area C and into layer 5 in Area B, thus allowing physical and chemical decomposition to take place.

The relatively high degree of bone decomposition in the upper layers must have influenced the composition of the faunal material. Especially bones of low density and small and thin-walled bones can be expected to be underrepresented in the material (Grønnow *et al.* 1983:76). Bird bones are generally smaller and more fragile than mammal bones, and fish

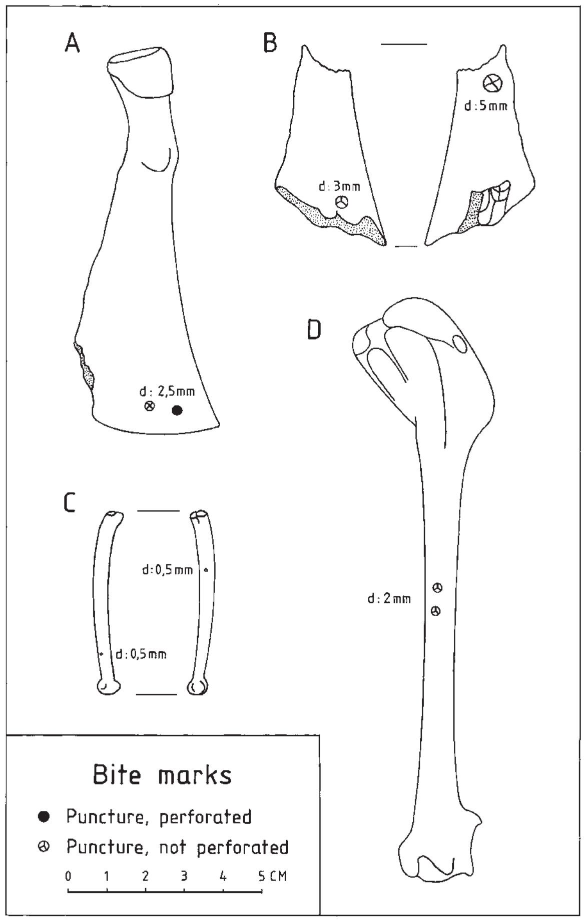


Fig. 8.2. Only very few animal bones carry bite marks, indicating that dog and scavenger activity has only had little influence on bone sample composition. Illustrated are four examples from square 13/24, A: radius of small seal, B: radius of seal, C: ulna of Brünnich´s guillemot, D: humerus of glaucous gull.

bones are smaller, more fragile and more pneumatic than both mammal and bird bones. This indicates that a slight under-representation of birds and a somewhat greater under-representation of fish can be expected in the upper layers. Also, there should be a trend towards better preservation of larger species within each of these groups. Differential preservation of different skeletal elements may also be expected, *e.g.* bird ribs may tend to disintegrate before bird limb bones and caribou antler would be more susceptible to decomposition than caribou limb bones (Binford and Bertram 1977; Grønnow *et al.* 1983:79).

The faunal material in the middle and lower faunal layers is preserved in all details. This includes bones from the smallest fish vertebrae and bird pha-

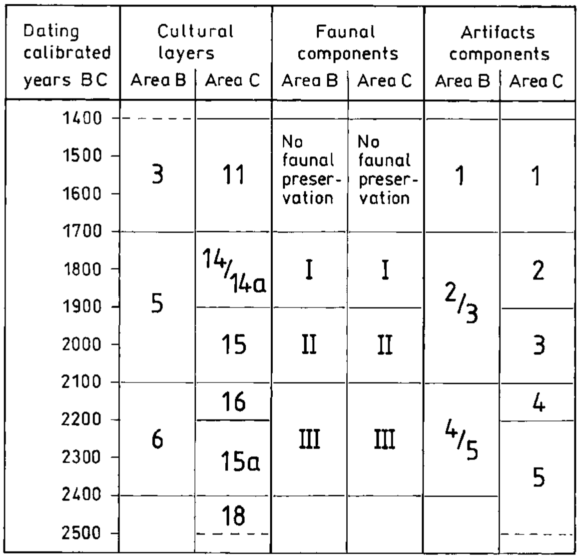


Fig. 8.3. "Calibration" of cultural layer numbers used during excavation with artifact components developed during artifact analysis (Grønnow 1994) and faunal components developed for the present faunal analysis.

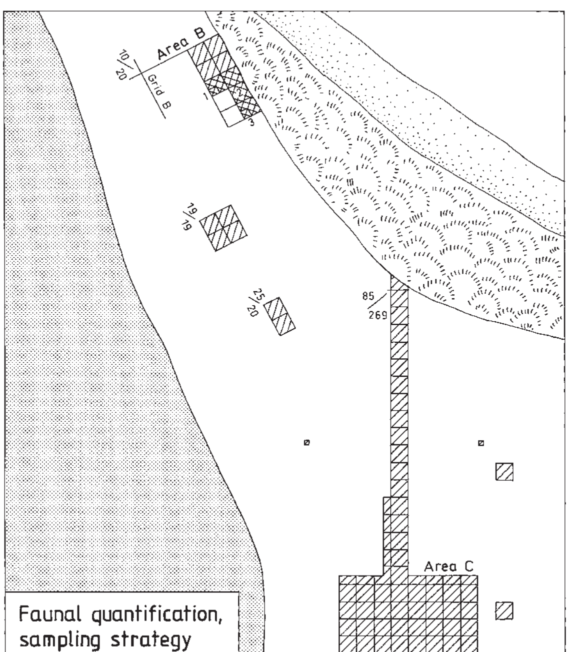


Fig. 8.4. Map showing the quantification methods used for faunal material from different site segments.

langes to whale scapulas, keratinous materials in the form of hair, claws, baleen, feathers and the periostrachum of molluscs, and even fragile and easily dissolvable materials such as the calcium carbonate parts of molluscs and the skins of mammals and birds.

The excellent state of preservation of all bone sizes and types of organic material indicates that there has been very little differential bone survival and that decomposition has had very little effect on the relative representation of species or skeletal elements.

Excavation technique

It has been shown time and again that it is necessary to implement sieving in order to produce representative faunal samples (Thomas 1969; Casteel 1970; Payne 1972, 1975; Clason and Prummel 1977).

At Qeqertasussuk it was decided that it would be too time consuming to sieve on location. Instead all soil from ¼ m² columns within each square meter was removed for sieving and further analysis in the laboratories at the Zoological Museum, Copenhagen.

Two sieves with wooden frames mounted with 4 and 2 mm mesh were constructed so that the 4 mm sieve fitted onto the 2 mm sieve. The soil samples were placed in the 4 mm sieve and gently washed through both sieves with a water hose. The residue from the two sieves was then dried separately and sorted using a binocular dissecting microscope at x12. The material was sorted into six groups (1) bone fragments, (2) insect remains, (3) seeds, (4) artefacts, (5) charcoal and (6) other remains.

Sieving and initial sorting turned out to be extremely time consuming, as it took 25 man-days to work through two ¼ m² units from Area B (12/23 and 14/24) (Figure 8.4). The results, however, were rewarding.

The number of fish species was increased by 200% through sieving (Table 8.1). Even though the excavation of units 12/23, 12/24, 13/24 and 14/24 in Area B was undertaken carefully with trowel, only two species of fish were found during excavation (cod and salmon). The 4 mm sieve added two species (arctic char and Polar cod) and the 2 mm sieve added two more (capelin and sculpin). The diameter of capelin and sculpin vertebrae is less than 2 mm, and it is only by chance that the bones were retained on the two mm screen.

Sieving also added a new mollusc, the periwinkle, to the species list. Only the keratinous operculum was

Table 8.1. Effect of sieving on fish species diversity. The excavated fragments are from 4 m^2 in Area B (12/23, 12/24, 13/24, 14/24). The fragments recovered on the 4 millimeter and 2 millimeter sieves are from 1/4 m^2 units in 12/23 and 14/24. Lengths of cod and salmon are averages for the fish represented in the material, while average lengths of the other species are from Muus (1981).

	Fragments excavated	Fragments sieved 4 mm	2 mm	Average length
Cod	43	12	0	ca. 100 cm
Salmon	1	0	0	ca. 90 cm
Arctic char	0	10	0	40-60 cm
Polar cod	0	5	6	13-27 cm
Capelin	0	0	1	15-20 cm
Sculpin	0	0	1	25-30 cm

Table 8.2. Effect of sieving on the relative frequency of seven bird species. The excavated fragments are from 4 m^2 in Area B (12/23, 12/24, 13/24, 14/24). The screened fragments comming from 1/2 m^2 in area B (1/4 m^2 in 12/23 & 1/4 m^2 in 14/24) have been multiplied by eight for comparison. Only species represented by more than 100 bone fragments have been included. Bird weights are from Salomonsen (1981).

	Fragments excavated	Fragments sieved	Percentage added by sieving	Average weight of bird
Glaucous gull	741	160	22%	1.0-2.0 kg
Iceland gull	213	56	26%	0.5-1.0 kg
Fulmar	2141	824	39%	0.5-1.0 kg
Brünnich's guillemot	2772	1624	59%	1.1-1.2 kg
Ptarmigan	605	544	90%	0.4-0.6 kg
Black guillemot	140	192	137%	0.4-0.5 kg
Little auk	534	1048	196%	0.1-0.2 kg

preserved. Due to its dark colour and small size it was not recognised during excavation.

The relative representation of species was also strongly altered by sieving. The seven most frequent bird species in the faunal assemblage from 12/23, 12/24, 13/24 and 14/24 provided a good example (Table 8.2). Sieving increased the number of fragments per species with between 22% (glaucous gull) and 196% (little auk). The increase in recovery in the sieve was clearly inversely related to bird size.

The same tendency became evident when comparing fish, bird and mammal bone recovery (Table 8.3). Fish bone numbers were increased by 636%, bird bones by 62% and mammal bones by 58%.

Practically all mammal and bird bones were retained by the 2 and 4 mm sieves. This was also the case with fish bones from species of the same size as, or larger than, polar cod. Based on the sieving results, the relative representation of these species in the excavated material can be corrected. However, most bones of capelin, sculpin and fish of similar size may have slipped through the sieves, and the correction factors are certainly too low. Accordingly the representation of these species in the material is likely to be highly underestimated.

Faunal identification

Bone identification can also be viewed as a taphonomic factor because the size and quality of the comparative collection used may influence the result. It is therefore important to report on the comparative collection used for identification purposes.

Fortunately, the number of species that can be encountered in Arctic Greenland is limited and the problems of distinguishing between closely related species are relatively small.

Nevertheless it takes a large reference collection to make correct identifications and the osteological reference collection used at the Zoological Museum in Copenhagen is fortunately substantial. Most species of Greenlandic mammals and birds are represented by ten or more complete skeletons of both sexes and of different age classes. The whales, however, form an

Table 8.3. Effect of sieving on the relative frequencies of bird, mammal and fish bones. Numbers are from table 9-2. The excavated fragments are from 4 m^2 in Area B (12/23, 12/24, 13/24, 14/24). The fragments recovered on screen are from 1/2 m^2 in Area B (1/4 m^2 in 12/23 and 1/4 m^2 in 14/24), and they have been multiplied by eight for comparison. Only bones identified to species or genus are included.

	Fragments excavated	Fragments sieved	Percentage added by sieving
Mammals	12848	7384	58%
Birds	7278	4488	62%
Fish	44	280	636%

Table 8.4. Size range of bones of recent West Greenlandic king eiders (*Sommateria spectabilis*) (n = 15 (6 males, 8 females)) and eider-ducks (Sommateria molissima) (n = 19 (11 males, 7 females)). The average live weight and total length of the king eider is 1 1/2-2 kilos and 55-62 centimeters and of the eider-duck 1 1/2-2 1/2 kilos and 60-70 centimeters (Salomonsen 1981). Measurements, in millimeters, have been taken according to Driesch (1976).

	Humerus (GL)	Ulna (GL)	Coracoid (Lm)
King eider	93-106	83-91	50-59
Eider-duck	101-110	88-95	55-62

exception. The largest of the whales (*e.g.* bowhead, blue whale and fin whale) are only represented by two or more specimens, and the smaller whales (*e.g.* minke whale, narwhal, and white whale) are represented by five or more skeletons. Unfortunately there is no grey whale skeleton in the museum's reference collection.

Skeletons of the more common fish species are generally well represented, but a few (*e.g.* sculpins and flounders) are only represented by a single skeleton, and a number of more uncommon species are not represented at all.

Even with this quite comprehensive reference collection at hand, a number of identification problems remain on the species level:

Species identification of seals

Six species of seals occur in Disko Bay. There is a gradual size increase from the ringed seal (*Phoca hispida*) over harbour seal (*Phoca vitulina*), harp seal (*Phoca groenlandica*), bearded seal (*Erignathus barbatus*) and hooded seal (*Cystophora cristata*) to the walrus (*Odobenus rosmarus*). At the same time there is a large size overlap, especially between the three smallest seals and between the bearded and the hooded seal. This makes species identification based on size difficult.

Fortunately, most skeletal elements of bearded and hooded seals can be separated on morphological grounds. However, only a few bones of harp seal, harbour seal and ringed seal have been found to be diagnostic to the species level. These are the cranium itself, the auditory bulla, the mandible, the humerus, the ulna, and the femur (Møhl undated).

In the present study the identification of ringed seal, harbour seal and harp seal has been based on these six diagnostic bone elements. Ribs, vertebrae, phalanges and other non-species-diagnostic bones are simply pooled as "seal bones".

It should, however, be added that following months of identification the investigator got a "feeling" of which were bones of harp seal and which were of ringed seal. This "feeling" identified the harp seal bones (ribs, vertebrae and limb bones) as generally more rounded in the contours while the ringed seal bones were characterized by a sharper outline.

Identification of the bearded seal and the hooded seal was based on all limb bones, including the pelvic bone and the scapula, but again ribs, vertebrae, and phalanges were pooled as "seal bones". Walrus bones were not present in the material, only a few fragments of ivory were found.

Species identification of eider-ducks, king eiders and mallards

The eider-duck (*Somateria molissima*), king eider (*Somateria spectabilis*), and mallard (*Anas platyrhynchos*) are rather similar in size, and their skeletons, especially the post cranial elements, exhibit a great deal of size overlap and a high degree of morphological similarity. However, a number of diagnostic traits and size characteristics have been found and used for species identification in this study.

Humeri, ulnae, and coracoidea have been used as species diagnostic bones. Mallards have been separated from eiders by (1) humeri with a closed fossa pneumotricipitalis as opposed to the eiders pneumatised fossa, (2) a longer ulnar depressio musculus brachialis, (3) coracoids with a shorter and more compressed processus acrocoraidei, with a more blunt angulus medialis, and a generally more narrow basal part.

The cranium is the only skeletal part which shows significant morphological differences between the eider-duck and the king eider. The post-cranial skeletons of the two eider species can only be separated by size differences (Table 8.4). Based on the assumption that the size of the eiders 4000 years ago was comparable to present eiders, humeri, ulnae and coracoids larger than recent king eiders have been identified as eider-ducks, while humeri, ulnae, and coracoidea smaller than recent eider-ducks have been identified as king eiders. Bones that fall within the zone of size overlap are identified as "eiders".

Species identification of Iceland gulls, glaucous gulls, and greater black-backed gulls

The skeletons of the Iceland gull (*Larus glaucoides*), the glaucous gull (*Larus hyperboreus*), and the greater black-backed gull (*Larus marinus*) are very similar morphologically, and the size of the glaucous gull and the greater black-backed gull is almost identical. The identification of the larger gull bones as bones of glaucous gulls has therefore been based on the assumption that the greater black-backed gull, like today, is very rare compared to the glaucous gull. It can therefore be expected that a few bones of the greater black-backed gull have been misidentified as glaucous gull bones.

Bones of the Iceland gull and the glaucous gull have been separated on the basis of size differences (Table 8.5). According to the measurement of humeri, ulnae, femora, tibiae and coracoidea there is no size overlap between the two species. This general size difference is quite evident during the actual identification process (Møhl 1986:fig. 7).

Species identification of the alcids

The little auk (*Plotus alle*), the great auk (*Pinguinus impennis*), the puffin (*Fratercula arctica*), and the black guillemot (*Ceppus grylle*) are easily distinguishable osteologically. However the razorbill (*Alca torda*), Brünnich's guillemot (*Uria lomvia*), and the Atlantic guillemot (*Uria aalge*) are quite identical in size and bone morphology. Fortunately their beaks are very differently shaped. Hundreds of beaks of Brünnich's guillemot have thus been identified in the material, but none of the razorbill or the Atlantic guillemot. Based on this result, all postcranial material is assumed to belong to Brünnich's guillemot.

Species identification of the fulmar and the great shearwater

The great shearwater (*Puffinus gravis*) and the fulmar (*Fulmarus glacialis*) are osteologically easily separable on the beak and cranium. Hundreds of fulmar beaks have been identified compared to only three shearwater beaks. The postcranial fragments, which are difficult to distinguish, have accordingly been assumed to represent fulmars. However in one case it was possible to identify an almost complete humerus as a shearwater, based on its slightly greater length and more slender appearance.

Table 8.5. Size range of bones of Greenlandic Iceland gulls (*Larus glaucoides*) (n = 8 (4 males, 4 females)) and glaucous gulls (*Larus hyperboreus*) (n = 10 (3 males, 4 females, 3 ?). The average live weight and total length of the Iceland gull is 1/2-1 kilo and 55-58 centimeters, and of the glaucous gull 1 – 2 kilos and 65-78 centimeters. All measurements are in millimetres, and all are greatest length of bones (GL) taken according to Driesch (1976).

	Humerus	Ulna	Femur	Tibia	Coracoid
Iceland gull	110-135	118-152	50-62	96-115	44-53
Glaucous gull	142-153	158-170	65-72	118-135	55-64

Species identification of Atlantic cod and Greenland cod

The skeleton of the Atlantic cod (*Gadus morhua*) and the Greenland cod (*Gadus ogaq*) cannot be distinguished morphologically. However the Greenland cod does not exceed *ca.* 65 cm in length, while the Atlantic cod may reach a length of 150 cm (Muus 1981). Bones of gadidae that compare to museum specimens longer than 65 cm have accordingly been identified as Atlantic cod, while bones from smaller specimens have been pooled.

Faunal quantification

Faunal components I, II, and III

The faunal material from Qeqertasussuk represents *ca.* 700 years of use and, as it is of interest to investigate possible changes in the subsistence economy, a temporal division of the faunal material is needed. The cultural deposits in Area B were relatively homogeneous with only limited internal stratigraphy. It was therefore decided to divide the cultural layers in Area B into three arbitrary layers or "faunal components" I, II and III of equal depth and each assumed to represent 2-300 years of deposition (Figure 8.3).

For comparative purposes the faunal material in Area C has been divided into the same three faunal components (I, II and III) (Figure 8.3).

Total number of identified bones (NISP)

The quantification and assessment of the relative representation and subsequently of the economic importance of the different species in a faunal sample has always been a major issue in the discipline of archaeozoology. It is usually recognised that the path of the bone from the kill site, through processing, storage, consumption and disposal probably differed from species to species, and that it is so complex that it would be overly optimistic to move directly from bone counts to paleoeconomy.

Many methods have been developed in an effort to correct the raw bone counts so that they more correctly reflect the economic importance of the species. Most important of these are the minimum number of individuals method (MNI) (Krantz 1968; Bökönyi 1970; Grayson 1975, 1978), the relative frequency method (RF) (Perkins 1973) and the bone weight method (Uerpmann 1973; Casteel 1978).

Unfortunately, each of these methods also adds bias to the material. Gilbert and Singer (1982) and Gilbert *et al.* (1983) have, for example, shown that RF and MNI calculations are dependent on sample size, and Noe-Nygaard (1977) has demonstrated that bone weight varies with depositional environment.

Even if these methods didn't skew the material, they wouldn't bring us much closer to an understanding of the economy at Qeqertasussuk, simply because the really serious problems of linking bone counts to economy are found at another level.

The economic importance of the large whales may serve as an example. Only 106 fragments of whale have been found. It would be quite reasonable to assume that the Saqqaq people didn't bother to carry heavy whale bones from the kill site to Qeqertasussuk, and therefore any quantification method applied to the material would underestimate the importance of large whales in the site's economy.

Based on the lines of reasoning presented above, quantification of the game species at Qeqertasussuk will be based on simple and unadjusted bone counts termed number of identified specimens or NISP-counts.

The faunal material used in NISP-counts at Qeqertasussuk was registered using a digitalised zoological classification code developed by Aaris-Sørensen (1983) for the analysis of zooarchaeological materials. The computer program "Knowledgeman" was used for data processing.

The faunal material from the midden area (Area B) was chosen for NISP-counts because its situation and slope indicates that it has been used as a midden dump in a fairly uniform way from *ca.* 2400 – *ca.* 1700 BC. Thus a faunal sample from this area could be expected best to reflect the inhabitants' subsistence economy and changes that might have occurred over time.

Four square meter units in Area B provided the faunal material for the NISP-counts: 12/23, 12/24, 13/24 and 14/24 (Figure 8.4). A total of 24,893 fragments were identified from these units and to these should be added 14,842 bones identified from the two ¼ m^2 columns that were sieved from unit 12/23 and 14/24.

Indicator bone count

The NISP-sample from Area B was judged to be representative of the midden area as such and to reflect the site's subsistence economy. However, in order to verify the results concerning temporal changes shown in the NISP-sample, the total excavated faunal sample from the site (except unit 13/23 and 14/23), in all *ca.* 180,000 bone fragments, were sorted through. Only selected bone elements from the individual species were counted. These bones are designated "indicator-bones" (IBC) because they are used to indicate temporal and spatial trends in the faunal material (Figure 8.4).

As indicator bones for ringed seal and harp seal, the bulla, mandibula, humerus, ulna, and femur were chosen, fox indicator-bones were the mandibula and humerus, and for the fulmar, eider, ptarmigan, Iceland gull, glaucous gull, little auk, Brünnich's guillemot and black guillemot the humerus and coracoid were selected.

During the sorting process for indicator-bones, an additional number of observations were systematically made:

1. all skeletal elements of other bird species than the eight mentioned (*e.g.* from great auk, great shearwater, and red-breasted merganser) were identified and registered,
2. all skeletal elements of other mammal species than the three mentioned (man, dogs and caribou) were identified and registered,
3. all skeletal elements of fish were identified and registered,
4. all fragments of molluscs were identified and registered.

Apart from providing data on temporal trends, this sorting and identification process has also allowed us, for example, to produce a comprehensive species list, to extract a complete sample of human and dog bones, to extract large samples of mandibula (an indicator bone) of fox and seals for aging and seasonality studies, and to collect a good sample of caribou bones that provide an insight into the "schlepp-effect".

Faunal correlation between Area B and C

Before changes in faunal composition between layers are interpreted as changes in subsistence pattern, the possibility of changes in activity patterns within Area A and Area C respectively must be evaluated carefully.

As argued earlier there seems to be little doubt that Area B was used as a refuse area throughout the site's existence, however, Area C shows signs of changing activity patterns. From 2400 to 1900 BC the area was used as a habitation area, but between 1900 and 1700 BC the area was primarily used as a refuse area.

Based on these data the relative changes in bone composition in Area C may in part be due to changing activity patterns, while relative changes in Area B seem to be less influenced by changing activity patterns. In the following discussion most reliance should therefore be placed on the results from Area B.

During the excavation and registration of the main section in Area B (Figure 6.11), changes in faunal composition between different layers were observed. In Area B the lowermost part of layer 6 was characterised by a relatively high proportion of seal bones, the upper part of layer 6 was characterised by many bird bones and the upper layers 5c, 5d and 5g had a higher proportion of seal bones. Finally the uppermost layer 5f was characterised by a high proportion of caribou bones, giving the layer its nickname "the caribou layer".

In Area C the changes were not as apparent, but there was also a shift from the lower layers more rich in bird bones to the upper layers that were more rich in seal. These observed differences in faunal composition were for the most part confirmed by the faunal analysis.

Assessing age and determining season of death

The study of growth layers in mammal teeth has proven to be one of the most useful methods for assessing age. The method has been developed by wildlife biologists in order to study the age structure especially of economically important species. Good reviews of growth layer studies in terrestrial mammal teeth have been given by Grue and Jensen (1976) and in pinneped and marine mammal teeth by Laws (1962) and Scheffer and Myrick (1980).

In recent years the method has been adopted by archaeozoologists with the aim of reconstructing the age structure of game species in archaeological faunal samples. Furthermore, it has become common practice to determine the season of death based on an interpretation of the last deposited growth layer (Stallibrass 1982; Gordon 1984).

The ringed seal

Thorough studies of the development of growth layers in the canines of ringed seals have been made by McLaren (1958) and Smith (1973) in the Eastern Canadian Arctic. McLaren (1958) used thin cross-sections while Smith (1973) used both thin cross-sections and thin sagittal-sections. All sections were approximately 100 μm, and they were examined under transmitted and reflected light (McLaren 1958) and under transmitted light only (Smith 1973).

Both investigators found that layers of dense and opaque dentine were deposited from July to March with a subsequent deposition of thin and translucent dentine from the end of March to the end of June, and Smith (1973) found that in some individuals more vacuolated dentine could be formed during the deposition of the dense opaque layer (Figure 8.5).

When the seals grow old the pulp cavity is filled up with dentine. In a few individuals this happens at 10 years of age but usually it does not happen until the seal is more than 20 years old. In these cases cementum counts were used to age the animals. However, Smith (1973:7) found that generally the cementum was not laid down in clear enough bands to be considered reliable for ageing.

In connection with an analysis of a Thule Culture faunal sample from Coronation Gulf in the Western Canadian Arctic (Morrison 1983) a study was made of

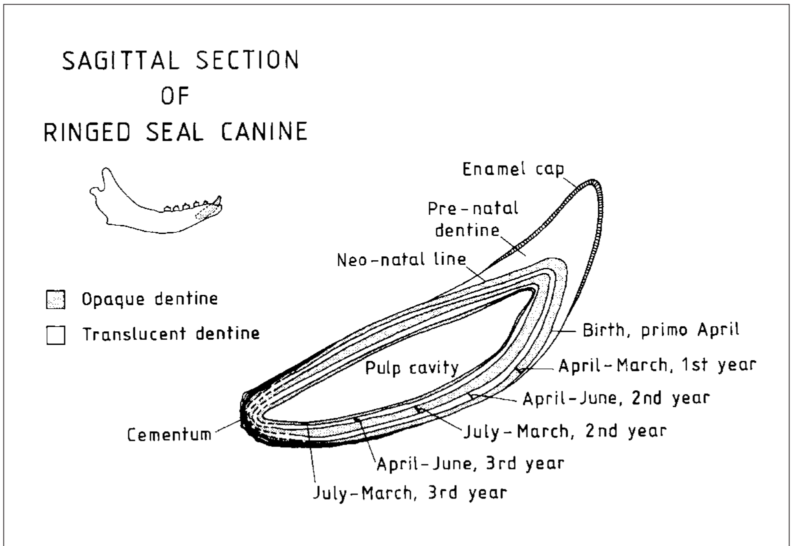


Fig. 8.5. The dentine of the ringed seal canines reveals age and approximate season of death. Over the years the pulp cavity is gradually filled up with dentine and differences in the transparency and density reflect changes in season and life cycle.

the deposition pattern of dentine and cementum in recent ringed seals from western Victoria Island (Presley 1984). It was found that the dense and opaque layers were deposited from mid September to mid March and that the less dense and translucent layers were deposited from the end of March to the first of September. The discrepancy between these and earlier results were explained by possible geographical variations in the deposition patterns and by an improved viewing clarity gained by using thinner sections (less than 60 um) (Morrison 1983; Presley 1984).

The ringed seal sample from Victoria Island was collected over a period of only seven months from March 13 to September 29 and the sample was relatively small (62 specimens), while the samples collected in the eastern area represented several hundred specimens collected throughout the year. I prefer to rely on McLaren's (1958) and Smith's (1973) results, both because of the larger sample sizes involved and because of their study area's geographical proximity to Disko Bay.

Smith's (1973) results have previously been used in an analysis of the seasonality of the Middle Dorset site Koliktalik-1 in Labrador (Spiess 1978), while Presley's (1984) results have been used in an analysis of the seasonality of Thule sites on eastern Ellesmere Island (McCullough 1989).

The sectioning technique, and methods of staining and viewing used in the present study follow the techniques and methods described by Dietz R. *et al.* (1991):

(1) The teeth were placed in 5% HNO_3 for approximately 24 hours depending on the compactness of the teeth.
(2) The decalcified teeth were cut sagittaly into 14 µm sections on a freezing microtome.
(3) The best eight to ten sections of each tooth were transferred onto a microscope slide in a slight gelatine solution (to make the sections adhere to the microscope slide).
(4) The sections were dried and transferred to a 0.1% toluidine blue solution for ten minutes and then washed in the following sequence of solutions: water – water – water – 70% alcohol – 96% alcohol – 99% alcohol – 99% alcohol – toluene and finally dried.

The time invested in producing readable sections from one tooth was estimated to be 15 to 20 minutes.

The sectioning and staining methods used produced thin-sections with clear and easily readable growth lines in both cementum and dentine. Both cement and dentine counts were used for assessing age, while only dentine counts of animals between one and three years were used for seasonality estimates. This rather conservative approach in estimating season of death was undertaken for two reasons. Firstly, the existence of at least one annual layer provides an important basis for the evaluation of the thickness of the last deposited layer. Secondly, the annual deposition of dentine becomes smaller and more difficult to read for every year as the animal grows older, and it

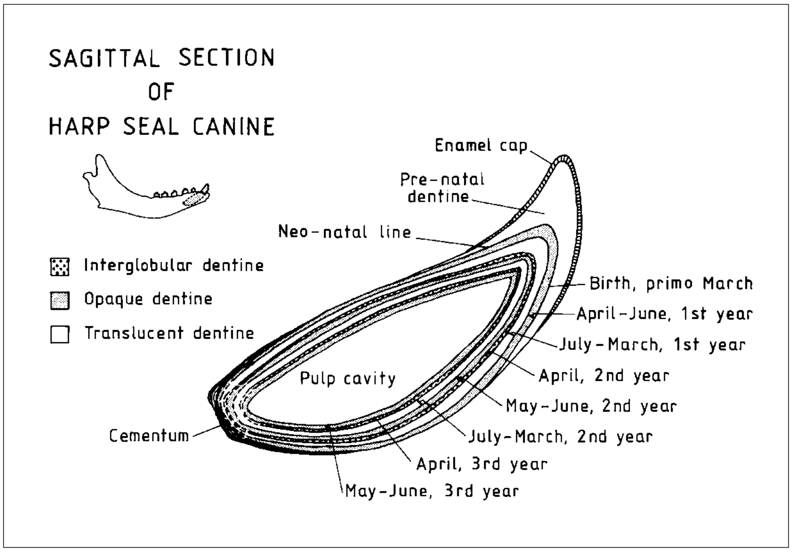


Fig. 8.6. The pattern and layering of dentine deposition is specific for each species. For example, most harp seals have a type of "interglobular" dentine which is not found in the ringed seal canines.

was felt that the interpretation of the season of death became more unreliable when the seal was more than approximately three years old.

All ringed seal jaws from the systematically excavated areas B and C were used in the study. The preservation of the teeth was generally excellent, and a total of 52 ringed seal canines provided readable sections and were aged. Only canines from right mandibles were sectioned to avoid duplication. The canines from the left mandibles were extracted and preserved in alcohol for future investigations. Only nine teeth were suitable for seasonality estimates.

The harp seal

A study of the development of growth layers in harp seal teeth, based on a sample of 155 known-age canines, was recently published by Bowen *et al.* (1983). They used unstained 200-250 μm thick transverse sections that were examined with transmitted polarised light. They found that the first layer of dense opaque dentine was deposited from the time of birth on the ice fields near Newfoundland around the first of March to late June, following their arrival in West Greenland waters. The first thin and translucent layer was deposited between July and late March during their summer stay and fall migrations along the Greenlandic coasts and return to Newfoundland. Then, in 60% of the individuals, an interglobular dentine layer is deposited during the moulting period in April. This pattern was repeated in the following annual layers (Figure 8.6).

The cementum was considered to be too indistinct to be used for reliable age estimates. Using a series of blind tests, the authors tested their results and found that the number of incorrectly aged specimens increased with the age of the animals, however more than 90% of the readings of animals younger than 3 years were correct. They also found that the growth of the thin translucent dentine seems to vary with time, and that the most rapid growth appears to occur in winter from January to March.

These findings have important implications for the interpretation of the zooarchaeological material. Firstly, it is to be expected that an incorrect age will be determined in a certain proportion of the samples examined, and secondly, care must be taken when correlating the width of the last growth layer with a season of death.

All harp seal canines were sectioned and stained following the same procedure as for the ringed seal. Both cementum and dentine layers were read and counted for ageing. The pulp cavity of most animals older than *ca.* 20 years was filled up with dentine, and in these cases the cementum was used for ageing.

A series of 18 canines were mounted in epoxy and cut sagittaly into halves with a diamond saw following the procedure described by Bourque *et al.* (1978). These were then polished and studied in a binocular dissecting microscope in reflecting light. The dentine layers were easily readable in the polished sections, while the layers in the cement were more difficult to distinguish.

Table 8.6. Pulp percentage of 112 subfossil arctic fox canines distributed according to excavation units and layers.

Unit and layer	Pulp percentage
Area B	
layer I	15, 25, 26, 52
layer II	22, 28, 29, 30, 51, 52, 55, 56, 57, 58, 58, 60, 61, 62, 66, 70, 71, 72, 74, 82
layer III	10, 17, 25, 44, 44, 47, 50, 57, 58, 60, 62, 63, 68, 69, 70, 71, 71, 71, 73, 77
Area C	
layer 14,14a	14, 19, 25, 54, 68
layer 15	15, 18, 22
layer 16,15a,18	12, 14, 16, 17, 18, 18, 19, 19, 28, 29, 32, 33, 37, 44, 55, 65, 66, 73, 75, 76, 76, 78, 80, 81, 93
Test pits	11, 16, 19, 20, 20, 23, 23, 25, 25, 27, 41, 49, 52, 54, 56, 59, 60, 61, 62, 63, 64, 64, 65, 66, 96, 70, 71, 71, 72, 72, 73, 74, 76, 79, 86

Season of death estimates were made on the dentine of one to nine year old individuals. Older and younger seals were not included for the same reasons as discussed for the ringed seal.

All harp seal jaws with canines in situ from the systematically excavated areas B and C were used for this study. Preservation was generally excellent and a total of 72 right canines were sectioned and aged. All left canines were preserved in alcohol. Season of death was estimated on 33 specimens.

The arctic fox

Based on a sample of 20 known-age arctic foxes from farms and 23 arctic foxes with known season of death from West Greenland, Grue and Jensen (1976) studied the growth layer formation in arctic fox canines. Stained histological thin-sections (12 μm thick) were examined in transmitted light. Only growth lines in the cementum were studied, as the pulp cavity is almost completely filled with dentine within two years. Thin translucent cement is deposited from the time of eruption of the permanent canine in the beginning of September to January, then follows a layer of dense cement which is deposited from February to May (or August), and finally thin cement is deposited from June (or September) to January.

Thirty five right fox canines from the Qeqertasussuk material were sectioned and dyed following the same procedures as for the ringed seal and the harp seal. This is also the method described by Grue and Jensen (1976) except that toluidine blue was used instead of hematoxylin. Age estimates were based entirely on cement counts.

It is possible to distinguish foxes less than one year old from adults by x-raying the teeth and estimating the "pulp percentage " (Grue and Jensen 1976). The pulp percentage was found by measuring the width of the pulp cavity and the width of the tooth at the same level and then calculating the pulp percentage. They found that one-year-olds could be nicely separated from adult foxes at a pulp percentage of 40 (Table 8.6).

In the present study this method was developed further. It was felt that the gradual and relatively quick deposition of dentine in the fox's first year could provide a useful tool to estimate the season of death of the animal and thereby the seasonality of the site.

For comparison 95 West Greenlandic foxes less than one year of age and with known season of death were studied. The right canines were extracted from the mandibles and x-rayed, and tooth width and pulp width was measured directly on the x-ray image. Finally the pulp percentage was calculated and a reference curve constructed showing the gradual decrease in pulp percentage through the seasons.

The archeological fox jaw material from the systematically excavated areas B and C produced 112 right canines which could be x-rayed and the pulp percentage subsequently calculated. Seventy three of these were less than one year old (pulp percentage over 40) and using the reference curve, an approximate season of death could be read.

Chapter 9

Subsistence

A marine menu

The menu of the inhabitants at Qeqertasussuk was diverse and included most of the fish and game species available in Sydostbugten.

In all 43 species of animals are represented in the faunal material (excluding man and dog) and these include 15 species of mammals, 18 species of birds, 6 species of fish and 4 species of molluscs (Table 9.1). Of all these only four are terrestrial species; the rest are marine.

One other contemporary site from West Greenland has a species list of comparable size: Nipisat I, a coastal site in the Sisimiut district where a total of 41 species of birds, mammals and fish were identified (Godtfredsen 1996, 1997a, 1997b, 1998).

Most other contemporary sites in the Baffin Bay/Davis Strait area have a menu-card of 20 species or fewer *e.g.* Qajaa (20), Bight Site (17) and Gull Cliff (10) (Figure 10.7, Table 10.1).

The number of species on the Qeqertasussuk menu decreases by *ca.* 20% from the early faunal com-

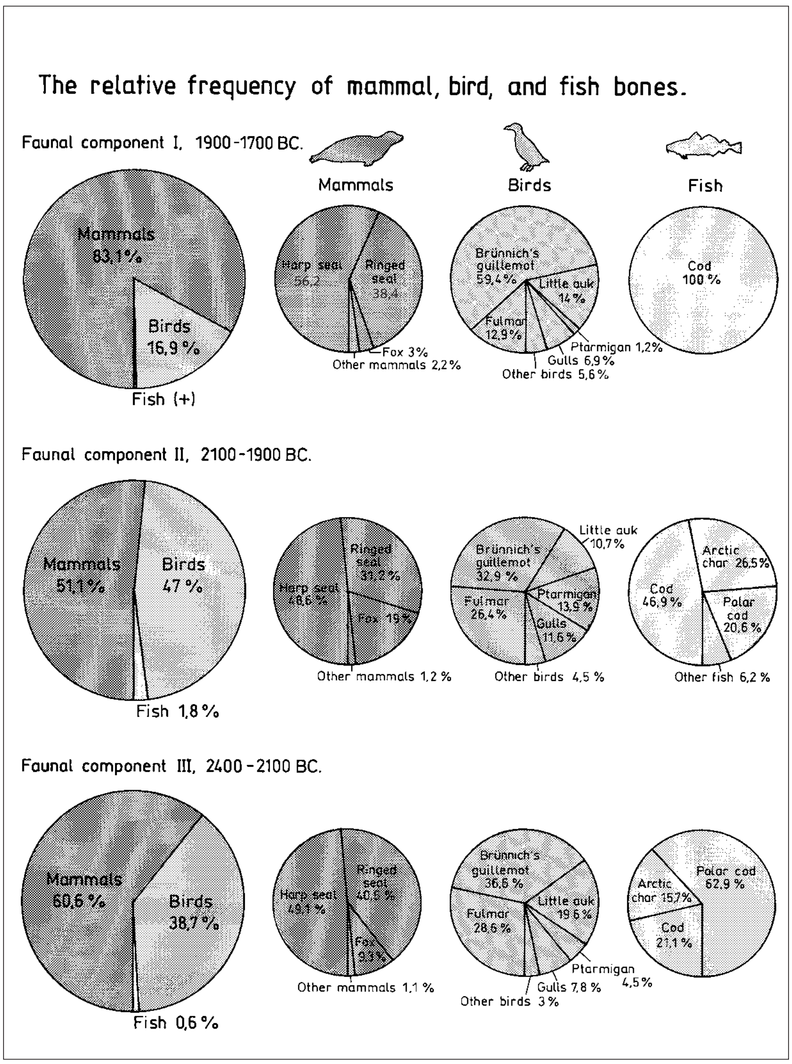


Fig. 9.1. Significant changes take place in the composition of the menu at Qeqertasussuk, such as the increase through time in the relative importance of harp seal hunting. Figures from Table 9.2.

Table 9.1. The menu. A complete list of the species found on Qeqertasussuk. Based on all identified faunal material. The great auk and the scallop were found out of stratigraphic context.

	Faunal component		
	I	II	III
Mammals			
Arctic hare (*Lepus timidus*)	+	+	+
Dog (*Canis familiaris*)	+	+	+
Arctic fox (*Alopex lagopus*)	+	+	+
Caribou (*Rangifer tarandus*)	+	+	+
Walrus (*Odobenus rosmarus*)	+	+	
Harbour seal (*Phoca vitulina*)	+	+	
Ringed seal (*Phoca hispida*)	+	+	+
Harp seal (*Phoca groenlandica*)	+	+	+
Bearded seal (*Erignathus barbatus*)	+	+	+
Hooded seal (*Cystophora cristata*)	+	+	
Sperm whale (*Physeter macrocephalus*)		+	+
Killer whale (*Orcinus orca*)			+
Harbour porpoise (*Phocoena phocoena*)	+		
Narwhal (*Monodon monoceros*)			+
Minke whale /Sei whale (*Balaenoptera acuto-rostrata* / *Balaenoptera physalus*)			+
Bowhead whale / North Atlantic right whale (*Balaena mysticetus* / *Eubalaena glacialis*)			+
Man (*Homo sapiens*)		+	
Birds			
Red-throated diver (*Gavia stellata*)			+
Great northern diver (*Gavia immer*)			+
Fulmar (*Fulmarus glacialis*)	+	+	+
Great shearwater (*Puffinus gravis*)	+	+	
Mallard (*Anas platyrhynchos*)			+
Eider-duck (*Somateria molissima*)	+	+	+
King eider (*Somateria spectabilis*)			+
Red-breasted merganser (*Mergus serrator*)		+	
White-fronted goose (*Anser albifrons*)			+
Ptarmigan (*Lagopus mutus*)	+	+	+
Iceland gull (*Larus glaucoides*)	+	+	+
Glaucous gull (*Larus hyperboreus*)	+	+	+
Kittiwake (*Rissa tridactyla*)		+	+
Great auk (*Pinguinus impennis*)			
Little auk (*Plotus alle*)	+	+	+
Brünnich's guillemot (*Uria lomvia*)	+	+	+
Black guillemot (*Ceppus grylle*)	+	+	+
Raven (*Corvus corax*)	+	+	+
Fish			
Salmon (*Salmo salar*)		+	
Arctic char (*Salvelinus alpinus*)		+	+
Capelin (*Mallotus villosus*)		+	
Cod (*Gadus morhua*)	+	+	+
Polar cod (*Boreogadus saida*)		+	+
Sculpin (cottidae/psychrolutidae)		+	
Molluscs			
Common mussel (*Mytilus edulis* L.)	+	+	+
Hiatella byssifera		+	
Scallop (*Pecten islandicus*)			
Periwinkle (*Littorina groenlandica*)	+		+

ponents III and II to faunal component I. The diversity decrease is especially evident for the fish species and the decrease is accompanied by a corresponding decrease in the relative number of bones of birds and fish (Figure 9.1).

A minimum of 289 tons of animal products were brought to the site between 2400 and 1700 BC (Table 9.4, Figure 9.3). At least 2,726 harp seals representing *ca.* 73% of the total biomass was by far the most important contributor with 2,116 ringed seals at *ca.* 20% coming in second. More than 20,000 birds of 18 species and at least 900 foxes only make up *ca.* 7% of the biomass represented.

Seal hunting

More than half of the excavated bones were seal bones (Figure 9.1, Table 9.2), and the majority of the hunting implements found were clearly for seal hunting (Grønnow 1990, 1994). No doubt seals were a cornerstone in the site's economy and seal hunting was one of the hunters' main occupations.

There is an increase in the relative importance of seal hunting from *ca.* 40-50% to *ca.* 80% between the early phases of site use (faunal components II and III, 1900-2400 BC) and the latest phase of use (faunal component I, 1700-1900 BC). At the same time there is a relative decrease in bird hunting and fox hunting from 40-50% to *ca.* 17% and from *ca.* 5-10% to *ca.* 2%.

These relative changes in the emphasis of seal hunting may be a result of general changes in site use and seasonality.

Throughout the habitation of Qeqertasussuk ringed seal and harp seal dominate the seal bone sample completely (Table 9.4). They represent ca. 99% of the seal bones while hooded seal, bearded seal, harbour seal, and walrus combined only make up approximately 1%. Harp seal and ringed seal were the two most important game species at Qeqertasussuk. They formed the backbone of the economy and provided food throughout the year.

The ringed seal

In November-December, when the sea ice starts to form in protected bays and small fjords, ringed seals begin to appear in the Qasigiannguit district (Porsild

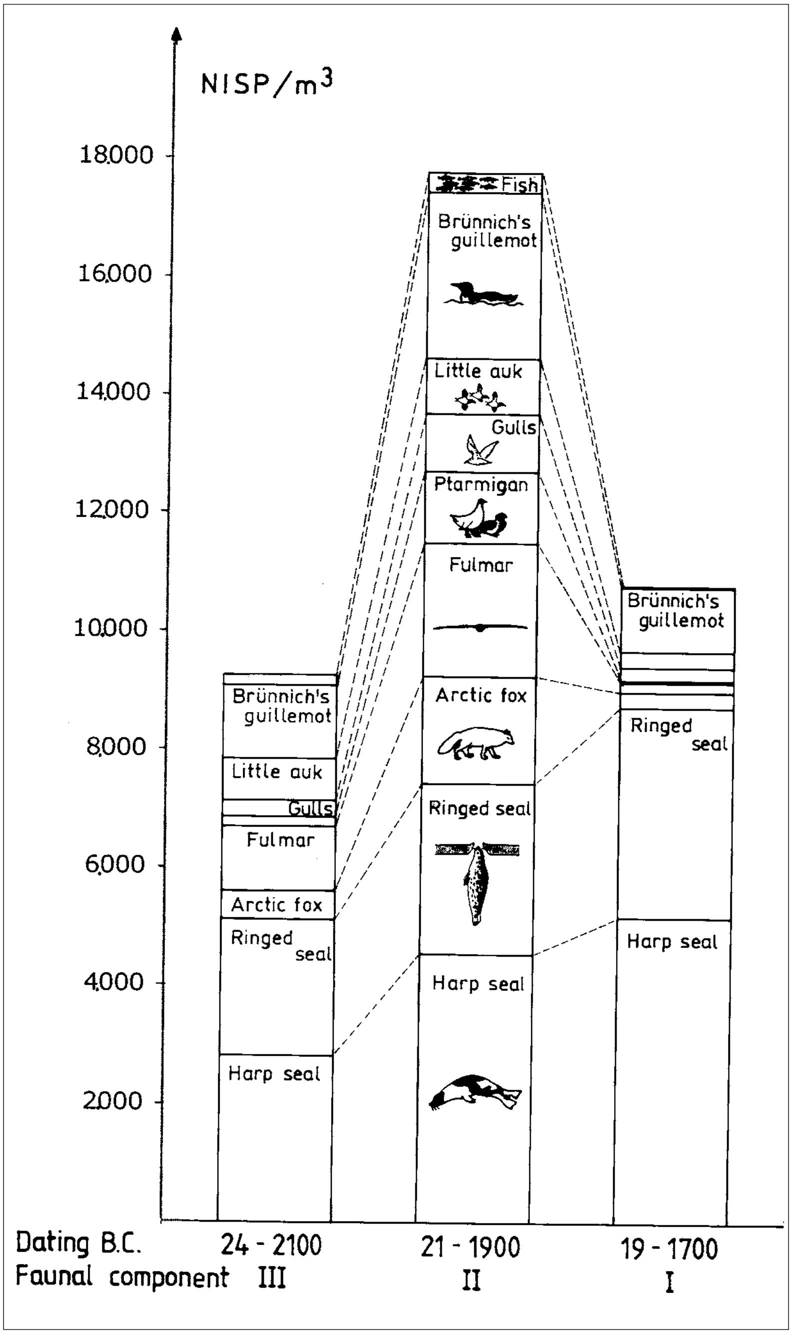


Fig. 9.2. The economic importance of the different game species is also reflected in number of identified specimens per cubic meter (NISP/m^3) (Table 9.3) and at the same time an immediate impression of changes in the intensity of site use and economy can seen (Bigelow 1984).

1921:292; Frederik Jensen, inf. 1982; Kasper Didrichsen, Henrik Iversen and Lars Johansen, inf. 1986). Sydostbugten has many such protected waters, for example the archipelago south and east of Ikamiut (Karl Olsvig inf. 1986), the bay Umiasussuup Tunua (Frederik Jensen, inf. 1982) and the area south of Akulliit with the islands Saattut, Alanngorleq, Avataq and Marlutsiaat (Frederik Jensen, inf. 1982; Karl Olsvig, inf. 1986).

In December or January, when the ice cover is complete, ringed seal can be found in all parts of the district. Using its strong claws it makes and maintains breathing holes in the sea ice (Figure 9.4), but it also favours areas with natural breathing holes, for example narrow and shallow runs, or off promontories where ice formation is hampered by the tidal currents (Frederik Jensen, inf. 1982; Henrik Iversen and Lars Johansen, inf. 1986). Such mini-polynias or areas with thin ice are found in runs in Tunutta imaa (Frederik Jensen, inf. 1982), between the northwestern point of

Table 9.2. The representation of species based on total number of bone (NISP) counts from four square meters in area B. Bone fragments identified to species excavated from 4 square meters in Area B (units 12/23, 12/24, 13/24, and 14/24). + means less than 0,05%.

1. Bone fragments recovered on 2 and 4 millimeter sieves from two 1/4 m^2 columns in units 12/23 and 14/24.
2. The number of fragments found on the sieves represented only 0.5 m^2 and accordingly they were multiplied by 8 to make the figure comparable to the number of fragments excavated in the four one square meter units.
3. The unspecified seal bones were divided between the represented seal species according to their relative representation.
4. A total of 6,410 unspecified animal fragments were excavated in the 4 m^2 units and a total of 2,634 unspecified animal fragments were retrieved from the sieved material from the two square meters columns.

	Fragments excavated[1]			Fragments sieved[2]			Corrected number[2]							
	I	II	III	I	II	III	I		II		III		All comp.	
							n	%	n	%	n	%	n	%
Mammals														
Arctic hare	1	20	5	0	2	1	1	+	36	0.5	13	0.3	50	0.2
Dog	0	4	1	0	0	0	0	0	4	0.1	1	+	5	+
Arctic fox	102	714	227	16	96	27	230	3	1482	19,0	443	9.3	2155	10.7
Caribou	14	21	3	0	3	0	14	0.2	45	0.6	3	0.1	62	0.3
Ringed seal	93	81	71	0	0	0	2954	38.4	2431	31.2	1929	40.5	7314	36.2
Harp seal	136	126	86	0	0	0	4323	56.2	3781	48.6	2336	49.1	10440	51.6
Bearded seal	2	0	1	0	0	0	67	0.9	0	0	27	0.5	94	0.5
Hooded seal	3	0	0	0	0	0	97	1.3	0	0	0	0	97	0.5
Unspecified seal[3]	4086	4374	2670	390	204	183								
Whale	1	2	2	0	0	1	1	+	2	+	10	0.2	13	0.1
Man	0	2	0	0	0	0	0	0	2	+	0	0	2	+
Birds														
Great northern diver	0	0	2	0	0	0	0	0	0	0	2	0.1	2	+
Fulmar	81	1430	630	15	58	30	201	12.9	1894	26.4	870	28.6	2965	25.2
Great shearwater	1	0	0	0	0	0	1	0.1	0	0	0	0	1	+
King eider/eider/mallard	7	56	4	1	3	0	15	1	80	1.1	4	0.1	99	0.8
White fronted goose	0	0	1	0	0	0	0	0	0	0	1	+	1	+
Ptarmigan	3	522	80	2	59	7	19	1.2	994	13.9	136	4.5	1149	9.8
Iceland gull	18	131	64	3	3	1	42	2.7	155	2.2	72	2.5	269	2.3
Glaucous gull	18	585	138	6	11	3	66	4.2	673	9.4	162	5.3	901	7.7
Kittiwake	0	4	2	0	0	0	0	0	4	0.1	2	0.1	6	0.1
Little auk	19	461	54	25	38	68	219	14	765	10.7	598	19.6	1582	13.4
Brünnich's guillemot	448	1690	634	60	83	60	928	59.4	2354	32.9	1114	36.6	4396	37.4
Black guillemot	11	106	23	7	11	6	67	4.3	194	2.7	71	2.3	332	2.8
Raven	3	48	4	0	0	1	3	0.2	48	0.7	12	0.4	63	0.5
Fish														
Salmon	0	1	0	0	0	0	0	0	1	0.4	0	0	1	0.3
Arctic char	0	0	0	0	9	1	0	0	72	26.5	8	15,7	80	24.7
Capelin	0	0	0	0	1	0	0	0	8	2.9	0	0	8	2.5
Cod	1	31	11	0	12	0	1	100	127	46.7	11	21.6	139	42.9
Polar cod	0	0	0	0	7	4	0	0	56	20.6	32	62,7	88	27.2
Sculpin	0	0	0	0	1	0	0	0	8	2.9	0	0	8	2.5
Molluscs /snails														
Common mussel	1	5	0	0	0	0	1	100	5	83.3	0	0	6	85,7
H. byssifera	0	1	0	0	0	0	0	0	1	16.7	0	0	1	14,3
Litorina saxatilis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals														
Total mammal	4438	5344	3066	406	305	212	7687	83.1	7783	51.1	4762	60.6	20232	62.5
Total bird	609	5033	1636	119	266	176	1561	16.9	7161	47	3044	38.7	11766	36.4
Total fish	1	32	11	0	30	5	1	+	272	1.8	51	0.6	324	1.0
Total mollusc /snails	1	6	0	0	0	0	1	+	6	+	0	0	7	+
Total no. of fragments identified to species[4]	5049	10415	4713	525	601	393	9250	100	15222	99.9	7857	100	32329	100.1

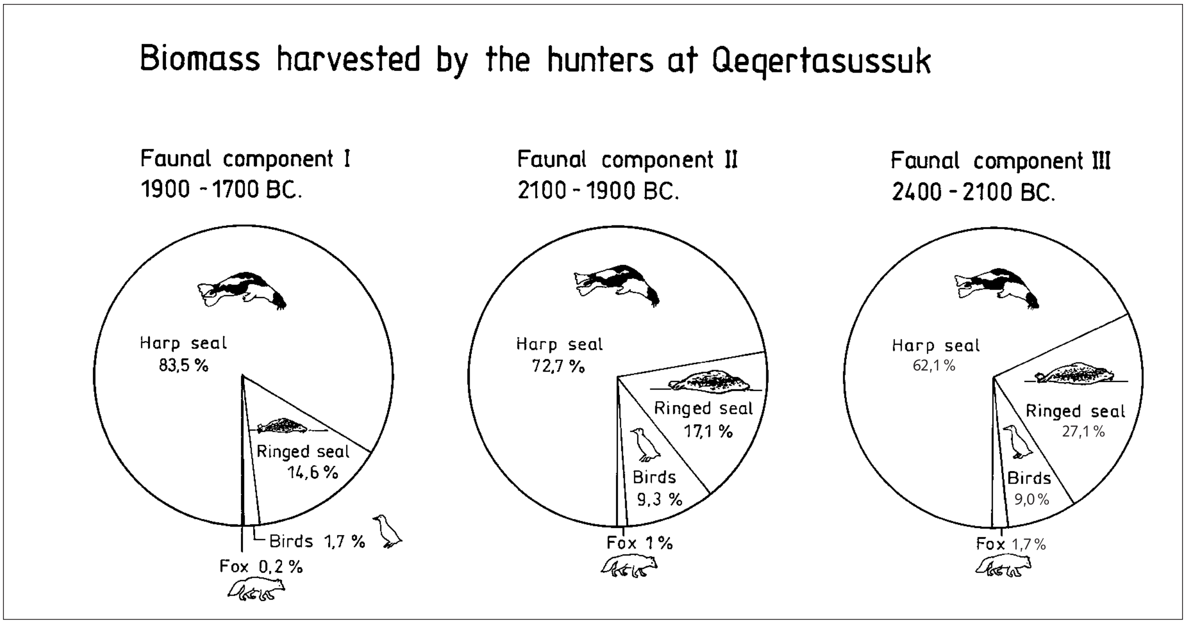


Fig. 9.3. Biomass harvested by hunters at Qeqertasussuk. Based on Table 9.4.

Sarpiusat and the islets off the point, off many promontories along the northern shore of Kangersuneq (*e.g.* Niaqornaarsuk ilorleq) and between islands separated by narrow and shallow straits (*e.g.* between Tinussaraaq and the islands Uigorleq and Tussaaq). The tidal cracks running parallel to the shore are also sought out by ringed seals, which have easy breathing access here (Müller 1906:215; Rosendahl 1942:59).

However, in severe winters, leads and polynias may freeze over and the sea ice may become so thick that the seals move away from the more protected parts of the bay towards the open sea, where thinner ice and more frequent cracks and channels make life easier (Anon. 1896:92; Porsild 1915:139; Rosendahl 1942:24; Vibe 1967:52-53).

In late March the seals start to haul out besides breathing holes and natural openings in the sea ice.

Table 9.3. Bones per cubic meter excavated midden deposit, also designated the Bigelow -DD indicator (Bigelow 1984). The DD-measure provides a measure of the changes of the proportion of species through time. Only the best represented species are included in the list. Data from Table 9.2.

NISP/m^3	I 1700-1900	II 2100-1900	III 2400-2100
Harp seal	5188	4537	2803
Ringed seal	3545	2917	2315
Arctic fox	276	1778	532
Fulmar	241	2273	1044
Ptarmigan	23	1193	163
Gulls	130	998	283
Little auk	263	918	718
Brünnich's g.	1114	2825	1337
Fish	1	326	61
Total	10781	17765	9256
Volume excavated (m^3)	0.8	0.8	0.8

Fig. 9.4. A Ringed seal in its breathing hole (photo: Christian Lydersen).

Still more basking seals are seen as insolation increases through April and May, and they can still be seen in June if ice is present (Krogh 1921:174; Boye Møller, inf. 1986). Sydostbugten is known for its many basking ringed seals (Rink 1855:117), Qoornua being a good example (Villads Olsvig, Søren and Kathrine Thorning, inf. 1986).

In spring the ice edge breaks up and creeps closer towards Sydostbugten, and large openings form in the ice. Along the ice edge and in these openings many ringed seals are found (Krogh 1921:108-9). When the ice disappears, usually in late May or early June, most seals disappear with it (Krogh 1921:174; Boye Møller, inf. 1986).

Two types of ringed seals are encountered in winter in the Qasigiannguit district: large, old, probably mature individuals and small, young, probably immature animals. The young seals are by far the most common. It is assumed by the hunters in the area that the young seals are associated with the Baffin Bay drift ice ("Vestisen") during the summer half of the year. The old seals spend the summer in the large glacier fjords north of the area, where they have their major breeding grounds (Fabricius 1791:81; Rink 1852:87-89, 1855: 132,140; Müller 1906:171; Porsild 1921:165,226; Kasper Didrichsen, Henrik Iversen and Lars Johansen, inf. 1986) (Figure 2.15).

When found in natural openings in the sea ice, the ringed seal is the most curious of all seals and can easily be lured very close. When found in its own breathing hole, however, it is very careful and extremely difficult to approach (Fabricius 1791:83; Müller 1906:177,193). During the moulting season, when the seals haul out on the ice, they are generally very alert, but as the sun rises above the horizon in April and May, they become more relaxed (Müller 1906:194-5). In special cases where the seals occur in areas rarely visited by predators, they almost ignore intruders, and can be approached to within a few meters (Rink 1852:87).

The ringed seal's body weight and blubber thickness declines during spring and early summer, which is their breeding and moulting season, and by July the seals have lost 18 to 39% of their body weight and reduced their blubber thickness by almost 50% compared to their prime condition in mid-winter (Frost and Lowry 1981:39). As a consequence of the weight loss, many of the larger ringed seals will sink if killed in July. During the rest of the year the seals will float (Müller 1906:171-172,177).

The occurrence of ringed seal is to a large extent dependant upon ice conditions. In extremely mild winters, such as the winter of 1927-28 (Anon. 1933:32-33) when high temperatures and frequent storms kept the sea ice from forming, the ringed seals are rare in Sydostbugten. In other winters when sea ice is present during the first part of the winter and breaks up early, say in February, the ringed seals disappear with the ice, and there will be no basking seals present that year (Anon. 1918:537; Anon. 1924:467). If the winter is severe, with low temperatures and calm weather, the sea ice may become too thick for the seals and they move out of the district and into areas with thinner ice (Anon. 1885:6; Anon. 1918:414).

Historical records show that the ringed seal population has fluctuated greatly through the past 200 years. According to the catch and trade statistics (Vibe 1967), the population in Disko Bay seems to have increased from a minimum in the late 18th and early 19th century, to a maximum lasting from approximately 1830 to 1920. A second decline set in about 1920 and the population stayed at a minimum until the 1940's when it increased once more (Anon. 1944:603-5; Rosendahl 1961). The 1920 to 1940 decrease is especially well documented and it appeared primarily to result from a climatic change that resulted, among other things, in increased sea temperatures and more unstable winter ice conditions (Anon. 1944:605; Rosendahl 1961:25; Vibe 1967: 51-56).

Ringed seal hunting at Qeqertasussuk

40% of the seal bones are from ringed seal (Table 9.4). An estimate, based on the minimum number of individuals represented in the excavated sample and on a calculation of the total amount of faunal remains present on the site, indicates that a minimum of 2116 ringed seals were landed at Qeqertasussuk. They represent *ca.* 56 tons of meat, blubber and intestines (Table 9.5).

Tooth section analysis (Table 9.6) indicates that *ca.* 77% of the seals were killed as juveniles in their 1st or 2nd year, approximately 8% were adolescents between 3 and 5 years old, and only 15% were killed as mature animals (more than five years old). This age distribution may in part be explained by the fact that young seals are less careful and more naive than older

Table 9.4. The relative representation of seal species based on the frequency of indicator bones (IBC) (Table 9.12) and total number of bones from four m^2 in Area B (NISP) (Table 9.2)
1. The harbour seal bones were found in the test pits, which were not included in the indicator bone count.
2. The walrus was documented by ivory implements.

	I				II				III				All comp.			
	NISP	%	IBC	%	NISP	%	IBC	%	NISP	%	IBC	%	NISP	%	IBC	%
Ringed seal	93	39.7	254	35.4	81	39.1	234	38.2	71	44.9	348	46.3	245	40.9	836	40.2
Harp seal	136	58.1	449	62.6	126	60.9	372	60.8	86	54.4	397	52.8	348	58.1	1218	58.5
Bearded seal	2	0.9	9	1.3	0	0	1	0.2	1	0.6	7	0.9	3	0.5	17	0.8
Hooded seal	3	1.3	3	0.4	0	0	2	0.3	0	0	0	0	3	0.5	5	0.2
Harbour seal[1]	0	0	1	0.1	0	0	1	0.2	0	0	0	0	0	0	2	0.1
Walrus[2]	0	0	1	0.1	0	0	2	0.3	0	0	0	0	0	0	3	0.1
Total	234	100	717	99.9	207	100	612	100	158	99.9	752	100	599	100	2081	99.9

seals and are therefore easier to catch (Smith 1973), but it is also a function of the natural age distribution in the area.

There are only few denning possibilities in Sydostbugten because the ice is too smooth. The mature seals therefore concentrate in areas such as Jakobshavn Isfjord where icebergs and packed ice present ideal breeding sites. Accordingly, immature seals dominate in areas such as Sydostbugten, where they find good feeding grounds throughout winter.

The age distribution of the seals hunted at Qeqertasussuk is reminiscent of the age distribution found in the hunting bag from the Cumberland Sound area (Smith 1973), which was also considered a poor den-

Table 9.5. Minimum estimate of the biomass represented by the main game species at Qeqertasussuk. Only the most common game species are included (Table 9.2). + means less than 0.05%.
1. Live weights have been adopted from Müller (1906) for arctic fox, from Smith (1973) for ringed seal, from Finn Kapel (pers.comm.) for harp seal, and from Salomonsen (1981) for the bird species.
2. Minimum number of individuals (MNI) have been calculated from the most frequently occuring indicator bone (mammals: the mandible, (except for fox in layer 3; humerus), birds: the humerus) in a bone sample of 407 kilos from Area B, and C. This sample represents approximately 8.7% of the total, both unexcavated and excavated, bone sample preserved on the site (Fig. 8.1), and the MNI's have accordingly been multiplied by a factor 11.5.
3. The MNI's for each age category of ringed seals and harp seals have been calculated on the basis of the age distribution presented in tables 9.6 and 9.8.

			Comp. I			Comp. II			Comp. III			All comp.		
		Live weight	MNI [2]	Biomass in kilos	%	MNI	Biomass kilos	%	MNI	Biomass in kilos	%	MNI	Biomass in kilos	%
Arctic fox		3.00	69	207	0.2	276	828	1	558	1674	1.7	903	2709	0.9
Ringed seal[3]	0-3 yrs	25.00	418	10450	9.6	350	8750	10.5	996	24900	25.7	1764	44100	15.3
	3- yrs	35.00	157	5495	5.0	156	5460	6.6	39	1365	1.4	352	12320	4.3
Harp seal[3]	0-1 yrs	30.00	0	0	0	198	5940	7.1	722	21660	22.4	920	27600	9.5
	1-4 yrs	75.00	518	38850	35.6	308	23100	27.8	96	7200	7.4	922	69150	23.9
	5- yrs	130.00	402	52260	47.9	242	31460	37.8	240	31200	32.3	884	114920	39.7
Fulmar		0.75	426	319.5	0.3	3496	2622	3.2	2708	2031	2.1	6630	4972.5	1.7
Ptarmigan		0.50	35	17.5	+	748	374	0.4	385	192.5	0.2	1168	584	0.2
Gulls		1.50	166	249	0.2	834	1251	1.5	914	1371	1.4	1914	2871	1.0
Little auk		0.15	121	18.15	+	926	138.9	0.2	587	88.05	0.1	1634	245.1	0.1
Brünnich's guillemot		1.10	1190	1309	1.2	3002	3302.2	4.0	4577	5034.7	5.2	8769	9645.9	3.3
Total			3502	109175.15	100	10536	83226.1	100.1	11822	96715.95	99.9	25860	289117.5	99.9

Table 9.6. Age distribution of ringed seal based on thin sections of right canines from Area B. Percentages given are for each layer seperately.

	I		II		III		Total	
Age	n	%	n	%	n	%	n	%
0-1	3	13.6	4	30.8	8	30.8	15	24.6
1-2	10	45.5	5	38.5	17	65.4	32	52.5
2-3	3	13.6	0	0	0	0	3	4.9
3-4	1	4.5	0	0	0	0	1	1.6
4-5	0	0	1	7.7	0	0	1	1.6
5+	5	22.7	3	23.1	1	3.8	9	14.8
Total	22	99.9	13	100.1	26	100	61	100

Table 9.7. Age distribution of ringed seals from Qajaa based on thin sections of canines (n=32). Ages of 5+ seals are: 15, 18, 18, 21, 25, 27, 28, 30.

Age in years	n	%
0-1	8	25
1-2	7	22
2-3	1	3
3-4	2	6
4-5	0	0
5+	14	44

ning area. Only 12% were adult seals, 61% were adolescents, and 39% were yearlings. Smith (1973) thought that this was most probably a result of an influx of immature seals from outside areas.

However, at the Saqqaq site Qajaa, situated adjacent to the glacier fjord Jakobshavn Isfjord, the age profile of the harvested ringed seals was quite different from the one found at Qeqertasussuk. *ca.* 44% represented adult seals, 9% adolescents and 47% juveniles (Table 9.7). This age distribution is not surprising considering that the glacier fjord is a major breeding ground for the ringed seals of Disko Bay. The mature and quite territorial ringed seals simply oust the

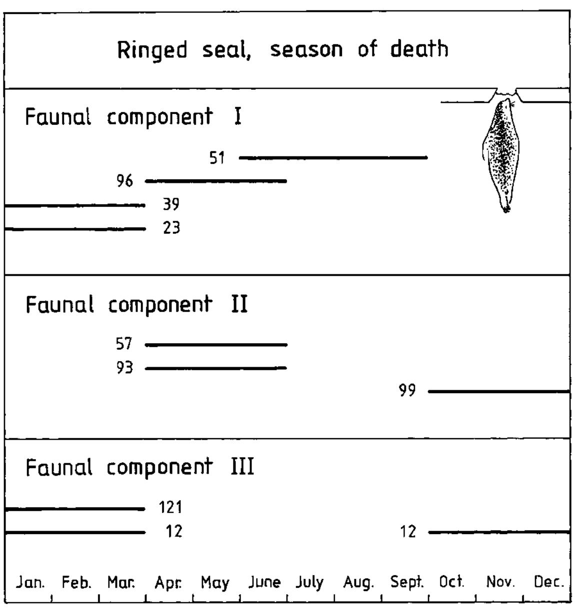


Fig. 9.5. Season of death of ringed seals based on dentine studies. Numbers refer to the individual teeth.

immature ringed seals from the area. It is interesting to note how the natural behaviour of the ringed seal creates major local differences in age structure and that these differences are reflected in the composition of the hunting bag and in the archaeological record.

Estimates of the season of death based on the ringed seal teeth from Qeqertasussuk (Figure 9.5) indicate that the seals were primarily killed in winter (January to March) and in spring (April to June), a few were taken in the fall (October to December) and one in summer (June to September). The sample is too small to identify changes in seasonal exploitation through the period of occupation.

Most of the seals were probably caught relatively close to the site. Qoornua, the sound separating Qeqertasussuk from the mainland, has traditionally a good ringed seal population, and the sea ice is dotted with their breathing holes. The winter ice cover is very stable in this part of the bay, and it is usually present from late December to early June.

The seals caught in mid-winter (January to March) were most likely taken in their breathing holes, as there are no open water areas in the vicinity at this time of the year. Those caught in spring (April to June) were probably taken either in their breathing holes or while basking on the sea ice. Even though the majority of the seals seem to have been taken when the ice cover was complete, some seals were probably hunted in the leads and cracks that form during break up either following storms in the winter period or in spring.

Breathing hole hunting was most likely undertaken with toggling-harpoon, which is a thrusting harpoon (Grønnow 1996, 1997) (Figure 9.6). Standing directly over the seal it was possible to exert considerable force and the full length of the harpoon head

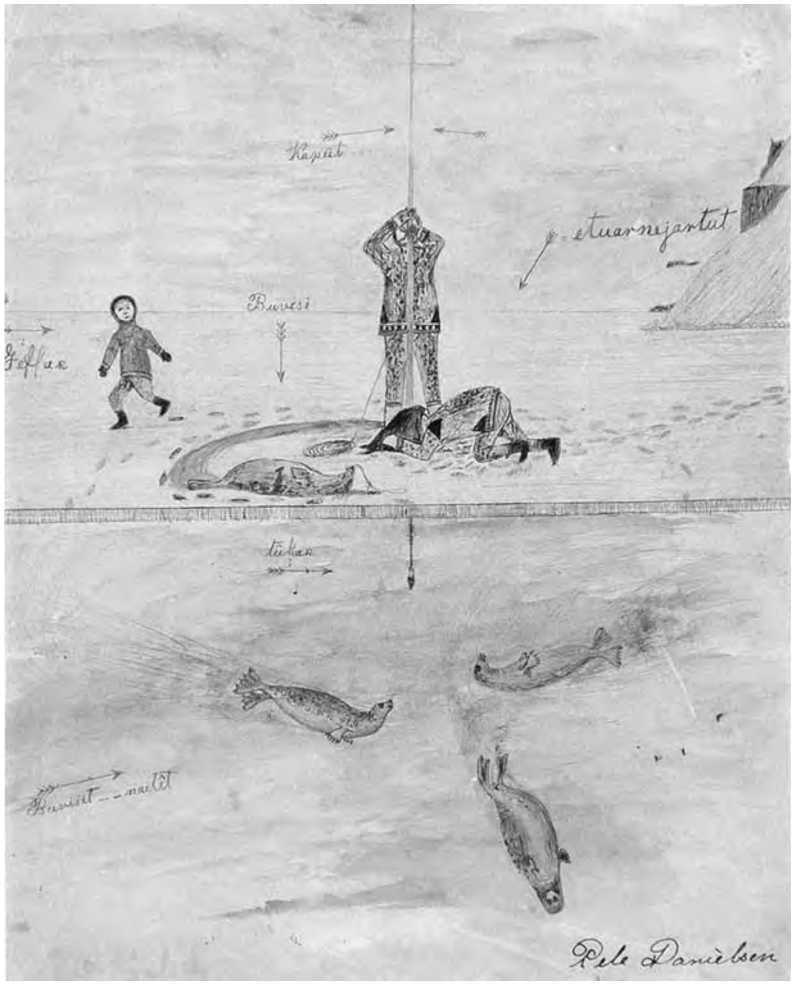


Fig. 9.6. There are many ingenious ways of catching ringed seals through the sea ice. Here a thrusting harpoon with a toggling harpoon head is used by a hunter using a helper that can spot the seals and guide the aim by looking through a hole in the ice (from the Disko Bay area, drawing by Pele Danielsen, courtesy: Greenland National Museum and Archives).

could easily to be driven through the seal's skin and anchored into blubber and muscle tissue. The toggling harpoon consisted of a wooden shaft onto which was attached a slender bone foreshaft which again fitted into the harpoon head itself. A thong of skin attached to the centrally placed line-hole in the harpoon head secured the harpoon head and the game once it was freed of the foreshaft.

The Pre-Dorset toggling harpoon is also known from the western, central and eastern parts of Arctic Canada as well as from other Saqqaq sites in West Greenland (Grønnow 1997). This distribution coincides well with the distribution of ringed seal – the breathing hole seal "par excellence" – and with the distribution of archaeological sites with ringed seal bones.

Some ringed seals were also taken while basking in the sun on the ice or in cracks and leads and during the spring break up of the sea ice. As long as open water areas were limited and boats were of little use, it is probable that the hunters also used the toggle-harpoon for these seals. But as soon as the sea opened up and their slender boats could be put to use, it is likely that the light throwing harpoon tipped with tanged and barbed harpoon heads would be superior.

About 50 harpoon heads were found at Qeqertasussuk and of these 45 could be assigned to 4 different types: Qt-A, Qt-B, Qt-C and Qt-D. Qt-A represents toggling harpoons and Qt-B, C, and D represent barbed and tanged harpoons (Grønnow 1997). Toggling harpoon heads make up ca. 35% of the total number of harpoons which corresponds well to the relative representation of ringed seal in the total seal bone sample at Qeqertasussuk (ca. 40%) (Table 9.4).

Ethnographical analogy confirms that the toggling harpoon was well suited for ringed seal and breathing hole hunting, and from historical sources we know that there was a refined and diverse technol-

Fig. 9.7. "Ammissut" – a group of harp seals bypassing Qeqertasussuk in Qoornua, June 1987 (photo: Morten Meldgaard).

ogy developed for this kind of hunting in the Disko Bay (Figure 9.6) (Porsild 1915).

Thus there seem to be several lines of evidence linking the Qeqertasussuk toggling harpoons to the ringed seal and to ice hunting in the Qoornua Sound.

Nets may also have been in use for winter sealing as indicated by baleen cordage and knots found on Qeqertasussuk and possible stone net-sinkers that have been found on contemporary sites. If this is the case, the method was probably comparable to the historically known net sealing in Disko Bay (Porsild 1915).

Ringed seal hunting in a Saqqaq Culture context has also been documented from the Disko Bay sites Qajaa and Niivertussannguaq (Andreasen 1998) and from Tingit in the Sisimiut district (Godtfredsen 1997a). At Qajaa ringed seals constitute ca. 20% of the mammal bone sample, which is somewhat less than at Qeqertasussuk (Table 10.1).

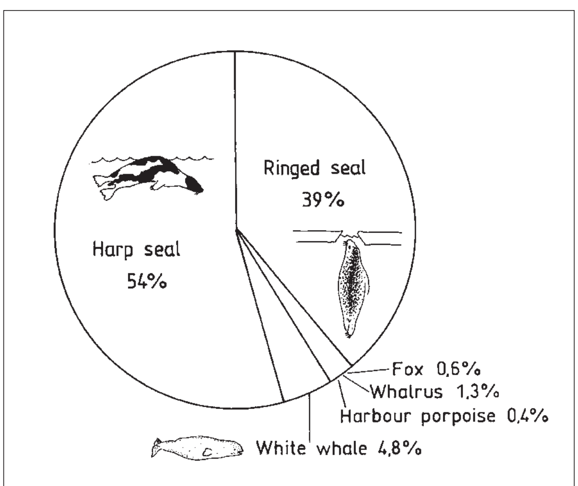


Fig. 9.8. Biomass harvested by Akulliit hunters 1955-1961. Based on hunting statistics for Northern Greenland (see also Figure 4.21 and Table 9.5 for live weight data)..

The harp seal

The harp seal is migratory. From its breeding grounds near Newfoundland it swims north in spring towards its feeding grounds along the West Greenland coasts. It reaches the Disko Bay area in late May, and depending on the break up of the sea ice, the first harp seals appear in the Qasigiannguit district in May or June (Porsild 1921:102,291; Søren Frederiksen, inf. 1986). These seals are all adults or immature seals more than one year old and they usually keep together in groups, a behaviour so characteristic that these groups have a specific name in Greenlandic: "ammissut" meaning "flock" or "school". The young-of-the-year arrive fourteen days to a month later than the older seals, and they always swim alone. At the peak of the spring migration there are seals everywhere. On a calm day it is often possible to see several ammissut of more than 20 individuals within a small area, and groups of more than a hundred are encountered (Fabricius 1791:107; Müller 1906:161; Ronald and Healey 1981; Kasper Didrichsen, Henrik Iversen and Lars Johansen, inf. 1986; T. R. Larsen pers. comm.) (Figure 9.7).

The seals eagerly pursue schools of capelin into fjords and bays, and they often pass promontories within harpooning distance (Fabricius 1791:128; Müller 1906:161). They quickly put on weight but still sink like stones if killed during spring migrations (Müller 1906:161: Kreutzmann *et al.* 1964).

In mid-July most of the seals disappear from the district and move further north along the coast. However a few can still be seen in the area throughout the summer (Krogh 1921:109).

In September-October the harps return to the district, but this fall migration is less pronounced than the spring migration. As in spring the groups consist primarily of older harp seals while the young-of-the-year prefer not to move about so much. The seals are fat in September but some still sink when killed. In October, however, all float (Müller 1906:163-4).

When sea ice formation starts in December or January the harp seals retreat to the outer parts of the Disko Bay until they leave for Newfoundland in February. If storms break the sea ice before the seals depart, they may appear in the district at this time of winter (Rink 1852:99; Rosendahl 1961). When ice-formation is very rapid groups of harp seals may become trapped in openings in the ice; a so-called "sassat" (Müller 1906:166; Lars Johansen, inf. 1986).

Areas known for the common occurrence of harp seals (primarily ammissut) are: the sea off Qeqertasussuk (Jakobsholm) (Søren Frederiksen, inf. 1986), Kangersuneq, especially near the mouth of the fjord (Søren Frederiksen, Jens Vetterlein, inf. 1986), Tunutta Imaa at Qenertarssuaq and the sea off Kangiusaq (Villads Olsvig),and Qoornua at Qeqertasussuk (Villads Olsvig, Lars Johansen, Søren and Kathrine Thorning, inf. 1986).

The harp seals prefer to pass through certain runs (Müller 1906:163), for example Tunuuta Imaa (Rink 1855:116; Jens Vetterlein), the runs between the northwestern point of Sarpiusat and the islets off the point (Kristian Jeremiassen, inf. 1986), the runs between Qeqertasussuk (south of Ikamiut) and the mainland (Kristian Jeremiassen, inf. 1986) and the runs near Ikamiut between the skerries and the mainland (Rink 1855:116). Many harp seal groups are also seen further at sea *e.g.* moving in and out of the Kangersuneq fjord and at sea around Tussaaq, Saarlat and Uigorleq (Jens Vetterlein, inf. 1986). The harp seals are generally easier to approach in spring, especially when feeding on capelin, than they are on their fall migrations. It can be dangerous to approach them, in particular if there are many ammissut in the area and the males can be quite aggressive and dangerous if provoked. The young-of-the-year are generally much easier to get at than the older seals (Fabricius 1791:115; Müller 1906:161-2; Broberg and Danielsen 1964; Henrik Iversen and Lars Johansen, inf. 1986).

Fluctuations in the numbers and distribution of the harp seals along the west coast of Greenland has occurred as far back in time as the records go (Vibe 1967). Well documented is the great increase in harp seal populations in West Greenland waters, including Disko Bay, between 1920 and 1950 (Anon. 1944; Vibe 1967:67-8) and the subsequent decline in the fifties, sixties and seventies (Rosendahl 1961:25-6; Kapel 1975a:473). These fluctuations were also evident in the Qasigiannguit district where harp seals have become much more numerous in recent years as has also been the case for West Greenland as a whole (Kapel 1986; Henrik Iversen and Lars Johansen, inf. 1986). The increase in the first half of the 20th century was accompanied by an expansion as far north as the Thule district (Anon. 1944; Vibe 1950:64, 1967; Rosendahl 1961).

When the harp seal population is large, more seals tend to spend the whole summer in the Qasigiannguit area (Henrik Iversen and Lars Johansen, inf. 1986) and they also seem to arrive earlier in spring and leave later in fall (Kapel 1975b). Also their behaviour seems to change with population density. When concentrations in the area are high, they are less shy and easier to approach than during population lows (Lars Johansen, inf. 1986).

The ice conditions may affect the occurrence of the harp seal in Sydostbugten. If, for example, spring break up is postponed, the majority of the northward migrating seals may pass the district by (Anon. 1887:4). When killer whales are present, the seals flee from the area (Fabricius 1791:121). A recent example was the occurrence of killer whales in Sydostbugten in

Table 9.8. Age distribution of harp seals based on thin sections and polished sections of canines.

Age in	I		II		III		Total	
years	n	%	n	%	n	%	n	%
0-1	0	0	9	26.5	15	68.2	24	33.3
1-2	5	31.3	5	14.7	2	9.1	12	16.7
2-3	2	12.5	5	14.7	0	0	7	9.7
3-4	2	12.5	4	11.8	0	0	6	8.3
4-5	0	0	2	5.9	2	9.1	4	5.6
5-6	0	0	0	0	0	0	0	0
6-7	2	12.5	1	2.9	0	0	3	4.2
7-8	0	0	0	0	2	9.1	2	2.8
8-9	0	0	2	5.9	0	0	2	2.8
9-10	0	0	1	2.9	0	0	1	1.4
10-11	0	0	2	5.9	1	4.5	3	4.2
11+	5	31.3	3	8.8	0	0	8	11.1
Total	16	100.1	34	100	22	100	72	100.1

November 1988. Their presence coincided with the absence of fall migrating harp seals (T. R. Larsen pers. comm.).

Harp seal hunting at Qeqertasussuk

Harp seal bones represent *ca.* 58% of the seal bone sample (Table 9.4), and it is the most frequently occurring game species of all. Calculated from the minimum number of individuals present in the excavated sample and from an estimate of the total amount of faunal material on the site, it can be estimated that at least 2,726 harp seals were landed at Qeqertasussuk. They represent a total of *ca.* 212 tons of meat, blubber and intestines (Table 9.5).

On average approximately 33% of the harps taken were in their first year, *ca.* 40% were adolescents between 2 and 4 years of age and *ca.* 27% were mature animals (Table 9.8). However, looking at the age profile of the catches at different points of time through the habitation period, there are some quite dramatic changes. In the early period (2400-2100 BC) the young-of-the-year constitute *ca.* 70% of the sample and this decreases to 26% during the period 2100-1900 BC, and to 0% in the period 1900-1700 BC (Table 9.8). This decrease is accompanied by a corresponding increase in the bag of adolescent and adult harp seals.

The natural age composition in the harp seal groups that frequent Disko Bay has been described by Kapel (1975b). Based on data from the small settlement of Saqqaq, northern Disko Bay it seems that *ca.* 76% are young-of-the-year, 11% are adolescents and 13% are mature animals. Kapel (1975b:105) believes that the percentage of young-of-the-year may be a bit too high, however he places confidence in the overall picture that these figures give.

The frequency of adolescents and mature harp seals in the Qeqertasussuk sample is clearly higher than would be expected if the hunters took a natural sample of the population. But what hunting strategies could produce such an age profile?

An example from Newfoundland and Labrador provides some insight into the age selectivity of different hunting methods (Bowen 1980). Many harp seals are netted in this area, and there is a clear selection towards older animals. This has to do with the different behaviour of the young-of-the-year and the older seals. The young-of-the-year migrate alone while the older seals swim in groups, and these groups are the target of the netting operations, which often take place in narrow runs or inlets (Tanner 1944:493-494). The age distribution of harp seals shot from small vessels in the same general area has a much higher percentage of young-of-the-year (Bowen 1980).

There is no significant change in the timing of the preferred harp seal hunting season through the three habitation periods (Figure 9.9) and there are no indications as to why the availability of the different age groups should change for natural reasons. So, the change in age profile must primarily be a result of changes in hunting selectivity.

The high representation of adolescent and mature harp seals in the Qeqertasussuk material is thus indicative of selective hunting. These animals typically migrate and feed in groups, the so called “ammissut”, and it is likely that these groups were the target of most harp seal hunts. It is likely that this selective hunting was undertaken with nets and from boats. The numerous finds of baleen cordage with knots, as well as the finds of boat and paddle parts, document that the materials and the technology were at hand (Grønnow 1994, 1996).

The non-selective harp seal hunt which characterizes the first centuries of habitation on Qeqertasussuk probably reflects a more individualistic hunting form where each hunter goes after the available harp seals including both ammissut and solitary young-of-the-year. The selective “ammissut hunt”, which seems to have been prevalent following the early period and which was probably undertaken with nets and boats, demands a more organized communal-type hunting.

According to tooth analysis (Figure 9.9), both spring and fall migrating harp seals were hunted. However, seals from the spring-early summer migrations (end of May to mid July) represent *ca.* 82% of the material, while seals taken during fall migrations (September to late December) make up *ca.* 18%. Apparently harp seal hunting was most important in spring and early summer. This trend stands out even more clearly when considering that the length of this season is only about half that of the fall season.

Fall hunting is also documented by the presence of foetal harp seal bones (Figure 9.10). Three mandibles were positively identified as harp seal and their size and state of development correspond well to that of a harp seal foetus collected in November or December in Disko Bay (from the collections of the Zoological Museum in Copenhagen).

The Qeqertasussuk site is very well situated for harp seal hunting (Figure 9.11 and 9.12). Both in spring and in fall numerous groups of harp seal swim through Qoornua Sound and many pass very close by the site. In some cases it would even be possible to harpoon the animals from the cliffs, but usually they keep a distance. Narrow runs where the seals could be netted or trapped and harpooned are not found in the immediate vicinity of the site. However, such places are found *e.g.* in Tunutta Imaa *ca.* six kilometres to the north of

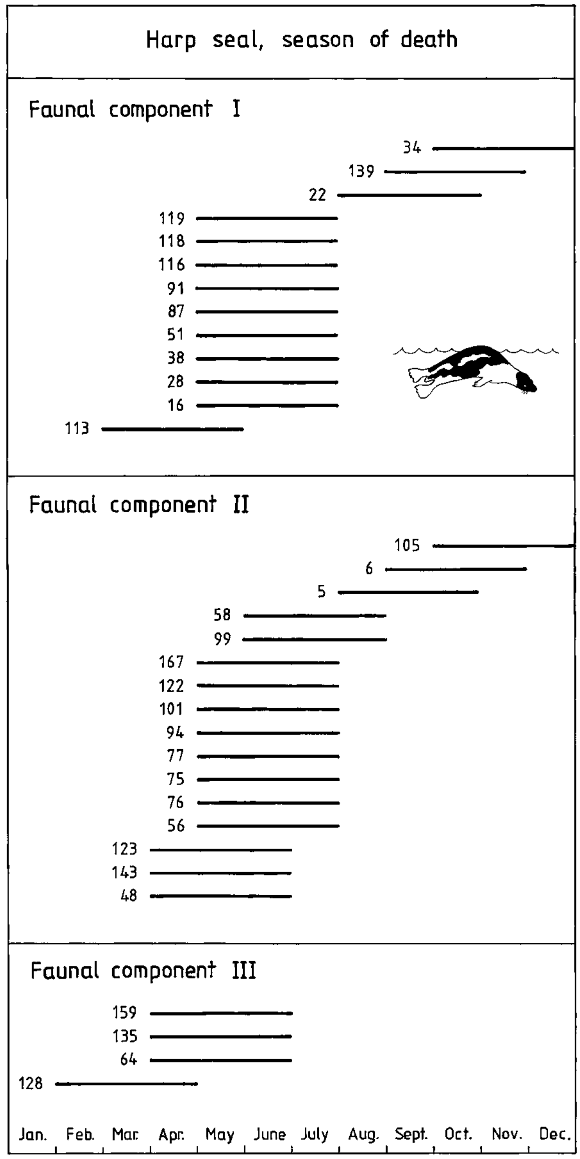


Fig. 9.9. Season of death of harp seals based on dentine studies. Numbers refer to individual teeth.

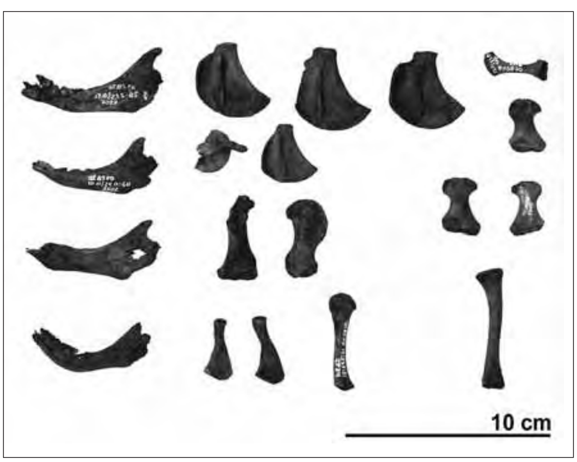


Fig. 9.10. Foetal harp seal bones. The mandibles represent foetal seals that were collected by hunters in November-December (photo: Geert Brovad).

Qeqertasussuk and off Sarpiusat *ca.* sixteen kilometres to the west. Some of the narrow inlets, points closer to the site *e.g.* Isortuarsuk were probably also potential netting places.

Combining the information on local availability and topography with the indications of changes in hunting selectivity, it seems reasonable to assume that during the pioneering period the hunters undertook relatively non-selective harp seal hunting. They focussed on the local hunting grounds in spring and early summer and stalked harp seals from boat mainly

Fig. 9.11. Harp seal in the midden. The articulated vertebral column and rib case indicates that food was plentiful at the time (photo: Kim Aaris-Sørensen).

in Qoornua Sound and in the area just north of the site. In later periods, however, they developed a more specialized and selective harp seal hunt, probably with nets aimed at spring migrating "ammissut" of older seals. Perhaps communal and drive hunting with hunters from nearby settlements was involved.

Harp seals hunted from boat were most likely taken with the light weight throwing harpoons that are known from Qeqertasussuk (Figure 7.9 and 9.13). The harpoon head was probably of the tanged type which is known to have been used for similar purposes in Alaska (Grønnow 1997). At Qeqertasussuk this harpoon head type represents *ca.* 65% of the total harpoon head sample corresponding well with the *ca.* 60% which is the relative representation of harp seal bones in the seal bone sample (Table 9.4).

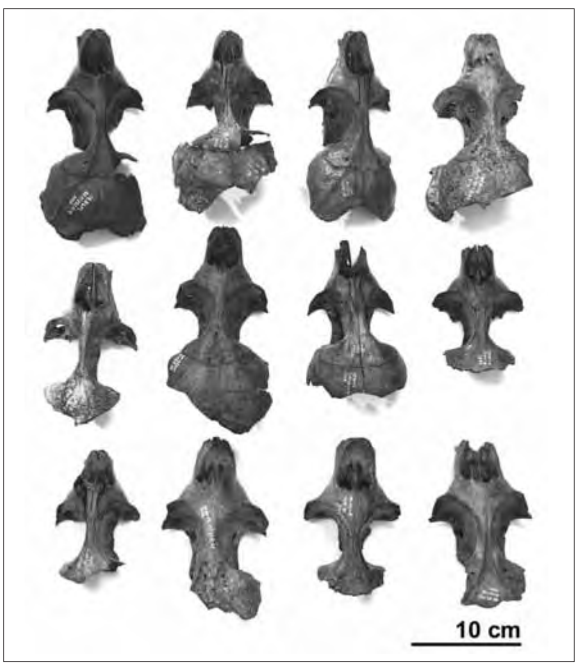


Fig. 9.12. Harp and ringed seal skulls. None were intact which may partly be due to their fragile nature, but the seal heads may well have been battered as part of the food processing procedure (photo: Geert Brovad).

It is tempting to use the small Saqqaq/Pre-Dorset/Independence I tanged harpoon head as a marker of harp seal hunting and past harp seal distribution. The tanged harpoon head is also known from other Saqqaq sites along the central West Greenland coast (Grønnow 1997) and from Devon Island (McGhee 1979; Helmer 1991) and Igloolik (Rowley and Rowley 1997) in Arctic Canada, a distribution that overlaps with the occurrence of migrating harp seals. The tanged harpoon type is not known from the Western Canadian Arctic which is prime ringed seal territory.

Harp seal hunting was also a major occupation at other Saqqaq Culture sites in Disko Bay. Qajaa (ca. 1900-900 BC) is the most prominent with harp seals representing *ca.* 70% of the total mammal bone sample (Table 10.1) (Møhl 1986). Thirteen harp seal canines from Qajaa were successfully sectioned and aged in connection with the present study. Of these none were juveniles, 15% were between 1 and 4 years of age and 85% were above 5 years of age. This emphasis on "ammissut" hunting, probably with nets, corresponds with the pattern documented from the latest occupation phase at Qeqertasussuk (17-1900 BC). It thus seems reasonable to conclude that the development of a selective communal type of harp seal netting was more than a local phenomenon and that it may have developed *in situ* during Saqqaq times over a larger part of Disko Bay and perhaps Central West Greenland.

Harp seal hunting was also a major occupation at the smaller Disko Bay sites of Niivertussannguaq (Andreasen 1998) and Ikamiut (Table 9.9) and at Tingit in the Sisimiut district (Table 10.1) (Godtfredsen 1997a).

Interestingly, the importance of harp seal hunting in Disko Bay has continued into modern times. The settlement Akulliit provides a case in point (Figure 9.8). The harp seal biomass harvested represented *ca.* 54% of the total marine mammal biomass procured at Akulliit.

The hooded seal

From late April to early June, depending on the ice conditions, migrating hooded seals show up in Qasigiannguit district (Kasper Didrichsen, Henrik Iversen and Lars Johansen, inf. 1986). The seals feed heavily on fish and are in good condition, hence the name "fat migration" (Vibe 1981).

Following a period of moulting in Denmark Strait, they return in August on the "lean migration" and they can be observed in the area until the formation of sea ice in December or January (Krogh 1921:174; Porsild 1921:291; Petersen 1964:84; Kasper Didrichsen, Henrik Iversen and Lars Johansen, inf. 1986). If the winter is mild and there is no ice, they may stay throughout the winter (Porsild 1921:291).

Hooded seals are quite common in the northern and more exposed parts of the district. They are more rarely seen in the protected bays and fjords of Sydostbugten (Müller 1906:230; Krogh 1921:109; Porsild 1921:102,291; T. R. Larsen pers. comm.).

Hooded seals are known to make rare almost random and often suicidal migrations over land (Vibe 1981). A seal was shot in 1986 on land near Ilimanaq (Claushavn) and another was shot in the mountains near Godhavn by a ptarmigan hunter (Henrik Iversen and Lars Johansen, inf. 1986).

The hooded seal is an excellent swimmer and diver. When attacked and wounded, it can be extremely aggressive and it is probably one of the most dangerous species to hunt. Both courage, skill and an intimate knowledge of the animal's behaviour is needed to engage in hooded seal hunting (Fabricius 1780:50-51, 1791:130; Müller 1906:235; Porsild 1921:226; Rosing *et al.* 1964; Petersen 1964:84).

The hooded seal's range and relative abundance vary markedly with time (Vibe 1967; Reeves and Ling 1981). From 1860 to 1910 they were common along the West Greenland coasts but from 1910 to 1960 the fall migrations ceased and the seals became rare. In recent years the numbers are once more on the increase, and the fall migrations have been revived (Vibe 1967; Reeves and Ling 1981; Kasper Didrichsen, inf. 1986). These fluctuations have largely been ascribed to climatic changes and related changes in ice cover (Vibe 1967; Reeves and Ling 1981).

Hooded seal hunting at Qeqertasussuk

The hooded seal is only represented by three bone fragments, all from the latest period (faunal component I) and constituting less than 1% of the seal bone sample (Table 9.4). Both cranial and post cranial parts are represented.

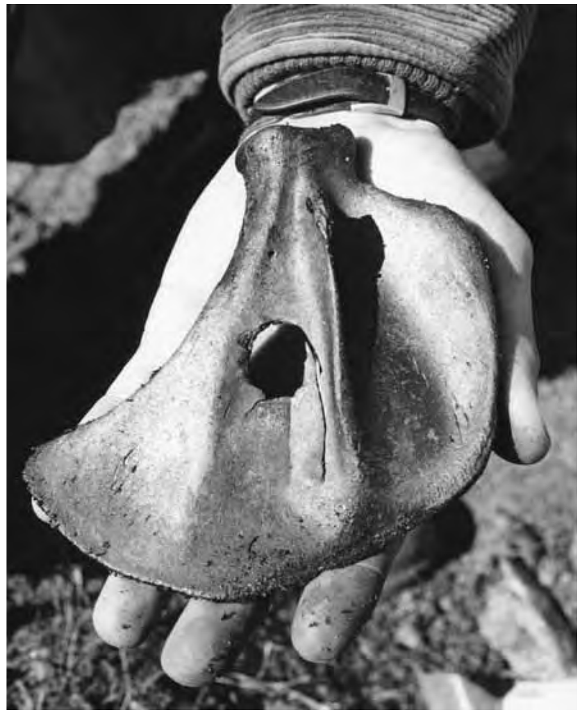


Fig. 9.13. Harp seal shoulder blade with a circular perforation that might have resulted from a harpoon strike (photo: Geert Brovad).

Table 9.9. Species list and TNB-count based on a test excavation at the Saqqaq site Ikamiut located in the western part of Sydostbugten.

	Fragments excavated
Mammals	
Dog (*Canis familiaris* L.)	2
Arctic fox (*Alopex lagopus (*L.))	
Caribou (*Rangifer tarandus* (L.))	5
Harp seal (*Phoca groenlandica* Erxleben)	9
Unspecified seal	57
Unspecified large whale	1
Unspecified mammal	17
Birds	
Unspecified duck	1
Iceland gull (*Larus glaucoides* Meyer)	2
Brünnich's guillemot (*Uria lomvia* (L.))	4
Black guillemot (*Ceppus grylle* (L.))	1
Total number of fragments	99

Based on biological evidence it seems reasonable to assume that they were caught during the spring migrations from late April to early June, or during the fall migrations from August to late December. Because the sea ice in Sydostbugten often stays intact well into June, however, it seems most likely that the seals were hunted in the fall.

The hooded seals were presumably relatively uncommon in the inner parts of Sydostbugten and this may in part explain their scarcity in the material. However, it should also be considered that it is larger and much more aggressive than the harp seal, and therefore more difficult and dangerous to hunt. It could be that the hunters to some extent avoided hooded seal hunting because of the risk involved.

Hooded seal hunting was also undertaken at the Saqqaq Culture site Tingit in Sisimiut municipality (Godtfredsen 1997a).

The bearded seal

The bearded seal is found year round in small numbers in southern Disko Bay (Krogh 1921:109; Porsild 1921:102; Henrik Iversen and Lars Johansen, inf. 1986).

In winter it generally prefers to be close to open water, but is capable of maintaining breathing holes in the sea ice until it reaches a thickness of approximately 15-20 centimetres (Müller 1906:220; Burns 1981; Vibe 1981). In spring it can be found hauling out on the sea ice and, when the ice disappears, it moves into the fjords and bays of the area. During the summer it is most often found in shallow water areas where there is easy access to its food which is mainly benthic (Müller 1906:220; Burns 1981). Good bearded seal habitat is found in the shallow waters north of Kitsissunnguit (Henrik Iversen and Lars Johansen, inf. 1986).

Bearded seals are generally easy to approach, especially the juvenile animals (Fabricius 1780; Müller 1906; Henrik Iversen and Lars Johansen inf. 1986).

Bearded seal hunting at Qeqertasussuk

Three fragments of bearded seal, two from the late period (faunal component I) and one from the early period (FC-III), were identified in the faunal material (Table 9.2 and 9.4). These fragments represent less than one percent of the seal bone sample. Based on the biological evidence, these seals were most likely caught during the ice free time of the year. The small number of bearded seal bones is probably a direct reflection of low bearded seal availability.

Bearded seals were also taken in small numbers at the West Greenlandic Saqqaq Culture sites of Itinnera (Møhl 1972), Tingit (Godtfredsen 1997a), Nipisat (Godtfredsen 1998) and Qajaa (Møhl 1986).

The harbour seal

The harbour seal is quite scarce and rarely seen. It has a few historically known breeding localities in Disko Bay, one on a small island in Ikerasak close to Torsukattak (Winge 1902:429) and probably one on small skerries and islands on the northwestern coast of Qeqertarsuaq (Disko) (Porsild 1921:291). In May and June the seals arrive at their breeding grounds to give birth to their young. When the sea ice starts to form, usually in December or January, they again disappear from the area and retreat to the open water areas along the outer coasts (Müller 1906:225; Vibe 1981).

Since 1910 approximately 10 harbour seals have been observed in the Qasigiannguit district (Kasper Didrichsen, inf. 1986). One has been seen in Tunutta Imaa (Frederik Jensen, inf. 1982), some off the western point of Sarpiusat (Jens Vetterlein, inf. 1986), but most are observed near the more remote islands of the district *e.g.* Kitsissunnguit (Porsild 1921:102). It is likely that it was more common in the area in earlier periods when hunting pressure was lower and disturbance less frequent, as the name of the district's main town, Qasigiannguit ("the place of the harbour seals") implies. Qasigiannguit is situated adjacent to a shallow bay with sandy beaches, a location often chosen by harbour seals for hauling out (Müller 1906).

The harbour seal is the most shy of all seals and will disappear from areas where there is too much disturbance. However, if encountered on the breeding grounds the females will try to protect their young, and they are consequently rather easy to approach (Fabricius 1780:52, 1791:105, 107; Winge 1902:429; Müller 1906:224). When killed it sinks more quickly than any other seal (Müller 1906: 223).

Harbour seal hunting at Qeqertasussuk

Two fragments have been recovered from test pits, but none from the main excavation units. All were mandibular fragments.

Based on the biological information available, it is reasonable to believe that harbour seal hunting at

Qeqertasussuk was undertaken in summer or fall. Also, the scarcity of harbour seal bones most likely reflects a natural scarcity of seals in the area.

In contrast, the harbour seal, including juvenile animals, was the most important marine game at the Saqqaq Culture site Nipisat in Sisimiut municipality (Godtfredsen 1998) which may indicate that major harbour seal breeding grounds were found in the vicinity of the site. A few harbour seals were also taken at Qajaa (Møhl 1986) and at Niivertussannguaq (Andreasen 1998).

Walrus

Historically the walrus is known to have been quite common from Kangaamiut northwards to Attu. Also along the west coast of Qeqertarsuaq (Disko) and further north it was a regular visitor. The walrus arrived in September and during the moult they hauled out on particular small islands and skerries until November. In February they disappeared from the coast (Winge 1902; Müller 1906; Svane 1964:87; Vibe 1967, 1981).

Walrus are rare in Qasigiannguit district. However stray animals are seen from time to time. In the 1920's or 1930's, two young animals were observed in the fall south of Saarlat (Kasper Didrichsen, inf. 1986), one has been seen near Sarpiusat (Lars Johansen, inf. 1986), and three have been observed south of Ikamiut (one in the 1960's, one in the 1970's, and an adult male in July 1988 (T. R. Larsen pers. comm.)).

Walrus hunting at Qeqertasussuk

Two pieces of ivory used for harpoon heads and a worked ivory fragment are the only indications that walrus were exploited. These tusk fragments could stem from animals that were actively hunted or they could have been collected from carcasses. Finds of both walrus bone and tusk from the contemporary site Qajaa at Jakobshavn Isfjord (Meldgaard 1983; Møhl 1986), however, indicate that walrus hunting did take place here. Other faunal finds from West Greenland (Godtfredsen 1996) confirm that Saqqaq hunters must have possessed a technology for walrus hunting.

As the walrus is an occasional visitor in Sydostbugten, the ivory pieces could stem from a stray animal taken near Qeqertasussuk. If this was the case, however, it would be expected that a few other bone fragments would have found their way into the midden deposits. It seems more likely that the ivory fragments were imported from more distant walrus hunting grounds, situated perhaps near the mouth of Jakobshavn Isfjord or in the outer parts of Disko Bay.

Whaling

Blue whale, fin whale, and sei whale

The fin whale is found along the West Greenland banks as far north as the Uummannaq district. It arrives in June and migrates south in September. The blue whales follow the same pattern (Anon. 1944; Vibe 1981; Kapel and Larsen 1983). Both species are from time to time observed in Disko Bay (Porsild 1921:293). They prefer the more open parts of the bay, in contrast to the minke whale and the humpback whale, that are often seen feeding closer to shore (Vibe 1981). Fabricius states that they are very wild and difficult to hunt (1818a:254).

The sei whale is also a summer guest in Greenlandic waters. The northernmost well documented observation was made off Sisimiut (Holsteinsborg), however it probably goes further north in periods when an increased influx of warm Atlantic water raises the sea temperature (Kapel 1985).

Grey whale

The grey whale became extinct in the western part of the North Atlantic in the early 18th century (Mead and Mitchell 1984). The surviving Pacific populations spend the summer in the Bering Sea and the adjacent parts of the Arctic Ocean. Historical sources indicate that the grey whale once occurred off West Greenland (Vibe 1981), and, assuming that they undertook the same type of north-south migrations as do the Pacific populations, it seems quite likely that there was a substantial population of grey whales feeding on the banks and in shallow waters along the West Greenland coasts.

Minke whale

The minke whale moves north along the West Greenland coast in spring, and in May-June some enter Disko Bay where they can be seen regularly throughout the summer (Porsild 1921:293; Kapel 1977b; Vibe 1981). It is often encountered in the southern part of Disko Bay and has been observed in Qoornua at Qeqertasussuk (Rink 1855:107). In November-Decem-

Table 9.10. Whale species identified.

		n
Sperm whale	Two teeth, one made into a spoon	2
Killer whale	One scapula. Complete, except for a centrally placed hole	2
Harbour porpoise	Four articulated cervical vertebrae, two articulated thoracical vertebrae, and one rib.	7
Narwhal	Two proximal tusk fragments, one made into a needle case	2
Minke or sei whale	Fragment of a pre maxilla.	1
Bowhead or northern right whale	Fragment of baleen, length 164 cm., calculated minimum length 214 cm	1

ber it migrates south to the wintering grounds (Kapel 1977b; Vibe 1981). According to Fabricius (1780) it is a swift whale that is difficult to approach.

Humpback whale

The humpback whale is a regular summer visitor in Disko Bay where it has its northernmost summering grounds. It comes to the bay in late April and throughout summer it can be seen feeding in the area, often quite close to shore (Winge 1902; Vibe 1981). Historically Sydostbugten has been known for its large concentrations of humpbacks (Winge 1902:498). The whales disappear again from the bay in November (Winge 1902; Vibe 1981). If ice formation is rapid in fall it may become trapped in openings in the ice (Porsild 1916). In calm weather it is often seen resting on the sea surface and in this situation it is quite easy to approach (Fabricius 1818a:74; Møller 1964:41).

Bowhead whale

Based on historical sources the migration patterns of the bowheads occurring in Disko Bay can be reconstructed. In early December the bowheads arrived from their summering grounds in northern Baffin Bay. Disko Bay was a favoured wintering area and they would stay in the ice free parts of the bay until early June when the northward migrations started. They were always found in close association with the sea ice either at the ice edge or in leads and openings. Being a social animal it was often seen in small pods and at good feeding places more than 100 whales could be seen together. They appear to have been most common in the outer and central parts of Disko Bay (Eschricht and Reinhardt 1861:442,447; Winge 1902; Vibe 1981; Reeves and Leatherwood 1985; Hacquebord and Leinenga 1994).

The land fast and stable ice cover in the southern part of the bay probably prevented the bowheads from frequenting this area during most of the winter season, however it is likely that the whales would turn up as soon as storms had broken the ice and thus made new feeding grounds available (Winge 1902:487). During periods with rapid ice formation the whales can become trapped in leads and openings in the ice and finally drown (Winge 1902:486).

North Atlantic right whale

The North Atlantic right whale is a boreal species that spends the summer in the southern part of the Davis Strait (Vibe 1981). In periods when the Davis Strait experiences a greater influx of Atlantic warm water, this whale may show up in Disko Bay.

Sperm whale

Sperm whale bulls are occasionally seen in summer as far north as the Uummannaq district (Winge 1902; Vibe 1981). When resting on the sea surface it is quite easy to approach (Fabricius 1780, 1818a).

Killer whale

The killer whale is seen regularly in summer in Disko Bay. Its occurrence in the area is known to have a large impact on the occurrence of other sea mammals. Harp seals, white whales and narwhal are known to disappear when killer whales turn up, and if pursued they take to shallow runs or, in the case of harp seals, they may crawl onto land (Müller 1906:159; Porsild 1921: 293; Anon. 1928:597, 1933:13,226, 1938:690; Vibe 1981).

Some time prior to 1840 there was a killer whale "sassat" in Sydostbugten. A period of rapid ice formation trapped the animals in a small lead (Winge 1902:504).

Large whale hunting at Qeqertasussuk

A total of 102 whale bone fragments, teeth, and baleen fragments have been excavated (Table 9.10 and 9.11, Figure 9.14). The whale material is present throughout the habitation period, but most strongly represented in the early habitation period (FC-III). Because of the

Table 9.11. Total number of worked bone, bone fragments and baleen from specimens of minke whale-size or larger (not identified to species).

Unit and dating	Bone	Baleen
Area B, comp. I (1700-1900 BC)	1	0
Area B, comp. II (1900-2100 BC)	3	0
Area B, comp. III (2100-2400 BC)	6	0
Area B, no comp.	5	0
Area C, comp. 14,14a (1700-1900 BC)	10	8
Area C, comp. 15 (1900-2100BC)	2	2
Area C, comp. 16,15a,18 (2100-2400 BC)	29	8
Area C, no comp.	2	
Test pits	6	9
Total	64	27

Fig. 9.14. Whale bone sample from Qeqertasussuk. Top left: rib and vertebrae from harbour porpoise, lower left: fragments of large whale bone material, right hand side: baleen fragments and baleen string (photo: Geert Brovad).

high degree of fragmentation and preparation it was only possible to identify fifteen fragments to species, namely the sperm whale (Figure 9.15), the killer whale (Figure 9.16), the harbour porpoise, the narwhal, the minke whale/sei whale and the bowhead/North Atlantic right whale (Figure 9.17).

Remains of large whales have also been identified at other West Greenland Saqqaq sites such as Nipisat (Godtfredsen 1998) and Qajaa (Møhl 1986).

Large whale exploitation

The minke whale and the sei whale could not be separated on the basis of the fragmentary pre-maxilla, and the bowhead could not be separated from the North Atlantic right whale because the 164 centimetre long baleen fragment, even with a calculated minimum length of 214 centimetres, was within the size range of both species (Cummings 1985; Reeves and Leatherwood 1985).

However, based on the biological evidence, it is reasonable to assume that the North Atlantic right whale has been an extremely rare guest in West Greenland waters and consequently it is most likely that the fragment, as well as most of the other baleen fragments found, come from bowhead whales. The shortest strands of baleen may, on the other hand, come from humpbacks that have a maximum baleen length of 85 to 104 centimetres or from *e.g.* the minke whale, the baleen of which only reaches *ca.* 40 to 50 centimetres (specimens in the collection at the Zoological Museum in Copenhagen).

It can safely be concluded that large whales were exploited, but it is problematic to determine whether whale hunting was undertaken actively or if whale exploitation was restricted to beached or floating carcasses. Even if this problem can be solved through the identification of whaling implements, one is left with the difficult task of estimating the importance of large whale products in the Saqqaq economy.

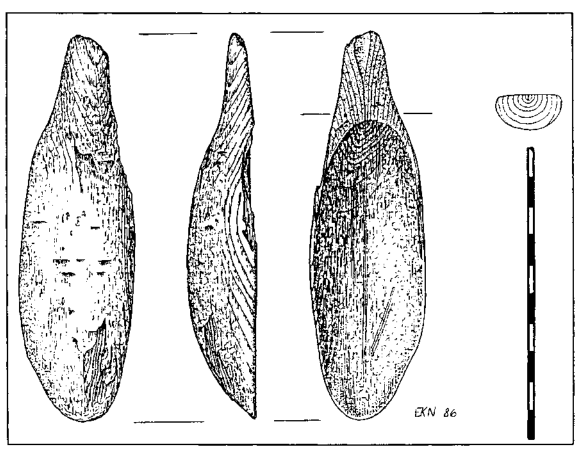


Fig. 9.15. Spoon carved from sperm whale tooth (from Grønnow 1994).

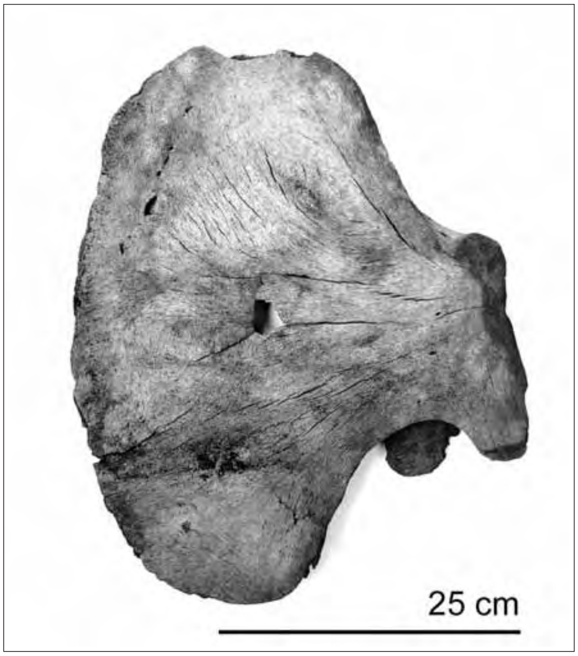


Fig. 9.16. Scapula of killer whale found in context with dwelling structures in excavation Area C (Fig. 6-23) (photo: Geert Brovad).

Identical problems are encountered when dealing with whaling in other prehistoric Inuit and Aleut contexts (see for instance Staab 1979; Black 1987; Savelle and McCartney 1988).

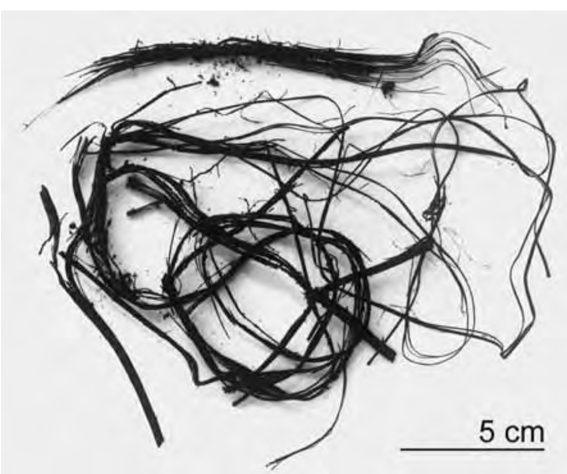


Fig. 9.17. Baleen string, probably drawn from bowhead baleen. Baleen was an important raw material for the production of cordage that could be used for nets, snares and house hold utensils (photo: Geert Brovad).

Hunting or scavenging?

What does it take to kill a large whale? Despite their size, bowheads, humpbacks, sperm whales and the other large whales are fairly easily killed. According to Fabricius (1780) a slight flesh wound was sufficient to cause inflammation, and within days, death of these whales, a fact also mentioned by Hall (1864), Birket-Smith (1924:336) and Gjessing (1945).

Fabricius himself once hit a juvenile humpback with a bird dart, and the following day the whale was found floating dead in the vicinity. He also describes how a wounded sperm whale, after a few days of pursuit, smelled rotten even before it died (Fabricius 1780).

It is probably crucial for the deadly effect of these, seemingly small, wounds that the weapons used are dirty with residues of blood and other organic compounds where bacteria can thrive. It is likely that the stress which the whale is put through when pursued hastens the effect of the inflammation.

Historically, both spears and toggle harpoons were used for whaling in West Greenland (Birket-Smith 1924; Møller 1964) as was also the case in Alaska (Black 1987).

Several large spear heads have been found at Qeqertasussuk, one of them mounted on a heavy wooden shaft (Grønnow 1988) (Figure 9.18), and they should be sufficient to mortally wound large whales. No harpoons large enough to be potential whaling harpoons, were found. However, the basal part of a large harpoon was excavated at the Saqqaq site Qajaa by Jakobshavn Isfjord and a complete 10 cm long specimen of Saqqaq type was collected at Kronprinsens Ejland in Disko Bay (Günther and Meldgaard 1983; Møhl 1986).

Unfortunately, neither spears nor harpoons prove that active large whale hunting was a Saqqaq occupation. But it must be concluded that the Saqqaq hunters did possess a technology sufficient for whaling and, by analogy, it is reasonable to believe that the Saqqaq hunters like the Thule people and the historic Aleut (Figures 9.19 and 9.20) did undertake active large whale hunting.

The economic importance of large whale products

An adult bowhead whale weighs approximately 50 tons (Vibe 1981) which equals the weight of 384 adult harp seals or 45,455 Brünnich's guillemots. One bowhead would supply more than 2000 meters of baleen and much bone. This underlines the importance of investigating the significance of large whales in the Saqqaq economy.

We know that the inhabitants at Qeqertasussuk made extensive use of baleen, teeth and bones from the large whales. Most of the whale fragments carry traces of knives or axes and much of the baleen found is in the form of strings often tied into knots. Among implements made from whale bone are foreshafts for harpoons, wedges, side prongs for bird darts, and flakers (Grønnow 1988, 1990).

Baleen provided raw material for strings that were used for a variety of purposes *e.g.*, lashings, knife grips, and for mending broken wooden implements. Finally, a sperm whale tooth was used as raw material for a "spoon" (Figure 9.15) (Grønnow 1988).

It is likely that the meat and blubber from the large whales was at least of temporary importance in the diet, because both whales that were found dead and whales that were killed were potential sources of food and fuel. Even though whale meat spoils quickly there are many records of naturally dead whales that have been used for consumption (Fabricius 1780; Porsild 1921).

If large whales were hunted actively, they were probably a more regular and important part of the diet than if occasional beached whales were exploited. However, in certain years when pods of *e.g.* bowhead whales became trapped by the sea ice drifting carcasses must have been a common sight and they may temporarily have boosted the economy.

Fig. 9.18. Heavy lance found with its end blade in situ (see also Figure 7.10). Such lances could have been used for whale hunting (photo: Geert Brovad).

Fig. 9.19. Whale lances from Alaska (courtesy of the Smithsonian Institution).

Large whale "collection-sites"

Based on the assumption that the degree of utilisation of whale remains is inversely related to the distance to the collection site, some clues as to the location of the large whale collection sites may be found.

As only highly fragmented whale bones and baleen were found, the raw material was not collected in the vicinity of the site, but had instead been transported some distance. Also, most of the worked pieces of bone and baleen were found in the habitation area and not in the midden area indicating that there was limited processing along the beach and that most material was brought from somewhere else directly to the main working areas around the tent houses.

It is most likely that the bowhead baleen was collected or hunted in the outer parts of Sydostbugten, or further out in Disko Bay, where large concentrations of wintering bowheads were found. The islands Imerissut (Kronprinsens Ejland), Kitsissuarsuit (Hunde Ejland), and Kitsissunnguit (Grønne Ejland) situated in the open part of Disko Bay are potential Saqqaq Culture sites for large whale hunting.

It is more difficult to identify the provenience of the other large whale fragments because carcasses of the different summering species can be encountered in all parts of the bay.

White whale

The first pods of white whales arrive in Qasigiannguit district as soon as the sea ice starts to break up in April or May. They follow the disintegrating ice edge and use cracks and leads to get access to fish and other food beneath the land fast ice (Rink 1852:100; Krogh

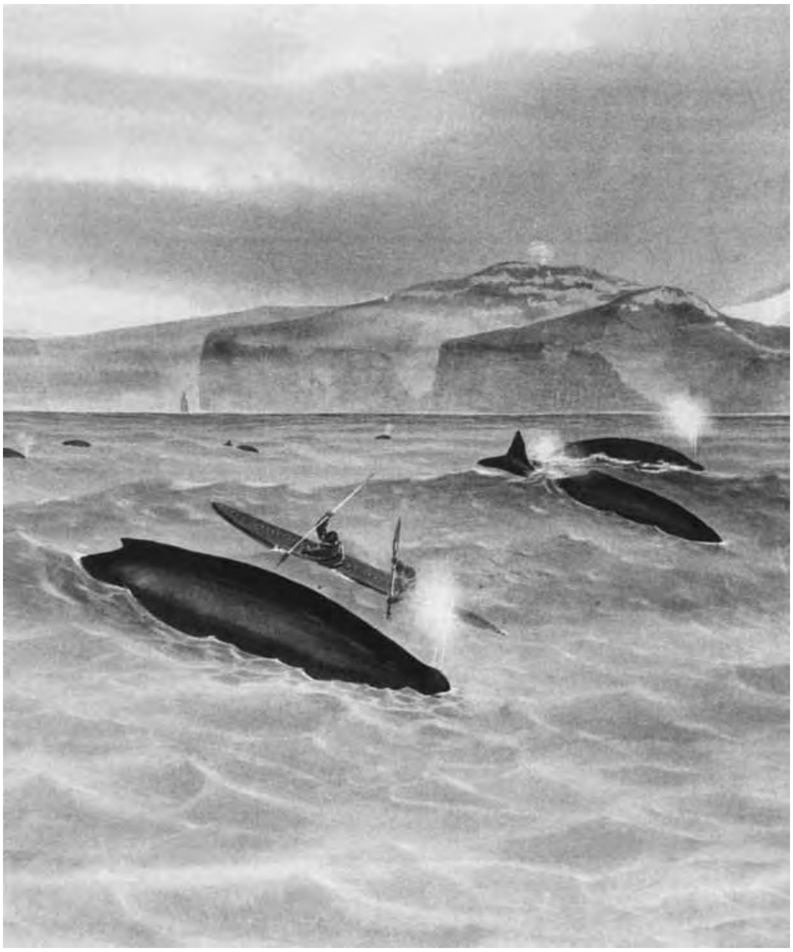


Fig. 9.20. Whaling from kayak in Alaskan waters (courtesy of the Smithsonian Institution).

1921:109; Porsild 1921:103; Kapel 1977a; Kasper Didrichsen, inf. 1986).

Well known localities where leads form at an early date and where large numbers of white whales congregate are the areas northwest of Tussaaq and between Tussaaq and Nuuk (Frederik Jensen, inf. 1982; Søren Frederiksen, Karl Olsvig inf. 1986), as well as the area west of Saarlat (Ane Møller, inf. 1986).

The whales disappear with the ice in early June (Porsild 1921:103; Kasper Didrichsen). In late October they return to the area and flocks of whales are seen migrating in and out of fjords and bays and through sounds and shallow runs feeding on fish. In December or January, when ice formation is starting, they once more move out of the district (Porsild 1921:103; Kapel 1977a; Boye Møller, Kasper Didrichsen, inf. 1986). The annual occurrence of spring migrating white whales is dependent on the ice conditions in Sydostbugten. If break up is in process the whales flock along ice edges and in leads in the outer parts of the bay, but if the ice cover is intact into early summer, the spring migrating whales may be prevented from entering the area. Also, if there is an unusually early break up, the spring migrating white whales may become more evenly dispersed than usual. The white whales are also very much affected by the appearance of killer whales. They simply disappear when they detect them. During freeze-up in late fall or in winter, substantial numbers of white whales may become trapped in small openings in the sea ice ("Sassat"), thus forming one of the most highly concentrated potential resources in Sydostbugten.

The white whale population is subjected to changes in numbers and distribution. Best documented are the changes that took place around 1920. Prior to 1920 they wintered off Southwest Greenland, but following the general warming of the West Greenland waters, the whales spent the winters further north. After 1920 wintering white whales were common in Disko Bay when ice conditions were favourable (Anon. 1944:625,632; Vibe 1967, 1981; Kapel 1977a). The timing of fall and spring migrations also changed. In fall they would come to the bay approximately one month later and they would leave approximately one month earlier (Hansen 1949:15; Vibe 1967:74, 1981). Heide-Jørgensen (1994:147) suggests that these changes in the distribution of white whales could also be a result of intensified exploitation involving nets and motorboats.

Narwhal

Coming from the summering grounds further north, narwhal arrive in Disko Bay approximately one month later than the white whales and they can be observed in small numbers in November and December (Winge 1902:513; Krogh 1921:109; Porsild 1921:227; Kapel 1977a; Boye Møller, inf. 1986). In spring, following break up, narwhal occur in the district (Krogh 1921:109). They are most common in the outer parts of the bay and they are generally considered relatively rare visitors in the Qasigiannguit district (Porsild 1921:103,293; Kapel 1977a; Kasper Didrichsen, inf. 1986; T. R. Larsen pers. comm.). From time to time flocks of narwhals are trapped by ice; more than a thousand whales may be trapped in this manner, but usually sassats number between 20 and 200 animals (Winge 1902; Porsild 1916; Kasper Didrichsen, inf. 1986). In Sydostbugten a recent and well documented narwhal entrapment occurred off Nuuk, where 45 narwhal were caught in 1982 (Siegstad and Heide-Jørgensen 1994).

Prior to 1920 narwhal wintered in Disko Bay in large numbers, but in the following years up until the 1950's the whales apparently shifted the wintering area to the north and they became less common in the bay. The situation was reversed in the 1960's and 1970's when the narwhals again showed up in larger numbers (Vibe 1967; Kapel 1977a).

Harbour porpoise

Disko Bay is the northernmost area regularly visited by the harbour porpoise. It occurs in the Qasigiannguit district from break up in May-June to September, with a peak occurrence in June, July and August (Kapel 1977a; Vibe 1981). The porpoises can be observed in shallow water close to shore and often females accompanied by their new-born are seen (Kasper Didrichsen, inf. 1986).

The sea off Tussaaq's northern coastline is known for its spring occurrence of porpoises, and the place name "Niisat", meaning harbour porpoise, testifies to its occurrence in that area (Olsvig, inf. 1986).

Other small whales

The bottlenose whale, the white-sided dolphin, the white-beaked dolphin and the pilot whale are all boreal species that spend the summer in the southern part of the Davis Strait (Vibe 1981). In periods when the Davis Strait experiences a greater influx of warm Atlantic water, these whales may show up in Disko Bay.

Small whale hunting

Two narwhal tusk fragments, one in the form of a needle case, reveal that this species was utilised by the inhabitants at Qeqertasussuk. At Qajaa narwhal bones have also been identified (Meldgaard 1983; Møhl 1986). White whale bones were not found at Qeqertasussuk, but from the Saqqaq Culture site Nipisat, white whale exploitation has been documented (Godtfredsen 1998).

Remains of white whale and narwhal are generally scarce on Pre-Dorset and Saqqaq sites (Savelle 1994) and it has been debated whether these people possessed the technology to undertake small whale hunting (Savelle 1994). However, with the present finds of boat remains and heavy lances, the equipment necessary for small whale hunting seems to have been available.

If we accept that small whales were actively hunted, then how do we explain the very limited faunal evidence for small whale exploitation at Qeqertasussuk? A reasonable explanation could be that the inhabitants at Qeqertasussuk focused their small whale hunt on spring migrating narwhal and probably also white whales which concentrate along the ice edge and in leads in the outer parts of Sydostbugten.

Considering that no other major resources are available in the area this early in spring, it seems likely that the inhabitants of Qeqertasussuk, during this period, moved to sites with good white whale hunting *e.g.* on Kitsissunnguit, along the coastline between Nuuk and Niaqornaarsuk Ilorleq, along the north coast of Tussaaq, or in the Ikamiut area. Several larger and smaller Saqqaq sites are located in this area and if conditions for preservation are good, this is probably where we can find the bone remains of narwhal and white whale hunted by the inhabitants of Qeqertasussuk.

A comparison with the relative importance of small whales in the subsistence economy of the nearby historic period settlement of Akulliit (1958-61) may provide further insight into small whale hunting at Qeqertasussuk (Figure 9.8). The hunters of Akulliit were skilled small whale hunters and whales were attractive game. Nevertheless they comprise only *ca.* 5% of the marine biomass harvested by the hunters. This percentage indicates that small whales, though significant, were never a cornerstone in the economy of hunting communities in the southeastern part of Disko Bay.

Porpoise hunting

The harbour porpoise is represented by seven intact post cranial bones, and six of these were articulated when found (Table 9.10). This indicates that summering porpoises were caught probably from boats in the vicinity of the site, but very low bone frequency of the species compared to the similar sized seal suggests that they were relatively rare. Porpoise were also hunted at the Saqqaq site Nipisat in the Sisimiut district (Godtfredsen 1998).

Bird hunting

Birds were an important element in the diet. This is shown both by the numerous light weight bird darts found during excavation (Grønnow 1990, 1996) and by the bird bones that represent approximately 36% of the total faunal sample (Table 9.2).

Brünnich's guillemot

In April, May or June, depending on the ice conditions, flocks of guillemots appear in Qasigiannguit district (Lars Johansen, inf. 1986; T. R. Larsen pers. com.). In June they move to their nesting grounds in northern Disko Bay, or to nesting grounds further north. The guillemot prefers to nest on steep cliffs that face the open sea. They avoid more protected locations in fjords and bays (Salomonsen and Johansen 1950). Good localities are not found in the Qasigiannguit district and consequently no breeding colonies are found in this area, however there is a major colony on Arveprinsens Ejland in the northeastern part of Disko Bay and a few small "satellite" colonies close by (Salomonsen and Johansen 1950; Salomonsen 1967; Boertmann *et al.* 1996).

In October the birds reappear in the Qasigiannguit district in quite large numbers on their southbound migration towards their wintering quarters. The adult guillemots swim south because they are in the process of changing their flight-feathers (Salomonsen and Johansen 1950; Kampp 1988). The last birds disappear from the district when sea ice formation starts (Kasper Didrichsen, inf. 1986). During periods with rapid ice formation, flocks of guillemots may become trapped in leads and openings in the sea ice where they finally perish (Müller 1906:134; Porsild 1916:54; Krogh and Ostermann 1921:175; Ostermann *et al.* 1921:148).

The annual occurrence of fall migrating guillemots in Sydostbugten is partly dependant upon weather conditions. In the fall of 1988 the guillemot flocks appeared later than normal, probably as a result of frequent southwesterly storms (T. R. Larsen pers. comm.).

Next to the little auk, Brünnich's guillemot is the alcid that is easiest to approach at sea. Especially when feeding in large flocks they do not take much notice of approaching hunters (Fabricius 1818b:247; Tobiassen 1964:65). The young-of-the-year are particularly easy to get within reach of (Salomonsen 1967; Kampp 1988).

Brünnich's guillemot hunting at Qeqertasussuk

A minimum of 8,769 guillemots were brought back to Qeqertasussuk. A guillemot weighs between 1.1 and 1.2 kilos, and the guillemots thus represent *ca.* 9.6 tons, live weight (Table 9.5).

The spring migration of guillemots is not very noticeable and a late ice cover may even deflect the birds so they only occur around Qeqertasussuk in very limited numbers. However, fall migrations are usually much more conspicuous and the birds stay in the area for a longer period of time (Figure 9.21). Accordingly, the bulk of the guillemots were presumably hunted by boat in fall, when numerous flocks of fledging guillemots are found feeding in the vicinity of the site.

The guillemot is the most important game bird throughout the habitation period represented by between one and two thirds of the total number of bird bones at the site (Figures 9.1 and 9.22). Even though the over all importance of bird hunting declines in the latest habitation period, the relative importance of the guillemot doubles in that same period. This tendency to specialization is also reflected in the increased focus on adult harp seal hunting.

Brünnich's guillemot was also hunted by the inhabitants of the coastal Saqqaq sites Nipisat I (Godtfredsen 1996, 1998), and Qajaa (Møhl 1986) but they only played an insignificant role in the economy as compared to Qeqertasussuk.

Fig. 9.21. Brünnich's guillemot swimming with razorbills. Brünnich´s guillemot pass through the district during their spring and fall migrations. It was the most important bird on the Qeqertasussuk menu (photo: Benny Gensbøl).

The fulmar

The fulmar arrives at the breeding sites in Disko Bay in early April when the sea ice is still intact. It breeds in large numbers on the bird cliffs of Qeqertarsuaq and a small colony is found in Orpissooq (Berthelsen 1921; Salomonsen and Johansen 1950; Salomonsen 1967). It often breeds in association with gulls, alcids and other sea birds. It prefers to nest on the upper parts of the bird cliffs (Salomonsen and Johansen 1950).

During the breeding period fulmars can be seen feeding in large flocks far away from the breeding colonies. In Qasigiannguit district these birds are especially common during the capelin season in June (Kasper Didrichsen, inf. 1986). The Qoornua Sound south of Qeqertasussuk and the mouth of Orpissooq are well known for their large congregations of fulmars, sometimes numbering thousands of birds (Søren and Kathrine Thorning, inf. 1986).

In early September the adult birds leave the bay. At the same time the juveniles leave the colonies, but they stay behind in the vicinity for a month or so before leaving the bay entirely (Salomonsen 1967).

The fulmar is known as the least shy of all Greenlandic birds (Fabricius 1818b:251; Müller 1906), and even intensive hunting does not seem to influence its behaviour (Berthelsen 1921:160). Juvenile birds that have just left their nests are particularly easy to approach (Salomonsen 1967).

Fulmar hunting at Qeqertasussuk

A minimum of 6,630 fulmars were killed by the hunters of Qeqertasussuk (Table 9.5). A fulmar weighs

Fig. 9.22. Articulated skeleton of Brünnich´s guillemot in the midden deposits (photo: Morten Meldgaard).

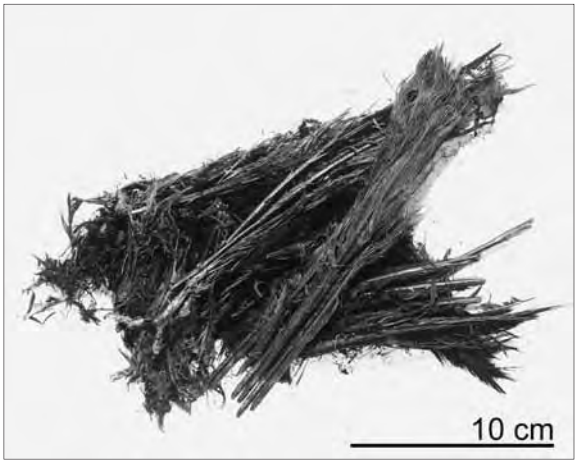


Fig. 9.23. Bird feathers were also well preserved in the midden deposits (photo: Geert Brovad).

ca. 0.75 kilos and the birds caught represent approximately 4.9 tons, live weight.

Fulmar hunting was very important at Qeqertasussuk and represented in the early periods (FC III and II) *ca.* one third of the bird bag (Figures 9.1 and 9.24). However, in the late habitation period fulmar hunting declines by 50% relative to other bird hunting (Figure 9.1). This could be caused either by a change in site seasonality or in a change in the availability of the birds.

The majority of the fulmars killed at the site were probably taken during summer when concentrations are highest. The birds are numerous in Qoornua close to the site, and they have been easily accessible by boat using *e.g.* the bird dart or baited hooks. It may also have been possible to catch them from shore as in historical times using bola-type devices (Berthelsen 1921).

Fig. 9.24. Articulated fulmar wing with the feathers still visible. This type of finds allows a more detailed analysis of game processing (photo: Geert Brovad).

Fulmars were also hunted by the inhabitants of the coastal Saqqaq sites of Qajaa (Møhl 1986) and Nipisat I (Godtfredsen 1996, 1998), but only in very small numbers.

The little auk

The little auk is a high arctic bird but occasionally and in small numbers it breeds in colonies on skerries south to Disko Bay. The colonies number from 10 to 50 pairs. In Qasigiannguit district a colony is found on Saattuarsuit west of Kitsissunnguit (Salomonsen and Johansen 1950; Kasper Didrichsen and Lars Johansen, inf. 1986). These birds appear in late April and they leave for their southern wintering grounds in August (Salomonsen and Johansen 1950).

From October until the ice forms, flocks of migrating little auks from the huge breeding colonies in the Thule district can be seen in the area (Winge 1899; Kasper Didrichsen, inf. 1986). The auks can sometimes be surprised by the quick formation of sea ice and flocks may get caught in leads and openings in the ice and perish there (Fabricius 1818b:246; Müller 1906: 139).

It is the least shy of the alcids and appears very docile and "tame" as Fabricius noted (1818b:246) (Müller 1906:139).

Little auk hunting at Qeqertasussuk

A minimum of 1634 little auks were brought to Qeqertasussuk. Auks weigh 100-200 grams, so despite their high frequency, they only represent around 245 kilos, live weight (Figure 9.1, Table 9.5).

Little auks were probably all hunted in fall from October to December and the majority were most likely taken from boats in the vicinity of the site. Even though bird hunting as such declines dramatically around 2000 BC, the relative importance of this small bird remains more or less the same.

Little auks were also hunted at the Saqqaq sites Nipisat I: 18 bone fragments (Godtfredsen 1998), and Qajaa : 2 bone fragments (Møhl 1986). These very low numbers, both in absolute and relative terms, are in contrast to the situation at Qeqertasussuk where little auk bones were counted by the thousands. This difference probably reflect differences in availability of the birds and shows how two sites such as Qajaa and Qeqertasussuk only *ca.* 70 kilometres apart each have their local and unique resource base.

The ptarmigan

The ptarmigan is common throughout Qasigiannguit district, even on islands off the coast (Figure 9.25). In summer it seems to be most common in the interior while it tends to be more common towards the coast in winter. During the breeding period ptarmigans are seen in pairs while they may congregate in small flocks in winter and in spring flocks of more than a hundred feeding birds are not unusual (Müller 1906; Salomonsen and Johansen 1950).

Generally the ptarmigan is a curious and tame bird that is very easy to approach (Fabricius 1780; Salomonsen and Johansen 1950).

The ptarmigan populations fluctuate in size. Every ten years or so they appear in enormous numbers and flocks of more than a thousand birds have been observed migrating through the Qasigiannguit district. From the end of March to the end of April 1950 thousands of ptarmigans were seen moving north through the Disko Bay districts. These migrating birds were extraordinarily tame and easy to get at (Müller 1906:52; Braestrup 1941:75; Salomonsen and Johansen 1950).

Fig. 9.25. Ptarmigan are found year-round in the region. They are generally quite easy to approach (photo: Thomas Berg).

Ptarmigan hunting at Qeqertasussuk

Ptarmigan represent *ca.* 10% of the bird bone sample (Table 9.2) and in absolute numbers the hunters brought home at least 1168 birds amounting to a minimum of 584 kilos or less than 1% of the biomass represented at the site (Table 9.5). From a purely economic point of view it could thus be said that ptarmigan played a very small role at Qeqertasussuk. This also seems to be the case at other Saqqaq sites such as Qajaa with ptarmigan making up *ca.* 3% of the bird bone sample (Møhl 1986) and at Nipisat I with less than 1% (Godtfredsen 1998).

There is some temporal variation in the relative importance of ptarmigan hunting: from *ca.* 5% in the early period (FC-III) it rises to *ca.* 14% in the middle period (FC-II) and drops to *ca.* 1% in the latest period (FC-I) (Figure 9.1). It is likely that these changes reflect changes in the size and availability of the ptarmigan population and, knowing the natural fluctuations in the ptarmigan populations, one could speculate that the middle period increase in ptarmigan hunting may have coincided with high natural levels in the ptarmigan population some time between 2100 and 1900 BC.

In many instances gizzard-stones were found in situ in the midden deposits as were articulated ptarmigan bones, indicating that intestines and bird carcasses were discarded after having been processed (Figures 9.26 and 9.27).

The glaucous gull

The glaucous gull arrives at the breeding localities in late April. It breeds primarily on steep cliffs, but it may also nest on small islands. It is more common than the Iceland gull and the colonies may number from 20 up to 1000 pairs (Figure 9.28). They often breed in association with gulls, alcids, cormorants, kittiwakes and fulmars, but colonies consisting of glaucous gulls only

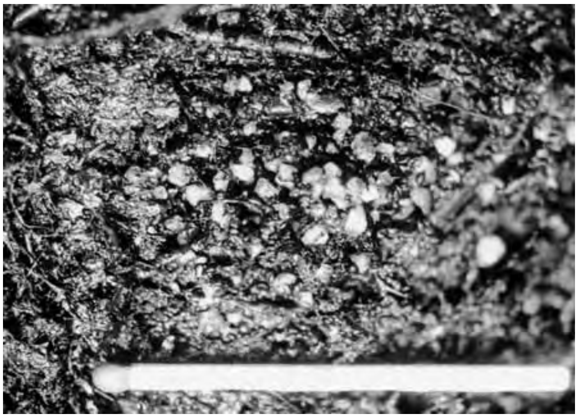


Fig. 9.26. Stones from ptarmigan crops in situ in midden deposits (photo: Morten Meldgaard).

are also known. They prefer the upper parts of the bird cliffs for their nests (Salomonsen and Johansen 1950; Riget 1985).

The immature gulls are often found in flocks with immature Iceland gulls along the coastal stretches of the bay. In August the juvenile gulls leave their nests, and in November they all migrate south along the West Greenland coast. A few may winter in the area if there is open water (Winge 1899; Salomonsen and Johansen 1950; Salomonsen 1967).

The glaucous gulls are more shy than the Iceland gulls, but the young-of-the-year are equally easy to approach (Müller 1906; Salomonsen 1967).

Fig. 9.27. Bird crop stone collection from Qeqertasussuk (photo: Geert Brovad).

Iceland gull

Iceland gulls appear at the breeding colonies in Qasigiannguit district in late April while the sea ice is still present. The gulls choose steep cliffs as their breeding sites. The colonies are usually quite small, numbering between five and a few hundred pairs (Salomonsen and Johansen 1950). They often breed in association with other species *e.g.* glaucous gulls, kittiwake and alcids. They prefer to breed above the kittiwakes and below the glaucous gulls (Salomonsen and Johansen 1950; Riget 1985). During the breeding period, the immature gulls congregate in flocks along the coasts. In October and primarily in November the gulls migrate south. However a few birds may stay behind and spend the winter where there are leads or open water (Salomonsen and Johansen 1950; Salomonsen 1967).

The Iceland gulls are generally easier to approach than the glaucous gull, and especially the juvenile birds are quite tame (Müller 1906; Berthelsen 1921:165; Salomonsen and Johansen 1950; Salomonsen 1967).

Glaucous and Iceland gull hunting at Qeqertasussuk

Glaucous gulls were hunted on a regular basis throughout the habitation period. They represent *ca.* 8% of the bird bone sample with only little variation between faunal components (Table 9.2).

Looking at both glaucous and Iceland gulls (ca. 2% of the bird bone sample) in absolute figures at least 2000 birds were brought to the site representing *ca.* 1% or 2.8 tons of the total biomass (Table 9.5). All individuals were adult birds.

At the Saqqaq site Qajaa, situated 50 kilometres north of Qeqertasussuk by the glacier fjord Jakobshavn Isfjord, gulls represent *ca.* 75% of the bird bone sample (Møhl 1986), while at the Saqqaq site Nipisat I, near Sisimiut gulls made up *ca.* 60% of the bird bag (Godtfredsen 1998). At Qajaa all gulls were adult individuals, while at Nipisat I more than 80% were chicks and immature birds (Godtfredsen 1998). It seems there could be two explanations for the absolute dominance of adult birds at the two Disko Bay sites: (1) the gulls could have been taken in a different season, presumably in the fall and (2) the gulls could have been

Fig. 9.28. Bird cliff dominated by nesting kittiwakes, Qoornua Sound. There are several bird cliffs in Sydostbugten. Historically they have housed large populations of nesting Brünnich´s guillemots, black guillemots, glaucous gulls, Iceland gulls, and cormorants (photo: Geert Brovad).

taken at some distance from the bird cliffs where the gulls nest. A combination of the two is also plausible.

It thus seems reasonable to believe that the gulls were taken locally in the vicinity of the site probably often as a by-catch when hunting other game. They may have been taken with bird darts, but lures and nooses could also have been employed. The knot technology and the baleen material at hand was certainly sufficient to produce self-catching gull traps known from historical times (Birket Smith 1924) (Figure 9.34).

Møhl (1986) noted that almost all epiphyses of the wing bones of gulls at Qajaa were bitten off, presumably to get at the marrow. This is also characteristic of the gull bones from Nipisat I (Godtfredsen 1996) and from Qeqertasussuk. It is easy to imagine how the marrow is easily sucked out of the bone when it is deprived of its epiphyses, however sometimes some marrow may get stuck and a simple marrow extraction tool may be devised out of *e.g.* the slender radius, nicely suited for pressing a marrow tit-bit into a waiting mouth. Finds of so called *inserted bird bones* may be the archaeological documentation of just such a practice. They have been reported from Qajaa, several were found at Qeqertasussuk (Figure 9.33), and they are also known from Thule Culture sites (*e.g.* Mathiassen 1931; Gulløv 1997:342).

Great shearwater

The great shearwater is common in the offshore parts of southern Davis Strait up to approximately 66°N (ca. to Maniitsoq (Sukkertoppen)). It arrives in June and can be seen especially on the West Greenland banks. In August during moulting they congregate in large flocks among the outer islands and in fjord mouths, and in late September they once more head for the southern Atlantic Ocean (Salomonsen and Johansen 1950; Salomonsen 1967). The shearwater is very easy to approach when moulting (Fabricius 1780, 1818b:251; Müller 1906:79; Salomonsen and Johansen 1950:43).

Shearwater hunting at Qeqertasussuk

The shearwater is only represented by 4 bones in the faunal material indicating that shearwaters only occa-

Fig. 9.29. Great auk in winter dress. This mounted great auk was caught by a kayak hunter off Qeqertarsuatsiaat, Central West Greenland in 1815 (photo: Geert Brovad).

Fig. 9.30. Wing bones from a great auk, the northernmost find of this extinct bird in the Western Atlantic (photo: Geert Brovad).

sionally were part of the menu (Table 9.12). The shearwater's occurrence at the northern fringe of their present range fits into the picture of a slightly warmer than present marine environment. The birds were probably taken by boat while moulting in the area.

Shearwaters were also hunted at the Saqqaq site Nipisat I but in limited numbers.

Black Guillemot

The black guillemot arrives in Disko Bay in April, and in June it can be found commonly breeding in crevices in steep cliffs along the rocky shores of the bay. It breeds in small groups of a few pairs together or in colonies of up to several hundred pairs, often in association with gulls, kittiwakes, cormorants or other alcids. For nesting it prefers the lowest parts of the bird cliffs just above the sea surface (Salomonsen and Johansen 1950). The guillemot stays in the area until November-December, when most move south towards the wintering grounds, but some stay behind until forced out by the ice. It can even be found wintering in the district in permanently open leads (Müller 1906; Salomonsen and Johansen 1950; Salomonsen 1967). The adults are the most shy of alcids, whereas the young-of-the-year are quite tame, and can rather easily be approached (Fabricius 1818b:249; Müller 1906:137).

Black guillemot hunting at Qeqertasussuk

The Black guillemot comprises approximately 3% of the bird bone sample (Table 9.2). Probably these birds were taken from boat along the rocky shores of Qoornua Sound in the summer.

Even though bird hunting in general declines after *ca.* 1900 BC the black guillemots relative importance increases somewhat (Table 9.2). This relative increase accompanies a relative increase in the hunting of Brünnich's guillemot.

Fig. 9.31. Flocks of kittiwakes are encountered feeding in the bay throughout the summer (photo: Morten Meldgaard).

Great Auk

This now extinct species wintered in historical times on the West Greenland banks northwards to Maniitsoq (Sukkertoppen) (Figure 9.29). In prehistoric times the great auk was found further north along the coast, and it even reached Disko Bay. It arrived from breeding grounds near Iceland or Newfoundland in September and stayed on the banks until February. The auks were primarily seen in coastal waters during or following spells of stormy weather. It probably bred in small numbers in the Paamiut area in the late 18th century (Fabricius 1780; Winge 1899; Meldgaard 1988a). It was an excellent diver and especially the adults were quite difficult to get close to (Fabricius 1780; Meldgaard 1988a).

Great auk hunting at Qeqertasussuk

Three great auk wing bones, probably from the same individual, were found in test pit 25/20 (Figure 9.30). As a bird of the open sea this auk was probably taken from a boat with a bird dart in Qoornua or the more open parts of Sydostbugten.

At the Saqqaq site Nipisat I situated closer to the Great Auk's core wintering grounds, 56 great auk bones were found (Godtfredsen 1998). At Qajaa none were found (Møhl 1986).

Great auks were probably taken when the opportunity presented itself, but being an ocean going bird and a very strong diver and swimmer, the availability of this meaty bird was always low and it only rarely occurred on the menu.

Kittiwake

Kittiwakes appear in Disko Bay in late April. Approximately 90% of the population breeds in colonies in the northeastern part of the bay and only 10% in the central and southern parts. This may be due to food competition between kittiwakes and arctic terns that breed in enormous numbers in the southern part of the bay (Salomonsen 1967). In the early breeding season in May and June flocks of kittiwakes are often seen feeding in Qasigiannguit district (Figure 9.31), but in July they spend more time in the vicinity of the colonies. The colonies that are situated on steep cliffs facing the sea are usually quite small, most numbering less than 1000 pairs. Kittiwakes usually nest in association with gulls and alcids, and they primarily use the lower parts of the bird cliffs (Salomonsen and Johansen 1950; Riget 1985).

In August the young-of-the-year leave the nests and they are seen in flocks in most parts of the district. In late August-September first the adults and then the juveniles disperse and move to the outer coasts and finally, in late October-November, they leave Greenland (Müller 1906; Bertelsen 1921; Salomonsen and Johansen 1950; Salomonsen 1967). The kittiwakes are subjected to changes in the timing of breeding and the time of departure from their summering area (Salomonsen 1948, 1950). The kittiwake is more easy to approach than the gulls and juveniles that have recently left their nests are especially easy to get at (Müller 1906; Salomonsen and Johansen 1950; Salomonsen 1967).

Today kittiwakes are common in Sydostbugten. They nest in relatively small numbers, but throughout summer and until departure in October, flocks of immature birds as well as feeding adults, and later in the season young-of-the-year, are seen everywhere. The glaucous gull and the Iceland gull are present in larger numbers, and they dominate the bird cliffs in the area, but still the kittiwake is a conspicuous element of the gull fauna in Sydostbugten.

Kittiwake hunting at Qeqertasussuk

With the information presented above in mind, it is curious that the kittiwakes only represent 0.1% of the bird bone sample at Qeqertasussuk compared to the larger gull species' 10% (Table 9.2). The same low frequency is seen in the material from the contemporary site Qajaa at Jakobshavn Isfjord. Here 0.4% of the bird bone samples were kittiwakes, while 75% were from larger gulls (Møhl 1986).

In contrast, the historic site Sermermiut, which also is located at Jakobshavn Isfjord in a similar ecological setting to Qajaa, produced a bird bone sample where 36% represented kittiwakes and 60% larger gulls (Møbjerg and Caning 1986).

The most reasonable explanation for the relatively low frequency of kittiwake bones at Qeqertasussuk and Qajaa would seem to be that the birds, at least locally, were more scarce at the time.

At the Saqqaq site Nipisat I kittiwakes were also hunted and here they constitute *ca.* 4% of the bird bone sample (Godtfredsen 1998).

Eider-duck

As soon as the ice begins to break up in April-May eiders appear in the district. Some of these birds continue north later on, but most come to breed. Historically they bred in very large numbers on many islands in the Qasigiannguit district, often in association with large colonies of arctic terns (Porsild 1921:103; Salomonsen and Johansen 1950; Boye Møller, inf. 1986). They have also nested below the bird cliff in Tunutta Imaa (Boye Møller, Søren and Kathrine Thorning, inf. 1986).

As soon as the period of egg laying is over, the males disappear from the nesting sites and gather in flocks often together with non-breeding birds. In late July and early August the males loose their flight-feathers and retreat to sheltered bays and fjords where they can be found in large flocks. Following hatching the females and their offspring can be seen along the shores of the bay where they also tend to congregate in flocks. They moult in September and early October (Berthelsen 1921; Salomonsen and Johansen 1950; Salomonsen 1967; Lars Johansen, inf. 1986).

Well known localities where eiders congregate in large flocks in fall are the shallow water areas north of Kitsissunnguit and west of Qeqertasussuk near Ikamiut (Boye Møller, Lars Johansen, inf. 1986).

The eider is generally a shy bird but can be approached when heavy with food (especially when feeding in flocks) and when moulting. The young-of-the-year are quite tame and easy to capture in September and October (Fabricius 1793; Müller 1906).

Eider duck hunting at Qeqertasussuk

Assuming that the major part of the eider/mallard bone sample are eider-duck bones, they constitute less than 1% of the bird bone sample identified from the site (Table 9.12). These birds were probably taken by boat in the summer half of the year. This is in contrast to the neighbouring site Qajaa, where eider-ducks represent 7% of the bird bone sample, and the Nipisat I site where they represent 23%. In both cases the sites are closer to more sheltered and shallow marine environments that are preferred by the birds. The low incidence of eider-ducks at Qeqertasussuk also indirectly indicates that the hunters from this site mostly caught their birds in the vicinity of the site where deeper waters prevail, and seldom went birding in the sheltered fjords of Orpissooq or Kangersuneq or the shallow areas around the eastern island of Qeqertasussuk.

King eider

The king eider is a true high arctic bird, and it does not breed in Disko Bay. It is however seen during its annual migrations. In April and May the birds move north from their wintering grounds in the open water areas off West Greenland but they are not encountered in the bay. The immature birds migrate north later in spring and many stay behind and can seen in Disko Bay during the summer.

The male eiders reappear in late July and early August and they congregate together with the immature birds in enormous flocks in the central part of Disko Bay near Qeqertarsuaq. In September, October and early November when these birds undertake their southward migration, they are regularly seen in the Qasigiannguit district. They disappear when sea ice formation starts (Winge 1899; Salomonsen and Johansen 1950; Salomonsen 1967; Lars Johansen, inf. 1986).

Their behaviour towards man is much the same as that of the eider-duck (Fabricius 1780, 1793; Müller 1906).

King eider hunting at Qeqertasussuk

The king eider was only rarely on the menu at Qeqertasussuk. One bone has been identified from the early habitation period (FC-III) (Table 9.12). But, as their occurrence in Disko Bay was probably quite limited temporally, it is reasonable to assume that they were hunted by boat in July/August in the more open parts of the sea surrounding Qeqertasussuk.

Mallard

The mallard arrives in Disko Bay in April. It breeds primarily in the interior, at the heads of fjords and in freshwater lakes and streams, but is also found nesting on islands (*e.g.* Kitsissunnguit) in the Qasigiannguit district (Salomonsen and Johansen 1950).

In mid-June the drakes leave the nesting females and are seen in small flocks along the coasts. They moult in July and early August, while the females loose their flight feathers at the nesting sites in August. In September the females and their off-spring leave the interior and mallards are seen more commonly in the bay until just before freeze-up in November-December (Salomonsen and Johansen 1950; Salomonsen 1967). It is a shy bird that is approached most easily during moulting (Fabricius 1780; Müller 1906:83,85).

Mallard hunting at Qeqertasussuk

A single bone fragment found in the oldest cultural layers (FC-III) testifies that the tasty mallard was hunted and eaten (Table 9.12). However, it seems that their availability was very limited and, as was the case with the eider-duck, this may well be due to the fact that fowling was primarily undertaken in the immediate vicinity of the site, which is not prime mallard country. At the Saqqaq site Nipisat I mallards were hunted more frequently, which could be explained by a locally good mallard habitat with low relief islands and protected waters.

Red-breasted merganser

The red-breasted merganser appears in Disko Bay in the first half of May. The majority of breeding birds nest on islands in the bay often in association with eider-duck and arctic tern colonies (Salomonsen and Johansen 1950). In the Qasigiannguit district the merganser has been found to breed on practically all small islands (Kristian Jeremiassen, Søren and Kathrine Thorning, inf. 1986). They also breed in the interior by larger lakes (Salomonsen and Johansen 1950).

In late June the males leave the nesting females and gather in small flocks along the coasts where they moult in August. In October – November they migrate south to their wintering grounds in the open-water areas off West Greenland (Fabricius 1780; Salomonsen and Johansen 1950; Salomonsen 1967).

It is a shy bird and quite difficult to approach (Fabricius 1818b; Müller 1906:113).

Merganser hunting at Qeqertasussuk

Only one merganser bone was retrieved from the middle layer (FC-II) showing that this bird on occasion also found its way into the pot (Table 9.12). The reason for its low representation is probably that, although it is common in the area, the population has probably never been very dense. Furthermore, it is quite shy, diminishing its availability to the Qeqertasussuk hunters.

The red-breasted merganser has not been found on other Saqqaq sites in West Greenland.

The white-fronted goose

White-fronted geese usually come to their inland breeding sites in late April or early May. If snow still covers the nesting sites they will often move to the coast and wait there for the snow to melt. It breeds by lakes in the interior parts of Central West Greenland. In July and August, when the goslings are well grown, the adults moult and often several pairs can be seen moulting together in the same lake. The immature geese congregate and moult in large flocks on interior lakes in June, and in July and August they move around in the area before they start their southward migration. In September all the geese migrate directly across the Inland Ice towards their winter quarters in Ireland (Müller 1906; Fencker 1950; Salomonsen and Johansen 1950; Salomonsen 1967).

The geese breed in quite large numbers throughout the interior of Qasigiannguit district. In a number of lakes in the interior, congregations of moulting geese occur year after year. Such localities are the lakes east of Orpissooq (Frederik Jensen, inf. 1982; Ane Møller, inf. 1986), the lake Kangersorngup Tasia near the head of Kangersuneq (Boye Møller, inf. 1986) the lakes between the head of Eqaluit and Tasiusaq (Bertelsen 1921:152; Boye Møller, inf. 1986), and lakes in Appannguit south of Sydostbugten (Bertelsen 1921:152).

The geese are extremely careful and shy, and it is only possible to get within reach of them when they are moulting (Müller 1906; Bertelsen 1921).

Goose hunting near Qeqertasussuk

One wing bone is the only testimony to goose hunting at Qeqertasussuk. It was found in the early habitation layer (FC-III) (Table 9.12). It is reasonable to believe that this bone stems from a goose that was hunted between June and September on one of the interior lakes east or south of Qeqertasussuk and as such is one of the few faunal indications of hunting excursions undertaken at more distant localities.

Red-throated diver

The red-throated diver is a common breeding bird in Disko Bay. It arrives in early May, and it can be seen in leads and openings in the sea ice waiting for the ice on inland ponds and lakes to melt. It prefers small shallow freshwater lakes and there will normally be only one pair per lake. The nesting birds often fly to nearby fjords to feed. In august, when the young-of-the-year can fly they move to the sea. The non-breeding birds spend the summer in small flocks along the coast. Fall migrations take place in September and October (Salomonsen and Johansen 1950; Salomonsen 1967). It is a shy bird quite difficult to approach (Müller 1906:129; Fabricius 1818b).

Red-throated diver hunting at Qeqertasussuk

A single bone fragment belonging to the red-throated diver was excavated from the early habitation level (FC-III) (Table 9.12). Only rarely was this bird on the menu at Qeqertasussuk, probably as a result of a generally low availability, which again is due both to its low population levels and its shy nature. This species was also caught by the inhabitants of the Saqqaq site Nipisat I (Godtfredsen 1998).

Great northern diver

The great northern diver comes to Disko Bay in mid May. Whilst waiting for the ice to melt on the lakes of the interior, it is seen in leads and openings of the sea ice. It breeds in large lakes further inland than the red-throated diver and is less common. It appears in fjords and bays in the breeding season during its regular foraging excursions. The divers will stay in the lakes until freeze-up and then move to sheltered fjords and bays for a short time until they migrate south in October (Müller 1906; Salomonsen and Johansen 1950; Salomonsen 1967). It is among the most shy of all Greenlandic birds and very difficult to get within close range of (Fabricius 1818b; Müller 1906:124).

Great northern diver hunting at Qeqertasussuk

Only 5 bone fragments from this magnificent bird were found at Qeqertasussuk in the midden's early habitation level (FC-III) (Table 9.12). As with the red-throated diver, the inland nature of the great northern makes its availability in the vicinity of Qeqertasussuk very low. On top of this, it is a very fast and shy bird, making it a difficult target for the hunter. Great northern divers were also taken at Nipisat I (Godtfredsen 1998).

Raven

The raven is a common bird in Qasigiannguit district. During the breeding season from February to July it is found nesting both in the interior and along the coasts where it is often associated with the larger bird cliffs. In August the young ravens congregate in flocks and gradually move south, but many especially adult birds stay in the district throughout the winter. Where there are concentrations of food, *e.g.* whale carcasses or kitchen middens large flocks of ravens may be attracted (Winge 1899; Müller 1906; Salomonsen and Johansen 1950; Salomonsen 1967). It is a very alert bird and difficult to approach (Salomonsen and Johansen 1950).

Raven hunting at Qeqertasussuk

Raven bones compose less than 1% of the bird bones sample and it is present in all habitation levels (Table 9.2). No doubt the midden refuse at Qeqertasussuk presented a great temptation to the local raven population and many a morning the inhabitants must have awoken to the hoarse shrieks of ravens fighting over scraps from the meals of past days. These birds always run the risk of being killed.

Raven bones are a small but consistent element of faunal samples of Inuit sites in West Greenland such as Qajaa (Møhl 1986), Nipisat I (Godtfredsen 1998) and Sermermiut (Møbjerg and Caning 1986). Probably they tell the same story as do the birds that today hover above the municipal dumps of West Greenland.

Birds we did not find

A number of species such as razorbill, arctic skua, gyrfalcon and great cormorant, which we know from other Saqqaq sites, were available and hunted in West Greenland (Møhl 1972; Godtfredsen 1998), but are not represented in the faunal material at Qeqertasussuk. This is probably due to the fact that the availability of these and other bird species was generally low. Therefore, their absence in the faunal assemblage at Qeqertasussuk is a matter of chance.

Fig. 9.32. Tern eggs. Historically the luxuriantly vegetated islands of Sydostbugten housed some of the worlds largest colonies of arctic terns. The eggs are easy to collect and form a tasty and nutritious snack (photo: Morten Meldgaard).

Bird hunting at Qeqertasussuk

The importance of fowling

Bird bones comprise approximately 36% of the total faunal sample (Figure 9.1, Table 9.2) and of this sample three bird species represent 75%; Brünnich's guillemot (37%), fulmar (25%), and little auk (13%). The remaining ten species (Table 9.2) represent 25% of the sample.

Bird hunting was apparently more intensive during the first 500 years of habitation with 40 to 50% of the bone material representing bird bones (Figure 9.1, Table 9.2). During the later period however bird bones represent less than 20% of the material, indicating a general decline in fowling.

There is a complete lack of egg remains in the midden deposits. But this should not automatically be taken as a proof of lack of egg collecting. Rather, it reflects lack of preservation in the slightly acidic midden soil. Also, terns eggs, which were probably abundant in the area, are so thin shelled that they don't store well and accordingly it is to be expected that they were often eaten at the collecting site (Figure 9.32).

Often bird bones were found articulated in the form of complete wings, feet or complete trunks. In a few cases the feathers were found in place at the wing bones (Figure 9.24). No quantitative study has yet been undertaken of the articulated bones but no doubt much can be learned about flaying techniques and meat processing. Such a study might also reveal to

Fig. 9.33. Inserted bird bones. Probably the slender radius was used to extract a tit-bit of marrow from the ulna (photo: Geert Brovad).

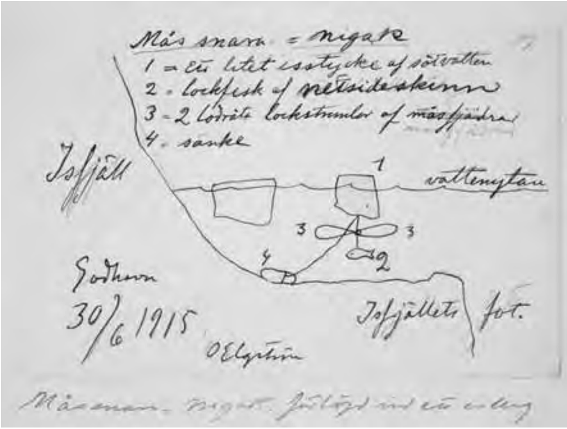


Fig. 9.34. Many contraptions have been designed to lure and catch birds. This gull snare placed on a floating ice berg was documented by the Swedish artist Ossian Elgström in 1915: (1) A small piece of freshwater ice, (2) fish lure made of ringed seal skin, (3) two snare loops made from gulls feathers, (4) weight (courtesy of Folkens Museum, Stockholm).

what extent bird skins were used for garments, blankets and other purposes.

Bird hunting in Qoornua Sound

The top three species of birds that dominate the bird bone sample, Brünnich's guillemot, little auk and fulmar, are all social birds that feed in flocks on deep water in the sounds and open parts of Sydostbugten. At the same time, there is a very low overall percentage of birds such as common eider, merganser and mallard that are typically found feeding in shallow and protected waters *e.g.* at the heads of the fjords and in small bays and inlets. This is substantiated by the fact that a bird such as the old squaw, which we know was hunted at Nipisat I (Godtfredsen 1998) and which has the same general behaviour as the above mentioned species, is absent from the faunal record at Qeqertasussuk.

It is also remarkable that no juvenile bird bones were identified and only in very few cases were bones with slightly juvenile characteristics found. This indicates that only little hunting was done at the nesting sites during breeding. In comparison Godtfredsen (1996, 1998) found numerous juvenile bird bones at the Saqqaq site Nipisat in the Sisimiut district. This again indicates that bird hunting at Qeqertasussuk only rarely took place near the bird cliffs which probably existed along the south coast of Qoornua and in the fjords of Kangersuneq and Qoornua.

Based on these observations it seems plausible that most fowling undertaken by the Qeqertasussuk hunters took place in the deep Qoornua Sound in the vicinity of the site or north of the island in the open parts of Sydostbugten (Figure 10.5).

This procurement pattern, where most of the birds were taken within a limited geographical area close to the site, is also recognisable at Qajaa (Møhl 1986) where gulls were the prime targets.

Bird hunting excursions

The find of a white-fronted goose gives us an indication of bird hunting excursions to the interior and thus suggests that Qeqertasussuk was part of a hunting camp system. Also, the many ptarmigan bones probably represent birds taken on the mainland, as only a few pairs of ptarmigan have been able to sustain themselves in the site's immediate surroundings.

Fowling season

Fulmars were probably taken in July and August before leaving the bay in September, while Brünnich's guillemot and little auk probably were taken on their fall migrations in October, November and December. However, there seems to be a temporal shift in the relative representation of the three species (Figure 9.1). From FC-III and FC-II to FC-I fulmars are reduced by half from 28% to 13% while Brünnich's guillemot at the same time almost double from 36% to 60%. The little auk shows no significant changes and hovers between 10% and 20%. This could indicate a shift around 1900 BC in the seasonal status of Qeqertasussuk, where Qeqertasussuk became more intensively used in fall and/or less intensively used during summer.

Birding season for glaucous gull, Iceland gull, black guillemot, mallard, eider-duck and merganser was restricted to the ice free period from break up in late May or early June until November-December. The kittiwake, the great northern diver and the red-throated diver also arrived at break up, but they left the area in September. Hunting for these species, never a significant undertaking, could have taken place at any time during these periods.

Other species are much more restricted in their seasonal occurrence and give a more precise season of

Fig. 9.35. Caribou are found in the interior regions east and south of Sydostbugten (photo: Bjarne Grønnow).

kill. The king eider was present in Sydostbugten from September to early November, the great shearwater was primarily accessible in August, while the great auk was available from September until ice formation

It thus seems that at least 75% of all fowling at Qeqertasussuk was undertaken in summer and fall from boats either in the deep waters of Qoornua Sound in the vicinity of the site, or further out in the open bay.

Caribou hunting

The largest concentrations of caribou are found on Lersletten south of Sydostbugten and in the interior regions east of Kangersuneq and Orpissooq (Ostermann *et al.* 1921:110-11; Porsild 1921:101; Meldgaard 1986) (Figure 9.35). Well known caribou localities are Appannguit, the heads of Orpissooq and Kangersuneq (Frederik Jensen, inf. 1982; Jens Vetterlein, Boye Møller inf. 1986), the area around Nunatsiaq and Anoritooq near Saqqarliup sermia (Frederik Jensen, inf. 1982).

Population fluctuations are very pronounced among the West Greenlandic caribou in general, and their distribution, behaviour and condition change accordingly (Meldgaard 1986). This is also typical of the caribou in Qasigiannguit district. Hunting and trading statistics concerning caribou have been kept from 1793 and when combined with historical, ethnohistorical and other information, it appears that four major fluctuations have occurred over the past 250 years in the regions south and east of Sydostbugten, as well as in West Greenland as a whole (Figures 2.19 and 2.20) (Meldgaard 1986, 1987b). Population maxima occurred around 1740, 1850, 1910 and 1960 and the length of the population cycles thus ranges from *ca.* 65 to *ca.* 115 years. The population maximum, as well as the population increase and decrease, each last approximately a decade, while the minimum may last from *ca.* 35 to *ca.* 70 years. The amplitude of the fluctuations is dramatic. A well documented case is the 1970 to 1980 reduction of the total West Greenlandic caribou population from a high of *ca.* 100,000 to a low of *ca.* 8,000 animals, a decline of more than 90% in ten years (Strandgaard *et al.* 1983; Thing 1984; Meldgaard 1986, 1987b).

When the populations increase in numbers, they expand into marginal and previously uninhabited territory (Figure 2.20), they start to undertake annual migrations between coastal wintering grounds and inland calving and summering grounds, and they attain larger body size. During population decrease the caribou abandon their coastal winter quarters and retreat to the inland areas. Annual migrations cease and the population becomes more stationary and at the same time body size decreases (Meldgaard 1986). During population minima the caribou may completely disappear from the Qasigiannguit district.

The causes of the caribou population fluctuations have been the object of many investigations (Vibe 1967; Strandgaard *et al.* 1983; Aastrup 1984; Thing

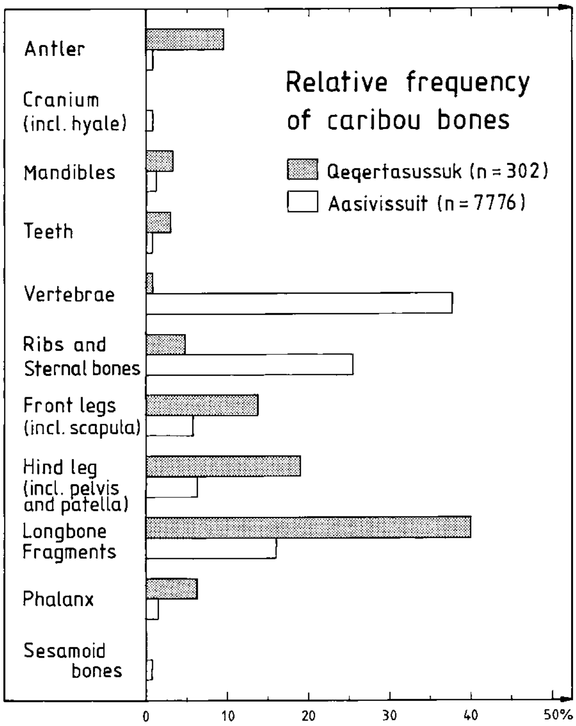


Fig. 9.36. Comparison of the representation of different body parts of caribou on a caribou hunting site (Aasivissuit) and on the seal hunting site Qeqertasussuk.

1984; Meldgaard 1986). The fundamental importance of weather and climatic change for the geographical and temporal distribution and density of West Greenlandic caribou is widely recognised, but it is also evident that overhunting, overgrazing and other density-dependant factors may be superimposed and in some situations result in a depression of the population below "natural" levels (Meldgaard 1986).

From a human resource point of view, caribou is a most unstable resource. Every second or third generation the hunters will be faced with a drastic decrease in the caribou population south and east of Sydostbugten. At the same time the caribou will retreat from the coastal areas to concentrate in pockets further south and close to the Ice Cap (J. Meldgaard 1983; M. Meldgaard 1986).

Caribou hunting at Qeqertasussuk

Caribou bones only constituted *ca.* 0.3% of the mammal bones excavated (Table 9.2). Altogether 302 caribou bones were excavated at Qeqertasussuk and their anatomical distribution is shown in Figure 9.36. Bones from the hind and front legs represent *ca.* 80% of the sample, while only *ca.* 5% come from the trunk. Finally the cranium, including mandibles, constitute *ca.* 6% and antler *ca.* 9% of the caribou bones. All bones were marrow cracked, even the 1st and 2nd phalanges.

Caribou hunting was undertaken from Qeqertasussuk throughout the habitation period. However, during excavation it was clear that a significant number of caribou bones were found in the uppermost layer with faunal preservation, dating to around 1700 BC. In section 10-15/23, which was documented in detail, caribou bones were present and even dominant in the upper layer 5 f (Figure 6.11).

The nutritional value of the anatomical parts represented by the leg bones is much higher than that of the ribs and vertebra. The leg bones have a high bone fat and marrow content, and they carry much meat, while the ribs and vertebra are poor in fat and marrow and carry less meat (Binford 1978). The caribou hunters at Qeqertasussuk thus primarily brought the parts of high food value to the site.

A similar bone distribution was found among the caribou bones from the Saqqaq site Nipisat 1 and interpreted in the same way (Godtfredsen 1992).

At these coastal sites, bone distributions are completely different from the bone distribution observed at the caribou hunting base camp Aasivissuit, which is situated in the heart of the caribou district north of SøndreStrømfjord (Grønnow *et al.* 1983). Here bone fragments representing anatomical parts of low food value dominated. This pattern was partly explained as the result of an export of high value parts to the coastal winter settlements.

Antler was used extensively for hunting implements and tools (Grønnow 1990, 1994), and the many worked pieces of antler show that it was brought to the site as a valued raw material. Samples of caribou hair preserved by the permafrost indicate that caribou skin was also brought back from the hunting grounds.

The distribution of skeletal elements, the intensity of marrow fracturing and the intensity of antler use all indicate that caribou were only rarely available on the island or on the nearby mainland, and that the transport distance from the kill site to Qeqertasussuk must have been relatively long.

The bases of two fully developed male antlers still attached to the pedicle show that caribou hunting, at least in these two cases, was undertaken sometime between July and December (Kelsall 1968). Late summer and fall caribou hunting was also documented at Itinnera, a Saqqaq caribou hunting site in Godthåbsfjorden (Møhl 1972).

It is most likely that the caribou brought to Qeqertasussuk were hunted inland of Kangersuneq and Orpissooq or to the south on Lersletten. It must be borne in mind that these inland areas were, at the time, more extensive, as the margin of the inland ice was situated 10-15 kilometres further east (Weidick *et al.* 1990).

However, this whole area has always been marginal for caribou and during population lows the inhabitants of Qeqertasussuk would have had to travel several hundred kilometres south to find caribou (Meldgaard 1986).

The idea of seasonal and specialized interior caribou hunting camps having been used by the West Greenland Saqqaq people is supported by finds from the inner fjord site Itinnera, with more than 90% caribou bones (Møhl 1972). However, it should be mentioned that at the costal Nipisat I site, situated as it is adjacent to the most important caribou territory, more than 50% of the mammal bone sample were caribou bones.

Caribou hunting was probably primarily undertaken with bow and arrow (Fig 7.12). The fact that arrowheads were dominant at the adjacent Saqqaq site, Orpissooq, situated in caribou territory, is in accordance with this (Hansen and Jensen 1991).

Arctic fox

Qasigiannguit district has one of the largest fox populations in West Greenland (Ostermann *et al.* 1921:111; Porsild 1921:101) (Figure 9.37). The foxes are found both in the interior, along coasts and on most islands. Especially good fox habitat is found along the coasts of Kangersuneq, Orpissooq and Sydostbugten (Kristian Jeremiassen 1983; Karl Olsvig, Villads Olsvig and Jens Vetterlein, inf. 1986).

While searching for food, they tend to follow particular paths that take them, for example, along the coastline at low tide, along tidal cracks in the sea ice, or along the ice edge. The adults are generally careful and quite difficult to approach, while the young-of-the-year are less shy (Josefsen *et al.* 1964; Müller 1906:314; Rosendahl 1942:56).

The arctic fox occurs in a white and a blue phase.

Fig. 9.37. The Qasigiannguit district has one of the largest fox populations in West Greenland (photo: Thomas Berg).

In Qasigiannguit these are almost equally represented but approximately every fourth year, large white foxes from Baffin Island invade the central parts of West Greenland and the percentage of white foxes increases significantly. Approximately every tenth year the stationary fox populations are subjected to large fluctuations (Braestrup 1941; Vibe 1967).

Fox hunting at Qeqertasussuk

Fox bones constitute approximately 11% of the mammal bone sample (Table 9.2. Figures 9.1, 9.3, 9.38, 9.39, 9.40) and a minimum of 903 foxes have been caught at the site (Table 9.5). At no other West Greenland Saqqaq site do we see such intensive fox hunting. Both at Nipisat I (Godtfredsen 1998), Qajaa (Møhl 1986) and Itinnera (Møhl 1972) fox bones constitute less than 1% of the mammal bone sample. Only at the Independence I Adam C. Knuth Site in Peary Land, with an astounding 44% fox bones, does fox hunting seem to have played a major role (Table 10.1).

Almost 60% of the foxes were immature animals less than one year old, while two, three, four and five year old foxes each represented *ca.* 10% of the sample (Figure 9.41). Only two individuals reached an age of five and six years respectively, and both of them had extremely worn teeth.

This result is consistent with the result of the X-ray investigations of relative pulp width which showed that *ca.* 65% of the canines belonged to young-of-the-year (Table 8.6). There are no significant temporal changes in age composition, however, in the early

Fig. 9.38. Articulated fox paw in midden deposits illustrates skinning procedures (photo: Geert Brovad).

period (FC-III) there seems to have been a relatively large number of older foxes that ended up in the habitation area as compared to the midden area (Table 8.6). The general dominance of juvenile animals probably reflects the fact that the young-of-the-year form a large part of the natural population and that they are less careful and relatively easy to approach.

An analysis of season of death of juvenile foxes, based on pulp width, revealed that *ca.* 90% were killed in fall and winter i.e. from October to March. Thus hunting pressure appears to have been relatively even from October to March, with a slight peak in November. A few animals were also killed in early fall (August and September) and in spring or early summer (April, May, and June).

There is one important advantage of winter foxes over summer foxes – their fur is of better quality. The arctic fox develops a winter coat in October, the juveniles a little earlier than the adults. From November to February the fur quality is best. Moulting occurs in April at which time the fur is shaggy and completely useless (Vibe 1981). The fine agreement between the season of the Saqqaq fox hunt and the season of optimal fur quality lends support to the idea that fox hunting was undertaken primarily to secure skins, for instance, for garments.

The butchering pattern, as revealed by cut marks and the high frequency of articulated vertebra and limb bones also indicates that fox skin was more important than fox meat (Figure 9.38).

Sydostbugten has always had a large fox population and the many recent stone built fox traps placed along the seashore give a good impression of the best fox localities and reflect the fox's habit of following tidal cracks running parallel to the coastline. There is good reason to believe that the Saqqaq hunters were

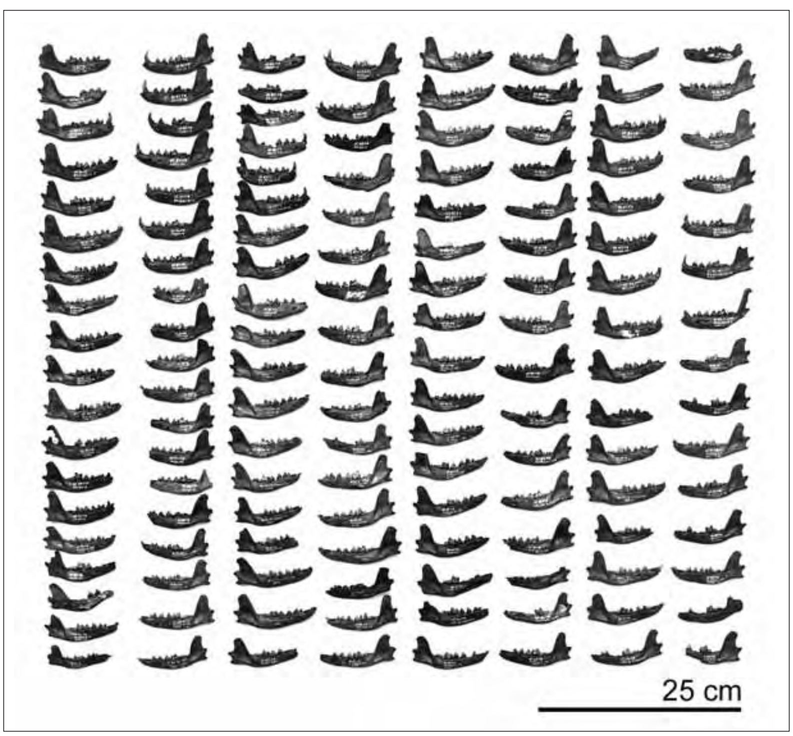


Fig. 9.39. Collection of fox jaws from the site. The canines were used for aging and for determining seasonality (photo: Geert Brovad).

well acquainted with this habit and caught many of their foxes along the shore in the vicinity of the site.

No stone structures found in the area can be interpreted as possible Saqqaq fox traps. However, the consistent pattern of breakage of the occipital and parietal region of the fox crania excavated, may be the result of mortal blows dealt to trapped foxes either by the trapping mechanism itself or by the hunter extracting the fox (Figure 9.40).

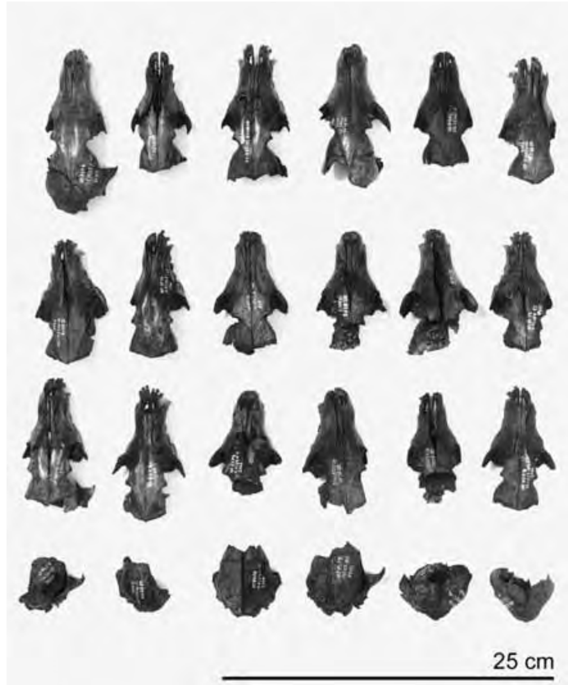


Fig. 9.40. Fox skulls from Qeqertasussuk. The consistent way in which the back part of the skull has been broken off can be interpreted either as marks from the traps used or as the result of fox brain extraction for eating (photo: Geert Brovad).

The excavated Saqqaq foxes are significantly larger than foxes from the extant population (Berg 1993). The arctic fox exhibits a high degree of size variation in the circumpolar region, and this variation has largely been attributed to variations in the quality of the food and in the length of the growth season (Braestrup 1941; Vibe 1967).

If this explanation is applied to the prehistoric fox population, it can be deduced that conditions for growth were better and/or the growth season was longer 4000 years ago compared to the present. Similar observations have been made by McGhee (1979:37) at the Independence I Cold component at Port Refuge, Devon Island, where many of the arctic fox bones represented individuals larger than those represented by arctic foxes in the modern comparative collections. The larger size of the prehistoric foxes was interpreted as an indicator of a warmer climate.

It should be borne in mind that the large size of the prehistoric foxes may also, at least to some extent, be due to differences in genetically based limits to growth. Only a more detailed study can sort this problem out (Berg 1993). However, the fact that two prehistoric fox populations in separate geographical areas exhibit the same size trend lends support to the climate hypothesis.

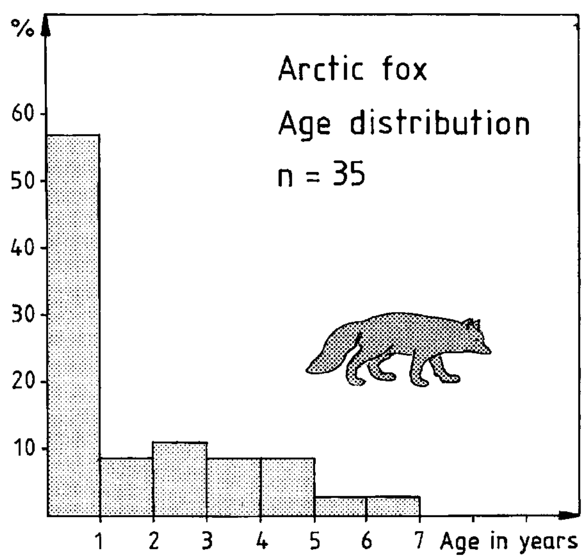


Fig. 9.41. The age distribution shows that the young-of-the year is most common in the catch. This has to do with their tameness and curiosity, behavioural traits that are modified when foxes grow older.

Arctic hare

The arctic hare is found everywhere in the Qasigiannguit district. It is especially common in the interior parts *e.g.* around the head of the fjords Kangersuneq and Orpissooq (Ostermann *et al.* 1921:111; Frederik Jensen, inf. 1982; Søren and Kathrine Thorning, inf. 1986). In winter they often congregate in groups on good feeding localities (Vibe 1981). In general the arctic hare is quite easy to approach (Müller 1906; Vibe 1981).

The hare populations fluctuate in numbers. In some years they are very scarce, in others they can be encountered in large numbers everywhere in the district. There are approximately ten years between population maxima (Müller 1906:364; Braestrup 1941; Vibe 1981).

Hare hunting at Qeqertasussuk

Hare bones only comprise 0.2% of the faunal sample (Table 9.2). It seems reasonable to assume that they were hunted when encountered but, because of their generally low availability, they never became economically important. This picture is repeated at the other Saqqaq sites in West Greenland (Møhl 1972; Møhl 1986; Godtfredsen 1998).

Land mammals not found at Qeqertasussuk

Both arctic wolf and polar bear were available and hunted by the Saqqaq people in West Greenland. A wolf canine was excavated at Itinnera (Møhl 1972; Dawes *et al.* 1986), four polar bear bone fragments were found at Nipisat I (Godtfredsen 1996, 1998), and a polar bear phalanx was identified at Niivertussannguaq (Andreasen 1998). The very low bone frequencies indicate that both wolf and bear were rare, as they have been historically in Disko Bay (Porsild 1915, 1921: 102, 290; Vibe 1981; Frederik Jensen, inf. 1982; Søren and Kathrine Thorning, inf. 1986; T. R. Larsen pers. comm.).

Fishing

Fish bones comprise 1.0% of the faunal sample (Table 9.2, Figure 9.1), and they represent 6 different species: salmon, arctic char, capelin, cod, polar cod and sculpin (Table 9.1).

Salmon

The salmon is a fall visitor in the Qasigiannguit district and is particularly common in Sydostbugten, *e.g.* in Qoornua around Qeqertasussuk (Porsild 1921:19; T. R. Larsen 1989). It arrives in July-August and migrates south again in October-November (Porsild 1921:19; Muus 1981). The appearance of salmon in the district is periodic (E. Geisler, pers. comm.) and apparently caused by climatic changes and related changes in the physical environment of the sea. A good example is the increase in salmon populations off West Greenland following the general warming of the sea in the 1920's (Jensen 1939; Tåning 1948; Dunbar and Thompson 1979).

Salmon fishing at Qeqertasussuk

A single parasphenoid comes from a 70-80 centimetre long salmon (Table 9.12), probably caught between August and October in the vicinity of the site. Salmon are difficult to catch by jig or by leister in the ocean. It is likely that nets were used for salmon fishing off Qeqertasussuk.

Salmon fishing has not been documented from other Saqqaq sites in West Greenland.

Arctic char

Arctic char come to the district in late July. The fish are in good condition and they head for freshwater streams and lakes where they can lay their eggs (Muus 1981; Søren Frederiksen, Ane Møller, inf. 1986). At rising tide running char can be seen in schools at the outlet of streams waiting to enter the fresh water.

Well known streams and rivers with good char runs from late July to September are found in Appannguit (Villads Olsvig, Boye Møller, inf. 1986), the head of Orpissooq (Karl Olsvig, Ane Møller, Boye Møller, inf. 1986), the head of Kangersuneq (Frederik Jensen, inf. 1982; Kristian Jeremiassen, Boye Møller, Lars Johansen, inf. 1986), Eqaluit, and in Tasiusarsuaq at Eqaluliata itinnera (E. Brinch Petersen pers. comm.).

Following spawning, which takes place from the end of August to September, the char are in poor condition. They winter in freshwater, and in May – June they migrate to the sea where they feed and become fat (Hansen *et al.* 1981; Muus 1981).

Char fishing at Qeqertasussuk

Ten bones (Table 9.12), nine probably articulated vertebra from a medium sized specimen and an operculum from an individual of *ca.* 30 centimetres, were collected on the four millimetre sieve. These fish were most likely caught between July and September either with nets in the sea near the site or with *e.g.* leister in one of the nearby rivers with running char.

Arctic char were also on the menu at the Saqqaq site Nipisat I (Godtfredsen 1998) and on Independence I sites in Peary Land (Knuth 1967; Darwent 2001). No fishing implements have, however, been documented from these sites.

Capelin

In June millions of capelin migrate into Disko Bay. They come to spawn in the shallow water of sandy coves and often they are so numerous and so densely packed that the water "boils" with fish. Following spawning, large numbers die from exhaustion and in protected bays and inlets mats of dead and rotting capelin cover the beach at low tide (Rosendahl 1942; Muus 1981).

The condition and the size of the fish varies locally (Porsild 1921:19,295; Rosendahl 1942:50; Lars Johansen, inf. 1986). The capelin from the Qasigiannguit district are, for example, considered to be fatter than those from the Aasiaat district (Lars Johansen, inf. 1986).

The spring spawning takes place in the same shallow watered and often sandy localities year after year. Qasigiannguit district has many such localities (Kasper Didrichsen, Søren and Kathrine Thorning, inf. 1986). Some of the more important are Qeqertasussuk south of Ikamiut (Kristian Jeremiassen, inf. 1986), Sarpiusat (Rink 1855), Saarlua on the northern side of Qeqertasussuk (Villads Olsvig, inf. 1986), Saattuatsiaat (Jens Vetterlein , inf. 1986), Saattut (Søren and Kathrine Thorning, inf. 1986), Nuuk (the eastern coast of Tunutta) (Søren and Kathrine Thorning, inf. 1986), Qenertuarsuit in Tunutta imaa (Jens Vetterlein, Søren and Kathrine Thorning, inf. 1986), Salleq off Akulliit (Ane Møller, Søren and Kathrine Thorning, inf. 1986), Niisat (Boye Møller, inf. 1986), the bay at Qasigiannguit (Ostermann *et al.* 1921:130), and Illorsuatsiaat (Frederik Jensen, inf. 1982).

In fall the capelin may return to the coast, and when the frost sets in they can often be seen in large schools close to shore. These fall capelin however swim deeper than in spring and they are more shy and difficult to catch (Porsild 1921:167,226,295).

There are annual variations in the occurrence of capelin. Even though the spring occurrence is generally quite reliable, in some years they do not come into the shallows to spawn at all (Ostermann *et al.* 1921: 235; Anon. 1928:722, 1933:33, 433; Vibe 1967).

The capelin populations are also subjected to long term changes. Before 1920 the northern limit of their distribution was found at Mannik approximately midway in Sullorsuaq (Vaigat), and at Kangerluk (Disko Fjord) on the west side of Qeqertarsuaq (Rink 1855: 142,144; Porsild 1921:228). During the climatic amelioration in the 1920's, 30's, and 40's the capelin spread as far north as the Upernavik district, and at the same time the occurrence became more unstable in the southern most part of West Greenland (Jensen 1939; Anon. 1944:662; Hansen 1949:15, Hansen *et al.* 1981; Muus 1981).

Capelin fishing

A single vertebra (Table 9.12), found on the two millimetre screen, is all that represents the capelin from Qeqertasussuk, despite the fact that it is one of the richest resources in Sydostbugten.

When the capelin enter Sydostbugten in June to spawn and later in fall appear in deeper water, it is the favourite food of seals, birds and other fish. It is therefore quite possible that this vertebra entered the site's midden in the stomach or crop of another animal. The only information that this find gives us is that capelin were available near the site and that it was brought to the site in early summer or in fall.

Finally, the bones are so small that even if they were preserved, they evaded discovery during excavation and sieving, as most of them probably went straight through the two millimetre sieve.

Atlantic Cod and Greenland Cod

Atlantic Cod (*Gadus morhua*) occur in Qasigiannguit district from June to October with a peak in August (Rink 1852:140; Anon. 1938: 27, 244, 504, 680, 962; Hansen 1949:7; Søren and Kathrine Thorning, inf. 1986). In the summer period, especially in June when capelin are present and again in August, both large and small cod move into shallow waters where they can be seen in large schools often breaking the sea surface (Olsen *et al.* 1964:52; Hansen *et al.* 1981; Boye Møller, Søren and Kathrine Thorning, inf. 1986).

Well known cod localities are the waters north and west of Akulliit (Kristian Jeremiassen, Søren and Kathrine Thorning, inf. 1986) and the sea just off the steep cliffs at Anoritooq east of Qeqertasussuk. The Anoritooq locality is especially well known for its occurrence of very large cod. The cod stock in Greenland waters fluctuate greatly in size and distribution changes accordingly. Around 1820 and again between 1845 and 1849 the cod spread north along the West Greenland coast and into Disko Bay. It followed the southern margin of the bay and continued north to Jakobshavn Isfjord which seemed to stop the expan-

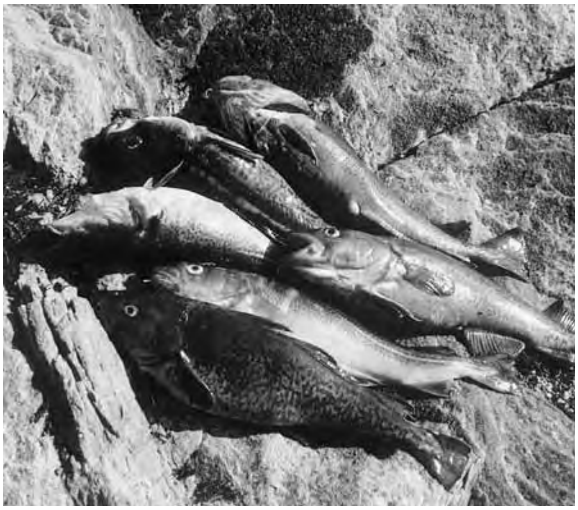


Fig. 9.42. Greenland cod (*Gadus ogaq*) are common everywhere in Sydostbugten and are easily caught even in shallow water (photo: Morten Meldgaard).

sion. In these periods the cod were plentiful in Qasigiannguit district but in the period in between, and in the years following 1849, they almost disappeared from the area (Rink 1852:140, 1855:116).

Around 1917 cod increased dramatically in numbers in southern Greenland and during the following years it expanded northwards and reached Disko Bay in 1931. This time the cod continued north into the Umanak district. The population peak was reached in the 1960's and from 1968 the stock declined (Hansen 1931, 1949; Jensen 1939; Muus 1981).

The distributional changes and population fluctuations are governed by changes in sea temperature. The general rise in sea temperature off West Greenland around 1920 and the contemporary changes in cod distribution and population size is a well documented example of the close relationship that may exist between sea temperatures and species distributions (Hansen 1931, 1970; Jensen 1939; Muus 1981; Buch *et al.* 1994).

Superimposed on these major shifts in population size and distribution are smaller annual fluctuations. These variations are primarily due to contemporary changes in the hydrographic conditions (Hansen *et al.* 1981).

A close relative of the Atlantic cod, the Greenland cod, is a common fish in Qasigiannguit district throughout the year (Porsild 1921:104) (Figure 9.42) and it is primarily found in the coastal zone, from the sea shore to a depth of approximately 400 meters (Muus 1981). Especially during spawning in March, the Greenland cod is seen in large numbers in shallow water near shore (Rosendahl 1942:58; Muus 1981).

Like the Atlantic cod, the Greenland cod is subjected to fluctuations in population size and distribution. In the 1920's, 30's and 40's, when the cod expanded northwards, the Greenland cod retreated to the north and became less frequent in Disko Bay (Rosendahl 1942:58; Anon.1944:663; Hansen 1949:14). During the subsequent cooling of the sea it spread south again and in the 1970's it became common once more (Hansen *et al.* 1981; Muus 1981). The Atlantic cod and the Greenland cod clearly replace each other according to changes in the temperature of the sea.

Atlantic cod and Greenland cod fishing

A total of 88 cod bones were identified (Table 9.12). Of these 20% were cranial or shoulder girdle bones and 80% were vertebrae. From the size of 59 of the gadid bones it was possible to estimate the total length of the fish. Four bones came from individuals smaller than 65 centimetres and may belong to either Greenland cod or Atlantic cod, while the rest, coming from larger specimens, can be identified as Atlantic cod.

60% of the cod were between 100 and 120 centimetres long (Figure 9.43). Cod of this size usually weigh from 15 to 25 kilos (Muus 1981).

Three out of four of the small gadid bones were found on the 4 millimetre sieve, while only five out of seventy-six of the large cod bones were found on the sieves. It is therefore likely that small gadids were missed during excavation and that they are underrepresented in the sample as a whole.

The cod were caught in summer from July to early October, probably in the vicinity of the site. If the small gadids are Greenland cod, they may have been caught at any time of the year.

The apparent high representation of very large cod may in part be explained as the result of selective fishing *e.g.* with leister or harpoon. Probably these fish were taken from boat when they were visible in or just below the sea surface. However, smaller specimens were also caught, and though they could also have been taken with leister or harpoon, it would seem possible that an "unselective" jig, a baited hook or a net was used.

Cod were also caught at Nipisat I (Godtfredsen

1998) and again large cod (more than 1 metre) were common in the catch.

The evidence shows us that Atlantic cod was at least periodically abundant along West Greenland from *ca.* 2400 BC to *ca.* 800 BC. Also, the presence of many large specimens indicates that the age structure of the cod population at the time was reminiscent of the age structure known from pre-industrial cod fishing in the North Atlantic. It is reasonable to believe that in this early prehistoric period, cod were present in as massive numbers as has been experienced historically.

The fact that cod were present in what must be assumed to be large numbers and that they were accessible with Saqqaq fishing technology provides us with an interesting perspective on Saqqaq subsistence. Potentially, cod could have played a central part in Saqqaq economy, however for a number of reasons this may be difficult to document archaeologically.

Fig. 9.43. Articulated cod vertebrae in situ in midden deposits. Most of the cod excavated were from individuals more than one meter long (photo: Morten Meldgaard).

Polar cod

The polar cod occurs in Disko Bay from October to late December. It is especially common in Jakobshavn Isfjord and Torsukattak where it probably spawns beneath the sea ice. It is usually associated with sea ice where it feeds on crustaceans, zooplankton and other small animals, and can often be seen swimming in cracks and leads (Rink 1852:144, 1855:129; Krogh 1921:194; Ostermann *et al.* 1921:235; Muus 1981).

Following 1920, when the sea temperature off West Greenland was relatively high, polar cod was rare in Disko Bay (Rosendahl 1942:58; Muus 1981). In recent years it has started to reappear near Qeqertarsuaq (R. Møbjerg Christensen pers. comm.), and it is frequently caught in and around Sydostbugten during monitoring trawls conducted by Grønlands Naturinstitut (Grønlands Naturinstitut 1995)

Polar cod fishing at Qeqertasussuk

Eleven bones comprising eight vertebra, two dentales and one artikulare, were found on the four and two millimetre sieves (Table 8.1, 9.12). The polar cod remains may have been brought to the site as the stomach or crop content of larger game. At any rate they indicate that the fish was present as a potential resource in the vicinity, and that it was thrown onto the midden during the fall. Polar cod have not been documented from other Saqqaq sites.

Polar cod bones are relatively large and the majority would be retained on the two and four millimetre sieves. The sample should therefore be representative.

Sculpin

The most common sculpin is the bull-rout (*Myxocephalus scorpius*) which is found in large numbers everywhere along the shores of the district from the tidal zone to a depth of approximately 200 meters, most commonly however from 3 to 25 meters. The sculpin tolerates quite large variations in temperature and salinity. It can therefore be found in the near shore zone throughout the year, and its occurrence in the district does not seem to be much affected by long term changes in the physical environment (Rink 1852:134-5; Porsild 1921:104; Muus 1981).

A number of other species of sculpins are found in the area, although not as frequent as *M. scorpius*, for example *Gymnocanthus tricuspis* and *Myxocephalus scorpioides* (Muus 1981).

Sculpin fishing at Qeqertasussuk

One vertebra was found in the two millimetre sieve (Table 8.1, 9.12). Again, it may represent stomach or crop contents but, as the sculpin is present year round in the area, the find does not specify the season of death of the fish. However, sculpins make a fine soup and the bone may have been part of a good meal.

Sculpin bones have also been found at Nipisat I (Godtfredsen 1998).

Most sculpin bones would pass through the two millimetre sieve, and they may be underrepresented for this reason.

Fish not found at Qeqertasussuk

It should be noted that a number of fish species, which have not been documented archaeologically, were probably available to the fishermen at Qeqertasussuk: *e.g.* Greenland shark (Porsild 1921:104; Muus 1981; Frederik Jensen, inf. 1982), lump-sucker (Fabricius 1818b; Rink 1852:143, 1855:114; Hansen *et al.* 1981; T. R. Larsen pers. comm.), long rough dab (Porsild 1921: 104,228; Hansen *et al.* 1981; Muus 1981), halibut (Porsild 1915:133; Muus 1981; Boye Møller, Søren and Kathrine Thorning, inf. 1986), Greenland halibut (Hammer 1893:27; Ostermann *et al.* 1921:234-5; Porsild 1921: 167; Jensen 1939; Anon. 1944:653; Nellemann 1960:50; Hansen *et al.* 1981; Muus 1981; Petersen and Nyegaard 1992) and catfish (Fabricius 1818b:265-266; Muus 1981; Ane Møller, Søren and Kathrine Thorning, inf. 1986).

Fish bones are rare on Saqqaq sites and only one species, a redfish from Nipisat I (Godtfredsen 1998), can be added to the list from Qeqertasussuk.

Fishing, a cornerstone in Saqqaq economy?

Acknowledging the potential economic value of fish, especially cod, char and capelin, to the inhabitants at Qeqertasussuk it is important to discuss the factors that influence the representation of fish bones in the faunal sample.

Fish bones in archaeological deposits on land tend to be greatly underrepresented (Møhl 1979a, 1979b; Rosenlund 1984; Jones 1986). The factors responsible for this underrepresentation may include (1) differential preservation due to differences in density and fragility of the bones (2) differences in destruction of bones by scavengers including dogs, and (3) differences in processing of fish as compared to birds and mammals.

Fish bones are less dense and more fragile than bird and mammal bones and in consequence they are more susceptible to destruction. This is most evident for a species such as the capelin, where the bones are so small and soft that they are most likely to have been eaten whole, as is the practice today. So that even though the conditions for preservation are excellent, this resource, though of possible great importance to the Saqqaq people, may never show up in the midden deposit.

Despite the fact that dogs and foxes seem to have had only a minor influence on the composition of the faunal sample in general, the fish bones are likely to have been those that were most strongly affected in a negative way because they would tend to be eaten whole. Again the strongest bias would be against the species with the softest bones, *e.g.* capelin, arctic char, lump-sucker, and Greenland halibut.

Fish processing procedures may have had a decisive influence on fish bone representation in the material. Interestingly, there is a distinct pattern in the horizontal distribution of the fish bones on the Qeqertasussuk site (Table 9.12). 92% of the fish bones were found in Area B and only 8% in Area C (Table 9.12). This could indicate that fish processing primarily took place close to or on the beach. If this was the case, it is quite possible that guts and vertebral columns from most of the fish caught were discarded on the beach with no chance of preservation. This type of fish processing procedure is well known historically and Ossian Elgström (1916) provided us with a fine example in his instructive drawings from Ilulissat.

It is quite clear that all the biasing factors discussed above have had a negative effect on the survival of fish bones at Qeqertasussuk, and it is to be expected that fish bones are strongly underrepresented in the faunal material. If we accept this idea and at the same time acknowledge that fish were abundant and that the Saqqaq people possessed a fishing technology that made cod, salmon, char and probably a number of other fish available to them, then it seems reasonable to assume that fish were in fact a cornerstone in the subsistence economy at Qeqertasussuk, probably as well as at other Saqqaq sites along the West Greenland coast.

Net sinkers (which could also have been used for sealing) and leister prongs (which could also have been used for birding) are known from Saqqaq sites but otherwise we have no indications of the fishing tackle that was used. Further studies focussed on identifying fishing implements among the many modified bird bones, baleen strings, and other materials are needed to provide further insight into Saqqaq fishing technology (Figure 9.44).

Table 9.12. Temporal variations in the relative frequencies of indicator bones (IBC). Indicator bones are as follows. Seals: bulla, mandibula, humerus, ulna, femur,. Arctic fox: mandibula, humerus. Fulmar, eider, ptarmigan, Iceland gull, glaucous gull, little auk, Brünnich's guillemot, black guillemot: humerus, coracoid. Other birds, other mammals, fish, molluscs: all fragments. + means less than 0,05%.

	Area B						Area C						Area B +C						Area B +C	
	Component I 1700-1900 BC		Component II 1900-2100BC		Component III 2100-2400 BC		Component I 1700-1900 BC		Component II 1900-2100BC		Component III 2100-2400 BC		Component I 1700-1900 BC		Component II 1900-2100 BC		Component III 2100 BC 2400 BC		All components	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Arctic hare	2	0.6	24	4.9	9	2.4	1	0.2	0	0	4	0.6	3	0.4	24	3.0	13	1.2	40	1.5
Dog	0	0	4	0.8	1	0.3	1	0.2	4	1.3	5	0.7	1	0.1	8	1.0	6	0.6	15	0.6
Arctic fox	10	3.2	70	14.3	69	18.3	12	2.4	12	3.8	128	18.3	22	2.7	82	10.3	197	18.3	301	11.2
Caribou	23	7.3	44	9.0	13	3.4	33	6.5	20	6.4	56	8.0	56	6.9	64	8.0	69	6.4	189	7.0
Walrus	0	0	1	0.2	0	0	1	0.2	1	0.3	0	0	1	0.1	2	0.3	0	0	3	0.1
Harbour seal	0	0	0	0	0	0	1	0.2	1	0.3	0	0	1	0.1	1	0.1	0	0	2	0.1
Ringed seal	110	35.1	126	25.8	129	34.2	144	28.6	108	34.6	219	31.2	254	31.1	234	29.3	348	32.3	836	31.0
Harp seal	161	51.4	212	43.4	147	39.0	288	57.1	160	51.3	250	35.7	449	55.0	372	46.5	397	36.8	1218	45.2
Bearded seal	3	1.0	0	0	2	0.5	6	1.2	1	0.3	5	0.7	9	1.1	1	0.1	7	0.6	17	0.6
Hooded seal	3	1.0	1	0.2	0	0	0	0	1	0.3	0	0	3	0.4	2	0.3	0	0	5	0.2
Sperm whale	0	0	0	0	0	0	0	0	1	0.3	1	0.1	0	0	1	0.1	1	0.1	2	0.1
Killer whale	0	0	0	0	0	0	0	0	0	0	1	0.1	0	0	0	0	1	0.1	1	+
Harbour porpoise	0	0	0	0	0	0	1	0.2	0	0	0	0	1	0.1	0	0	0	0	1	+
Narwhal	0	0	0	0	1	0.3	0	0	0	0	0	0	0	0	0	0	1	0.1	1	+
Sei or minke whale	0	0	0	0	0	0	0	0	0	0	1	0.1	0	0	0	0	1	0.1	1	+
Bowhead or right whale	0	0	0	0	0	0	0	0	0	0	1	0.1	0	0	0	0	1	0.1	1	+
Large whale	1	0.3	3	0.6	6	1.6	16	3.2	3	1.0	30	4.3	17	2.1	6	0.8	36	3.3	59	2.2
Man	0	0	3	0.6	0	0	0	0	0	0	0	0	0	0	3	0.4	0	0	3	0.1
Mammals total	*313*	*99.9*	*488*	*99.8*	*377*	*100*	*504*	*100*	*312*	*99.9*	*701*	*99.9*	*817*	*100.1*	*800*	*100.2*	*1078*	*100*	*2695*	*99.9*
Red-throated diver	0	0	0	0	0	0	0	0	0	0	1	0.1	0	0	0	0	1	+	1	+
Great northern diver	0	0	0	0	5	0.4	0	0	0	0	0	0	0	0	0	0	5	0.2	5	0.1
Fulmar	34	13.5	634	29.5	335	26.8	80	17.2	38	29.7	201	22.4	114	15.9	672	29.5	536	25.0	1322	25.7
Great shearwater	1	0.4	3	0.1	0	0	0	0	0	0	0	0	1	0.1	3	0.1	0	0	4	0.1
Mallard	0	0	0	0	0	0	0	0	0	0	1	0.1	0	0	0	0	1	+	1	+
King eider	0	0	0	0	0	0	0	0	0	0	1	0.1	0	0	0	0	1	+	1	+
Eider or mallard	2	0.8	16	0.7	8	0.6	7	1.5	5	3.9	26	2.9	9	1.3	21	0.9	34	1.6	64	1.2
Red-breasted merganser	0	0	1	+	0	0	0	0	0	0	0	0	0	0	1	+	0	0	1	+
White-fronted goose	0	0	0	0	1	+	0	0	0	0	0	0	0	0	0	0	1	+	1	+
Ptarmigan	1	0.4	260	12.1	55	4.4	14	3.0	0	0	36	4.0	15	2.1	260	11.4	91	4.2	366	7.1
Iceland gull	12	4.8	41	1.9	30	2.4	12	2.6	3	2.3	27	3.0	24	3.4	44	1.9	57	2.7	125	2.4
Glaucous gull	10	4.0	175	8.1	65	5.2	26	5.6	12	9.4	97	10.8	36	5.0	187	8.2	162	7.5	385	7.5
Kittiwake	0	0	5	0.2	2	0.2	0	0	1	0.8	0	0	0	0	6	0.3	2	0.1	8	0.2
Little auk	10	4.0	213	9.9	86	6.9	15	3.2	3	2.3	37	4.1	25	3.5	216	9.5	123	5.7	364	7.1
Brünnich's guillemot	168	66.9	703	32.7	632	50.6	299	64.3	66	51.6	431	48.1	467	65.2	769	33.7	1063	49.5	2299	44.7
Black guillemot	10	4.0	51	2.4	25	2	10	2.2	0	0	30	3.3	20	2.8	51	2.2	55	2.6	126	2.5
Raven	3	1.2	49	2.3	6	0.5	2	0.4	0	0	8	0.9	5	0.7	49	2.2	14	0.7	68	1.3
Birds total	*251*	*100*	*2151*	*99.9*	*1250*	*100*	*465*	*100*	*128*	*100*	*896*	*99.8*	*716*	*100*	*2279*	*99.9*	*2146*	*99.8*	*5141*	*99.9*
Salmon	0	0	1	1.2	0	0	0	0	0	0	0	0	0	0	1	1.2	0	0	1	0.9
Arctic char	0	0	9	11.1	1	5.3	0	0	0	0	0	0	0	0	9	11.1	1	3.7	10	8.9
Capelin	0	0	1	1.2	0	0	0	0	0	0	0	0	0	0	1	1.2	0	0	1	0.9
Cod	4	100	62	76.5	14	73.7	0	0	0	0	8	100	4	100	62	76.5	22	81.5	88	78.6
Polar cod	0	0	7	8.6	4	21.0	0	0	0	0	0	0	0	0	7	8.6	4	14.8	11	9.8
Sculpin	0	0	1	1.2	0	0	0	0	0	0	0	0	0	0	1	1.2	0	0	1	0.9
Fish total	*4*	*100*	*81*	*100*	*19*	*100*	*0*	*0*	*0*	*0*	*8*	*100*	*4*	*100*	*81*	*99.8*	*27*	*100*	*112*	*100*
Common mussel	2	40	12	92.3	2	66.7	0	0	0	0	0	0	2	40	12	92.3	2	66.7	16	76.2
H. byssifera	0	0	1	7.7	0	0	0	0	0	0	0	0	0	0	1	7.7	0	0	1	4.8
Periwinkles	3	60	0	0	1	33.3	0	0	0	0	0	0	3	60	0	0	1	33.3	4	19.0
Mollusc total	*5*	*100*	*13*	*100*	*3*	*100*	*0*	*0*	*0*	*0*	*0*	*0*	*5*	*100*	*13*	*100*	*3*	*100*	*21*	*100*
All bones	573		2733		1649		969		440		1605		1542		3173		3254		7969	

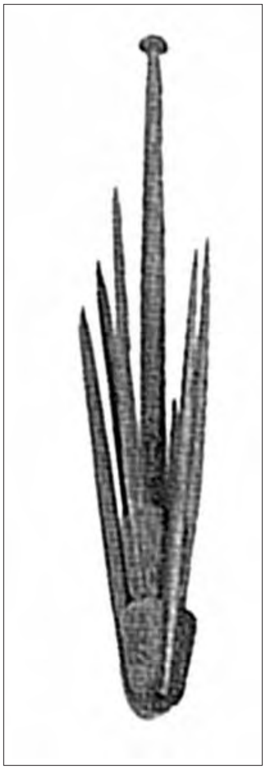


Fig. 9.44. Composite fish hook from Alaska. It is likely that fish hooks were used at Qeqertasussuk, but if they were of a composite nature they may be difficult to identify among the many pointed bird bones and twigs (courtesy of the Smithsonian Institution, Washington).

Gathering

Mussels and snails

The common mussel (*Mytilus edulis*) is found in large numbers along the rocky shores of Qasigiannguit district, especially in cracks and crevices around the low-water mark. In more protected situations, the snail *Litorina saxatilis* is abundant and mussels such as *Serripes groenlandicus, Mya truncata*, and *Hiatella byssifera* are common in the soft bottom on depths of from 3 to 10 meters (Krogh 1921:109; Porsild 1921:104; Petersen and Smidt 1981).

Fig. 9.45. Mussel (Mytilus edulis) with both shells in situ. These tasty shell fish were abundant along the shores of the island (photo: Morten Meldgaard).

Gathering mussels and snails at Qeqertasussuk

A total of 21 shell fragments of the common mussel, all from Area B (Table 9.12) and test pits 19/20 and 20/20, were excavated, and four of these still carried the periostracum (Figure 6.13). Most of these remains represented discarded shell halves, while one was found with both shells in situ (Figure 9.45). The common mussel is abundant around the low-water mark along the shores of Sydostbugten and they were probably collected close to the site, especially in the lagoon to the south (Figure 6.3).

Four periwinkle operculi from the two soil sample columns in Area B (Table 9.12) were found on the two millimetre sieve. These small snails may either have been collected for eating or they could have entered the site in the stomach of a bird. Periwinkles occur in large numbers along the rocky shore in the area and they could have been collected locally.

Two shell fragments of *Hiatella byssifera* (Table 9.12) and *Chlamys islandicus*, from Area B and test pits 19/20 respectively, were probably not collected in situ, rather they were washed ashore and picked up on the beach. They are both most frequent at depths greater than three meters (Birket-Smith 1924; Petersen and Smidt 1981), and probably out of reach of the Saqqaq gatherers.

Invertebrates not found

Small crabs are common everywhere in shallow water along the shore where they can be seen as soon as the sea ice disappears. Larger crabs are found in deeper water especially at the glacier fjords and on clay substrate in other parts of the bay (Porsild 1921:104, 167, 229).

Seaweed

Seaweed is common in Qasigiannguit district where it forms a well developed and continuous zone along the rocky shores. Several species are edible, *e.g.* species of the genera *Alaria* and *Laminaria,* and the species *Rhodymenia palmata*, *Ascophyllum nodosum* and *Fucus vesiculosus* and they all have a very high vitamin C content (Birket Smith 1924; Porsild 1953; Bonneval and Robert-Lamblin 1979; H. Fencker pers. comm. 1981).

Seaweed collection at Qeqertasussuk

One well preserved fragment of *Fucus vesiculosus/ Ascophyllum nodosum* was found in Area C (Figure 9.46). The species is edible, but it is impossible to say if this single fragment represents a resource that was exploited, or if it was brought there by chance. In general, it will be difficult to document seaweed consumption, as there are no parts that could be expected to survive except perhaps bryozoa that adhere to the weeds.

Fig. 9.46. Edible sea weed found in the midden deposits (photo: Geert Brovad).

Berries and plants

The Qasigiannguit district is known as a very fine berry district. Crowberry (*Empetrum nigrum*) is very common everywhere in the district, and arctic blueberry (*Vaccinium uliginosum*) (Figure 9.47) is also widespread. Good blueberry and crowberry localities are found in the fjords Kangersuneq and Orpissooq (Kristian Jeremiassen, Ane Møller, Boye Møller, Søren and Kathrine Thorning, inf. 1986), on the mainland around Qasigiannguit and on the islands of Sydostbugten (Ostermann *et al.* 1921:111; Boye Møller, Søren and Kathrine Thorning, inf. 1986). These berries ripen in August-September (Ane Møller, inf. 1986), and they are easily stored frozen (Porsild 1953). Rock cranberry (Vaccinium vitis-idaea) occurs in larger numbers in the Qasigiannguit district than anywhere else in Greenland. Renowned localities with high crowberry density are the islands of Tussaaq, Akulliit, Savik, Saarlat and Oqaatsuarsuit (Rypeholm) (Ostermann *et al.* 1921:111; Frederik Jensen, inf. 1982; Kristian Jeremiassen, Boye Møller, inf. 1986). The cranberries and also crowberries sweeten after a few nights of frost and they are therefore often collected into October (Birket Smith 1924; T. R. Larsen pers. comm.).

The Rock cranberry production fluctuates and it is only substantial about every third year, but during these years the harvest can be so large that the whole of northern West Greenland can be supplied with berries, as was the case around 1900 (Ostermann *et al.* 1921:111).

Many Greenlandic plants are edible, but based on their palatability and nutritional value there are a number of plants that seem more attractive than others. All of these species, except angelica, are found on the islands and on the mainland around Sydostbugten. Angelica is at present only known from one locality in the Disko Bay region and that is from Qeqertarsuaq (Disko) itself (Böcher 1975).

The succulent young flowering stems and leaves of roseroot (*Rhodiola rosea*) , the roots of hairy lousewort (*Pedicularis hirsute*) and woolly lousewort (*Pedicularis lanata*) the leaves and succulent young stems of the mountain sorrel (*Oxyria digyna*), and the leaves and flowers of the willow-herb *Epilobium lactiflorum* are all juicy and tasty and they have a high content of vitamin C and thiamine. Also the root stocks and bulbs of viviparous knotweed (*Polygonum viviparum*), the young leaf-stalks and flowering stalks of the angelica (*Angelica archangelica*), and leaves of arctic blueberry (*Vaccinium uliginosum*) can be important vegetables (Birket Smith 1924; Porsild 1953). Furthermore Hertz (1968) mentions the mountain avens

Fig. 9.47. Arctic blueberry. Good blueberry and crowberry localities are found in the fjords Kangersuneq and Orpissooq, as well as on several islands in Sydostbugten (photo: Geert Brovad).

Dryas integrifolia, and common Scurvey-grass (*Cochlearia groenlandica*) as food plants and Bonneval and Robert-Lamblin (1979) describe the dandelion (*Taraxacum croceum*), moss campion (*Silene acaulis*) and arctic thyme (*Thymus praecox*) as edible. Edible mushrooms and puffballs are also common throughout the Qasigiannguit district.

Berry picking and plant collecting at Qeqertasussuk

Thousands of crowberry seeds were found throughout the layers, especially in Area B. Berry seeds are constructed to resist destruction during the passage through mammalian and avian digestive tracts, and the fact that many crowberry seeds were found in concentrations of a shape and size reminiscent of human excrement indicate that many of the seeds in the midden layers actually had survived such a passage. Some of the seeds may of course also have been deposited by dogs and foxes, but their large quantities can only be explained as a result of systematic collection.

Also, seeds either of arctic blueberries or of cranberries were found, but in much lower frequencies than the crowberry seeds (Böcher and Fredskild 1993).

The crowberries could have been collected anywhere in Sydostbugten from the time of ripening in August – September and well into the winter when the frost has sweetened them (Birket-Smith 1924; Hertz 1968).

Pollen samples from the site and from a lake nearby show that edible plants such as mountain sorrel, sheep sorrel (*Rumex acetocella*), seaside plantain (*Plantago maritima*), and willow were available to the inhabitants of Qeqertasussuk, and there are indications that mountain sorrel and sheep sorrel "nuts" were actually eaten (Böcher and Fredskild 1993).

Based on the evidence at hand, it seems reasonable to conclude that berries represented a significant and vitamin rich resource to the inhabitants at Qeqertasussuk. Probably berries and other greenery were also eaten by Saqqaq people elsewhere, but no archaeological evidence has as yet been produced.

Chapter 10

Subsistence and settlement 2400-1400 BC

The first generation ca. 2400 BC

When the first group of Saqqaq hunters entered Disko Bay around 2400 BC they must have marvelled at the rich and undisturbed animal life they encountered. Disko Bay was protected from the fog of the Davis Strait, most of the low pressure cyclones passed the bay by, and the huge glacier fjords created a powerful up-welling of nutrient-rich bottom water that sustained exceptional densities of seals and birds. Topography, oceanography, and climate worked together to create one of the biologically most productive marine ecosystems in West Greenland.

After a short period of reconnaissance these pioneers set up camp on the lyme grass clad beach at Qeqertasussuk in the protected southeastern part of Disko Bay. They picked the site wisely. Qeqertasussuk is situated where resource availability is high and where there is easy access to high resource concentrations throughout the seasons (Figure 2.16).

The faunal material from Qeqertasussuk does not

Fig. 10.1. June 2003 BC. Harp seals have been caught from kayak-like boats and are now being processed on the ice-foot at the northern beach of Qeqertasussuk. Three families and some followers have set up camp and the kids are enjoying a game of ball. Reconstruction by Jens Rosing.

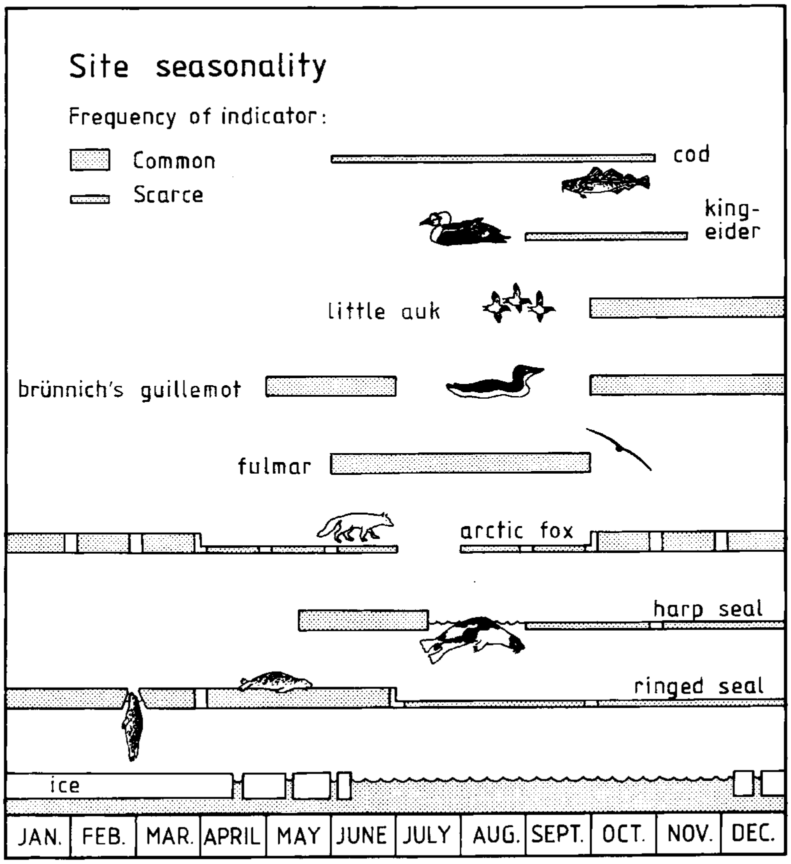


Fig. 10.2. Seasonal indicators for Base Camp period I, 2400-2100 BC.

have a stratigraphic resolution that allows us specifically to analyse the subsistence of the first generation of inhabitants on the island. However, it would seem reasonable to assume that the subsistence settlement system that is revealed by the early faunal component (FC-III: 2400-2100 BC) was being developed already in the first generation. Thus during this early settlement period Qeqertasussuk functioned as a year-round base camp from which exploratory hunting excursions were undertaken. Probably more than 90% of the game and fish needed for sustenance was taken in the immediate vicinity of the site (i.e. within a radius of *ca.* 5 kilometres) and the use of seasonal hunting camps in a regular manner and as part of a settlement system was very limited.

It should be noted that these early immigrants entered what could be termed a "pristine ecosystem" unadjusted to human hunting pressures. Initially, most birds and mammals did not respond to man as a predator, and they must have seemed unusually tame to the hunters. Thus it is well known that tameness develops in many species of arctic mammals and birds in the absence of man the hunter. Walrus (E. Born, pers. comm.) and ringed seal (Rink 1852:87) are cases in point. Some migratory species, such as the harp seal, however, must have been well acquainted with hunters in other parts of their range, *e.g.* along the Labrador coast.

Within a generation or so this "Garden of Eden" situation must have changed as most mammals and birds became aware of their new predator. A few species may early on have been adversely affected by the Saqqaq hunters' activities. Great auk breeding rocks which could have been present in the area would have been very vulnerable to predation (Meldgaard 1988a) as would walrus or harbour seal that might have hauled out on local beach localities.

During the first generation human population densities in the Disko Bay area must have been low, with only a few Qeqertasussuk-type base camps spread over the region. Consequently competition for resources must have been almost non-existent.

Base camp period I, 2400-2100 BC

The faunal material from this period is rich and provides quite detailed insight into economy, seasonality, hunting area and subsistence settlement systems (Figures 9.1 and 9.3).

A year-round base camp

Figure 10.2 presents the most important seasonal information documented from this period. The fox tooth data indicate that the site was inhabited throughout the year except July. Harp seal and ringed seal tooth data indicate winter habitation (ringed seal, January to mid April), spring habitation (ringed and harp seal, late April to June), summer habitation (ringed seal, July to September) and fall habitation (harp and ringed seal, October to December).

The migratory birds give evidence of spring through fall hunting. Some, *e.g.* the gulls and the guillemots, may have been taken throughout this period while birds such as king-eider (August-November), little auk (October-December) and Brünnich's guillemot (April-June and October-December), are more restricted in their seasonal occurrence in the area (Figure 2.13). Also, fish such as polar cod (October-December) add to our understanding of the seasonal occupation at Qeqertasussuk.

Many leaves, fruits and unripe pollen of dwarf birch indicate that this dwarf shrub was collected intensively in summer (Böcher and Fredskild 1993). The seeds of numerous crowberries as well as the seeds from rock cranberries or arctic blueberries are found in the midden, and they indicate berry collecting either immediately following ripening in August-September or during the winter.

Hunting excursions and hunting camps

Even though a year-round occupation has been demonstrated, it should be borne in mind that the intensity in the use of the site may have fluctuated through the seasons. The identification of caribou bones combined with the documentation of nearby Saqqaq period caribou hunting camps (Figure 5.15) indicates that Qeqertasussuk was more or less depopulated during caribou hunting excursions in summer and fall. White-fronted goose, great northern diver, red-throated diver, char, and other game with inland affinities were probably also taken during such inland caribou hunts.

White whale, narwhal and possibly bowhead whale hunting probably also necessitated spring hunting trips to localities near the ice edge along the outer parts of Sydostbugten where Saqqaq camps were located (Figure 5.6).

A pioneer period

During this early occupation period it seems that the inhabitants at Qeqertasussuk were exploiting all four major resource zones that have been identified in the area (Figure 2.16): Resource zone I: the outer coast and island zone, where whales and seals are important resources at the ice edge in late April and May. Resource zone II: the inner bay zone where capelin, harp seals and breeding birds occur in large numbers in June and early July. Resource zone III: the inner fjord and interior zone, where char and caribou are important resources in late July, August and September and Resource zone IV: the bay zone where the resources, primarily ringed seal, are evenly dispersed below the sea ice.

Based on the faunal and archaeological evidence presented, the following subsistence settlement system can be reconstructed covering Qeqertasussuk's first base camp period between 2400 and 2100 BC.

The subsistence settlement system

A. Spring-early summer. In May narwhal and white whales concentrated along the ice edge that usually runs from Nuuk via Tussaaq to Ikamiut. At this time of year no other resource of comparable concentration and potential economic importance was available, and it is reasonable to believe that the Qeqertasussuk hunters travelled to this area to take part in the whale hunt. Saqqaq sites, which could have served as spring whale hunting camps, have been located both on Tussaaq and on the coastline between Nuuk and Illorsuatsiaat (Figure 5.6).

It is possible that spring also was the time for large whale and primarily bowhead whale hunting. These hunting excursions may well have taken the hunters further to sea, perhaps to the island groups Kitsissunnguit, Imerissut and Kitsissuarsuit, where the bowheads had their preferred feeding grounds.

In June, following break up, capelin poured into Sydostbugten followed by numerous flocks of harp seals, and all the islands were populated by countless breeding birds. At no other time of the year did resource availability reach comparable levels. The sun was out 24 hours a day, weather was generally calm, and resources were highly concentrated. Capelin were probably collected during spawning at sandy and shallow locations close to the site, *e.g.* near Saarlua on the northern part of Qeqertasussuk, around the small islands Saattutsiaat just north of the site or at Saattut and surrounding islands.

At this time harp seals were constantly present in Qoornua and the sea around Qeqertasussuk where they were within easy reach from the base camp itself. The same was the case with large flocks of foraging fulmars. Eggs of eiders, terns, gulls and other birds were found on islands and bird cliffs everywhere in the region throughout June. Probably small excursions were undertaken to some of the good egg sites close by *e.g.* on Saattut or Marlutsiaat. Saqqaq sites that may have served as campsites during egg collecting and capelin fishing have been found on Satutsiaat and Saattut (Figure 5.6).

There is no archaeological evidence of food storage at Qeqertasussuk, and one can only assume that the surplus of the spring and early summer hunt, for instance meat and blubber of seals and whales, fish and eggs, was prepared and stored for the coming winter.

B. Summer and early fall. July was relatively low in resources, and those present were more dispersed than in spring and early summer. The capelin and the migratory species of seals and whales had left. Schools of cod started to appear in July and they were taken throughout summer, probably close by the site. Salmon, though less common, were also caught when they migrated past.

In August and September running arctic char occurred in the freshwater streams around Sydostbugten. This coincided with the ripening of crowberries, craneberries, and blueberries, and with the fattening of the caribou. There were three main locations where people from Qeqertasussuk could have fished running char, namely the head of Kangersuneq, the head of Orpissooq, and Appannguit just opposite the base camp, and these places were ideal as points of departure for hunting trips into caribou territory.

Archaeologically Saqqaq sites that served as seasonal hunting and fishing camps have been documented at the heads of both Orpissooq and Kangersuneq fjords.

C. Fall. From October to December the migrating harp seals and white whales returned to Sydostbugten, and Brünnich's guillemots, little auks and other birds were seen everywhere in small flocks. Resources were more abundant, but also more dispersed than in summer. However, the availability of these resources was much lower due to the decreasing daylight and more adverse weather conditions. Consequently, most hunting was probably done within a short distance from the Qeqertasussuk base camp.

D. Winter. The hunters were primarily based on Qeqertasussuk during the winter season from January to March. Both Qoornua and the sea to the north and the south of Qeqertasussuk usually had a stable ice cover from late December to early June. Throughout winter and spring the sea ice formed the frozen hunting grounds where ringed seal was the most important game. The ringed seals were distributed more or less evenly beneath the sea ice and within a radius of *ca.* 5 kilometres from base camp the hunters would have access to a population of more than 500 seals which, together with stored foods, would carry them through the winter time.

From January to March the hunters concentrated on breathing-hole hunting, but as the numbers of basking ringed seals increased, hunting for these became still more important. The availability of seals was lowest during mid-winter because light conditions made hunting difficult. As spring approached, however, the rapidly increasing hours of daylight greatly improved hunting conditions and thereby resource availability.

A centralized system

While hunting excursions to other resource zones have been documented, it should be remembered that the faunal material revealed that the bulk of the living resources (harp seal, ringed seal, foxes, waterfowl and fish) were retrieved in the immediate vicinity of the Qeqertasussuk base camp, probably primarily in Qoornua Sound.

In this early base camp period (2400-2100 BC) Qeqertasussuk was a centralized year round base

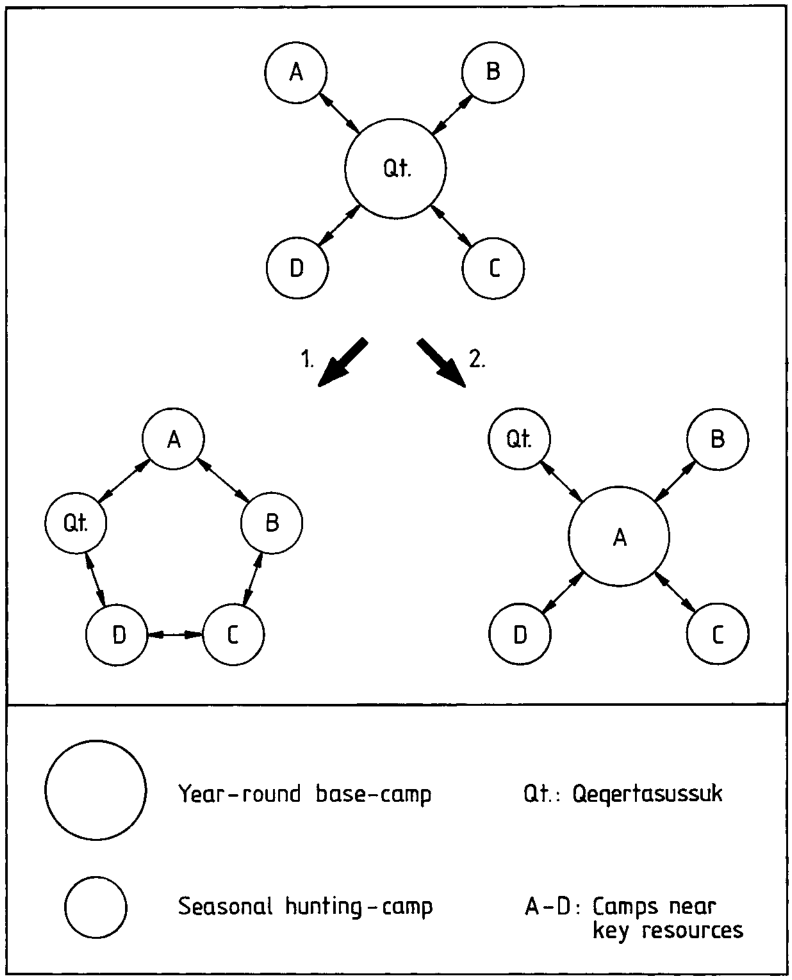


Fig. 10.3. Qeqertasussuk develops from a year-round base camp to a seasonal hunting camp. Two scenarios can explain this development: that (1) Qeqertasussuk becomes a seasonal camp alongside and comparable to other camps or (2) a new base camp emerges and Qeqertasussuk is reduced to a seasonal satellite. Model (1) seems best to fit the available data.

camp with smaller satellite hunting camps being used only briefly seasonally (Figure 10.3). Probably more than 90% of the biomass brought to the site for consumption was harvested within a radius of *ca.* 5 kilometres – an area of approximately 80 km^2.

In Figure 10.4 the relative economic importance of the major groups of animals and plants procured are illustrated. As pointed out fish are, for taphonomic reasons, underrepresented in the faunal material and it is suggested that fishing especially for cod was a cornerstone in the economy at Qeqertasussuk. Most of these fish were probably taken in the immediate vicinity of the site and thus add to the high percentage of locally procured products.

The economic importance of small whale hunting is also, due to a considerable "schlepp-effect", difficult to assess. However, a comparison with the economic importance of whaling at the 20th century settlement of Akulliit could provide an interesting analogy and some insight (Figures 4.22 and 9.8). Despite the fact that the Akulliit hunters were ardent small whale hunters, the white whales and narwhal caught represent less than 6% of marine mammal meat brought to the settlement. There is no reason to expect that the share was much greater during the early base camp period at Qeqertasussuk, and thus small whale hunting was probably of lesser importance as compared to *e.g.* fishing.

Unfortunately the importance of large whale hunting is more difficult to evaluate as we have no really well documented analogies from the area.

Resource crisis on an annual scale

Even though the midden deposits of the early base camp period at Qeqertasussuk appear very homogeneous and no stratigraphical subdivisions were evi-

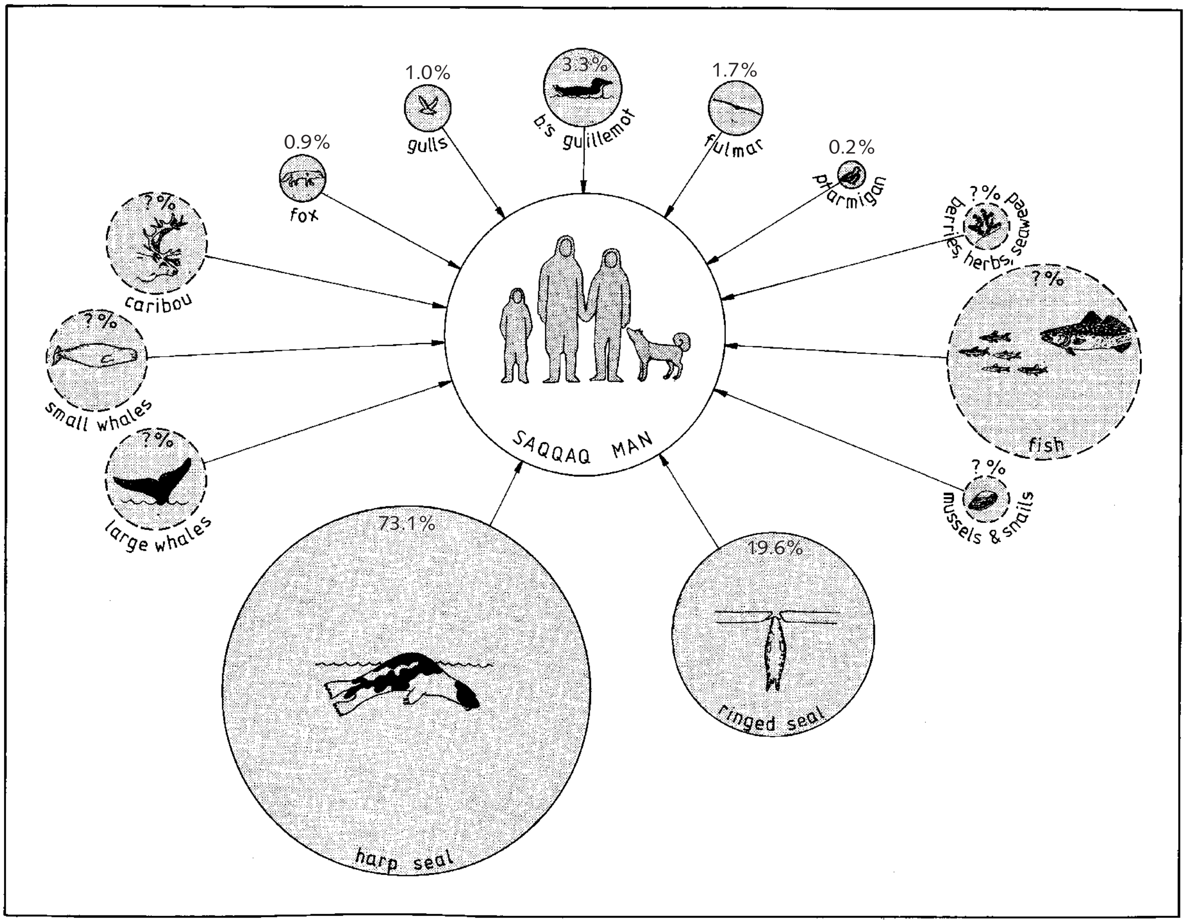


Fig. 10.4. The relative importance of the different economic components at Qeqertasussuk based on biomass figures (fully lined circles) (Table 9.5) and on an assessment that takes the taphonomic processes into account (stippled lines).

dent, our knowledge of the resource dynamics of the area indicates that the inhabitants, during these early centuries, still had to cope with quite dramatic changes in inter-annual resource availability.

Inter-annual variations in resource availability are more unpredictable than the seasonal variations and are more difficult to deal with. Important factors that affect resource availability on a year to year basis are (1) abnormal ice conditions, for instance prolonged ice cover which may deflect spring migrating white whales, harp seals, and birds, (2) abnormal weather conditions, for instance frequent fall and winter storms that may continuously break up the sea ice and prevent hunting of fall migrating marine mammals and birds and of ringed seals, or extraordinarily low sea temperatures in June which may prevent the capelin from spawning.

Even if food for storage can be secured, its preparation depends on weather, for instance the success in the drying of capelin, a potentially very important winter food item, depends on sunshine and wind. If it rains in the capelin drying season the crop may be destroyed altogether.

Inter-annual variations in resource availability are often relatively local. Föhn storms may for instance affect ice cover in Sydostbugten while no wind is felt in Qasigiannguit just 25 kilometres further north, and even though spring migrating marine mammals are barred from Sydostbugten by ice, they may well be accessible near Ikamiut or near Kitsissunnguit. Thus Saqqaq people living at Qeqertasussuk could probably in many cases avoid immediate starvation by moving out of Sydostbugten.

Inter-annual variations in resource availability have probably time and again both during the early base camp period and during later periods depopulated Qeqertasussuk for months or possibly for years. Even though such short-term variations were unpredictable, they occurred so frequently that ways of overcoming them had to be integrated into the subsistence patterns. High mobility and the ability to draw upon all alternative and available resources must have been important elements in the survival strategy also during the early base camp period. However, we still need to document these local and short-term resource crises archaeologically.

Base camp, period II, 2100-1900 BC

The faunal material from this period (FC-II) is large and well preserved and gives us a detailed picture of the subsistence economy (Figures 9.1, 9.2, 9.3 and 10.5). Basically, the economy is comparable to what was seen in base camp period I, but there are differences.

Communal harp seal net hunting

The relative economic importance of ringed seal hunting has decreased as compared to birds and harp seals (Table 9.2, Figure 9.1). This indicates that the relative importance of winter and spring ringed seal hunting was on the decline. This development is much more pronounced during the following period (FC-I, 1900-1700 BC) and it may be interpreted as a development towards a more restricted seasonal use of Qeqertasussuk.

This tendency to specialize also finds an expression in the hunting selectivity for certain age groups of harp seals (Table 9.8). From base camp period I (2400-2100 BC) to base camp period II (2100-1900 BC) there is a dramatic 40% decrease in the catch of young-of-the-year harp seals. From representing nearly 70% of the harp seal bag they drop to less than 30%. It has earlier been argued that this probably reflects a change in hunting methods and hunting strategy where a non-selective harp seal hunt employing more individualistic methods was undertaken in base camp period I and a more selective hunting practice perhaps with nets and boats targeted at harp seal groups, so called "ammissut", dominated in base camp period II.

The development of what could have been a more organized communal type harp seal hunting is interesting as is the possible employment of nets. Comparable communal harp seal net hunting has been undertaken *e.g.* in Labrador (Tanner 1944:495, 503) and Greenland (Rink 1852:119; Müller 1906; Ostermann *et al.* 1921:150; Kristiansen 1964; Lybert 1964) in historic and recent times. The fact that the specialized hunting for harp seal groups emerged centuries after the settlement of Qeqertasussuk indicates that it was an "in situ" development.

It should be taken into consideration that the Saqqaq people, coming from a high arctic environment, may only have had limited prior experience with migratory and social seals such as the harp seal and it is reasonable to believe that it took some time to find the best ways to harvest these animals.

Also, communal hunting for harp seals could have demanded the cooperation of several hunters, probably more than were present among the resident Qeqertasussuk families. Thus a certain human population level both regionally and in the local area may have been a prerequisite for the development of communal hunting, a level that it probably took several generations to attain.

Local fowling and fishing

During Base camp period II the importance of fishing and fowling was greater than during any earlier or later period of occupation and this indicates that the intensity of site use was as high as ever during spring, summer and fall. The importance of bird hunting was evident even to the eye during excavation and the excavators talked of the "bird layer". It was also revealed in the section recorded in the midden area (Figure 6.11).

Brünnich's guillemot and fulmar, cod and char were especially favoured on the menu. It is likely that most fish and birds were taken in the immediate vicinity of the site and that the catchment area was comparable to what was seen during base camp period I.

Specific mention should be made of the high number of ptarmigan that found their way into the pots of the Qeqertasussuk inhabitants during this period. As argued earlier this apparent preference probably reflects variations, which can be quite dramatic, in the natural population of ptarmigan.

Hey-days

The faunal evidence shows that base camp period II represents the most intensive occupation period docu-

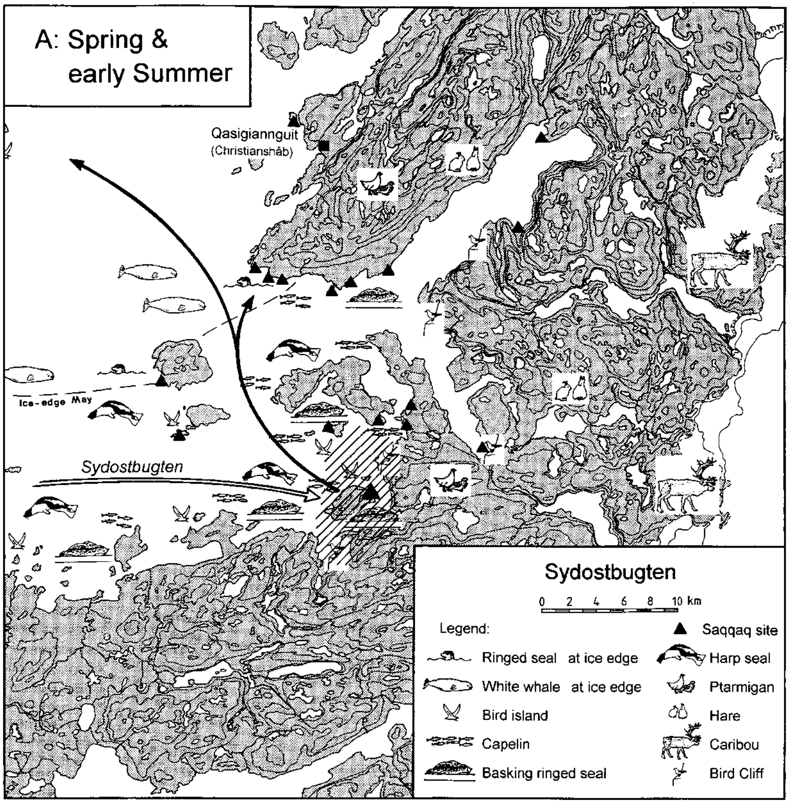


Fig. 10.5. A reconstructed Saqqaq subsistence settlement system for Base Camp period II (2100-1900 BC). Spring and early summer. Resource availability is highest in the outer island zone I (spring) and in the inner bay Zone II (early summer) (Fig. 2.16).

Key:
Large triangle = base camp
Small triangle = seasonal camp
Hatching = primary catchment area
Black arrow = journey to seasonal camp
Open arrow = influx of "outsiders"

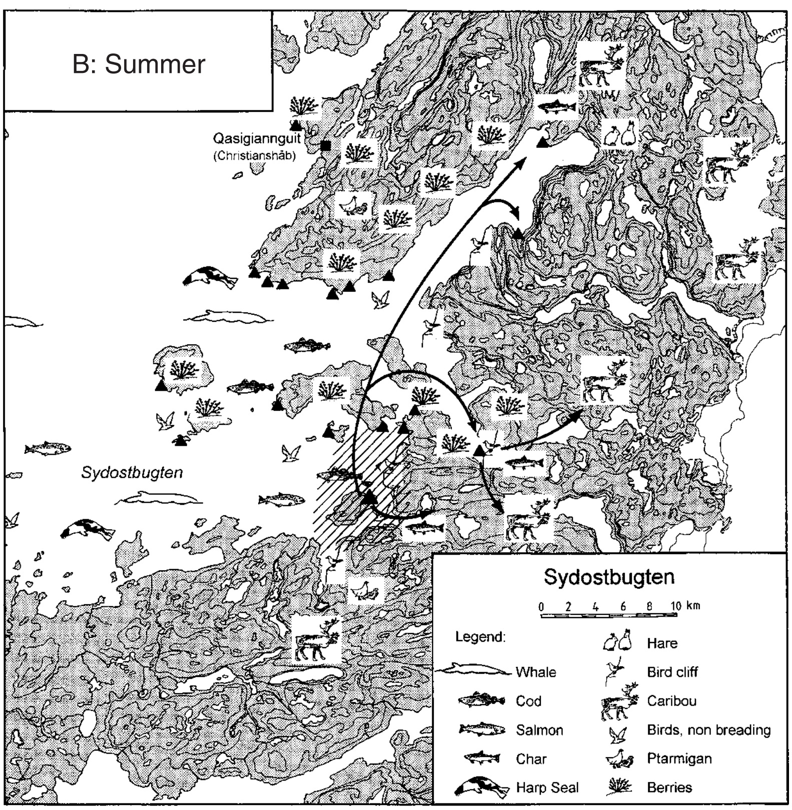


Fig. 10.5. (B). Summer. Resource availability is highest in the inner bay zone II.

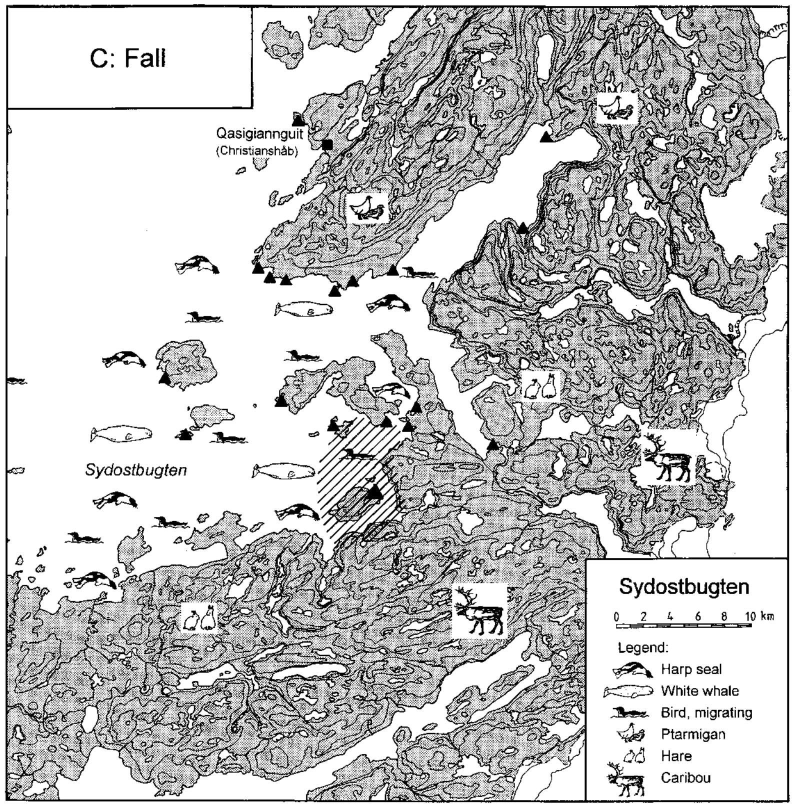


Fig. 10.5. (C). Fall. Resource availability is highest in the inner fjord and interior zone III.

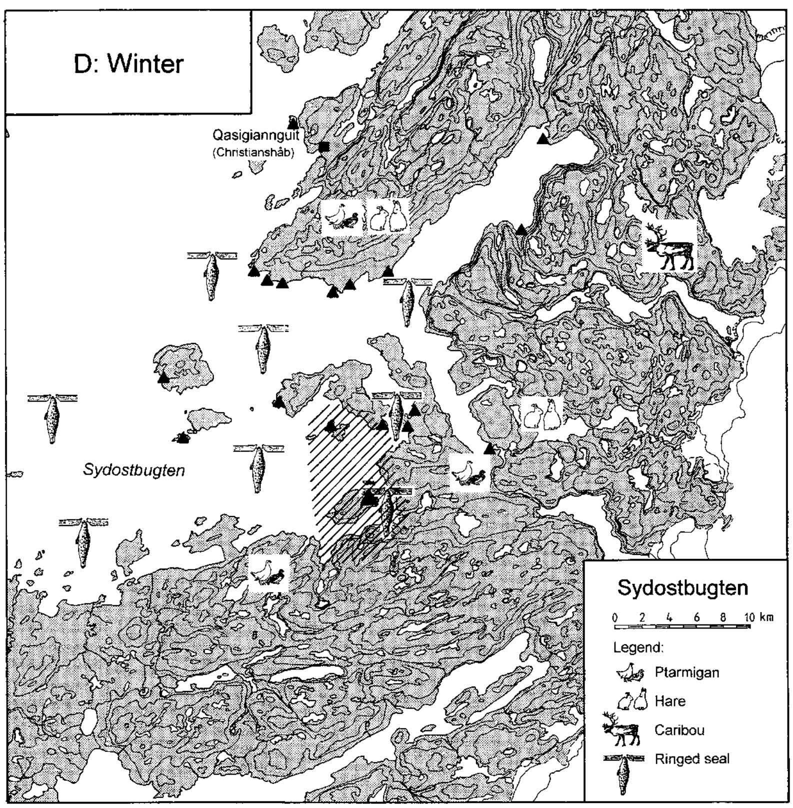


Fig. 10.5. (D). Winter. Resources are evenly distributed in winter bay zone IV.

Table 10.1. The table provides an overview of the subsistence economy of nine sites: The Pre-Dorset sites Umingmaq (Münzel 1987), and Gull Cliff (McGhee 1979) and the Independence I sites Cold Component (McGhee 1979) and Adam C. Knuth Site (Knuth 1983), and the Saqqaq sites Bight Site (Schledermann 1990), Qajaa (Møhl 1986), Tingit (Godtfredsen 1997a), Nipisat (Godtfredsen 1998), and Itinnera (Møhl 1972).

Numbers are total number of bone fragments and the following procedures were undertaken to make the fig.s comparable from site to site. + means less than 0.05%.

Itinnera: Unidentified seal bones (n=110) and bird bones (n=70) are distributed according to the representation of the individual species

Nipisat: Unspecified seal bones (n=5626), mammal bones (n=20046), and bird bones (17521) are distributed according to the representation of the individual species.

Qeqertasussuk: fig.s taken from table 9-2.

Qajaa: Unspecified seal bones (n= 13491) are distributed according to the representation of the individual species. Unspecified bird bones (n=108) are distributed according to the representation of the individual bird species.

Adam C. Knuth Site: Unspecified bird bones (n=24) are distributed according to the representation of the individual bird species.

Bight Site: SgFm-16, feature 1 and 2. Large seals (n= 60) are interpreted as bearded seals. Small seals (n=1947) are distributed according to the representation of ringed and harp seals. Unidentified bird bones (n=25) are distributed according to the representation of the individual species.

Gull Cliff (McGhee 1979) and Cold Component (McGhee 1979) are unadjusted.

Umingmaq (Münzel 1987): bones of hare to fox size (n=103) have been distributed according to the representation of hare and fox. Bones of caribou to musk ox size (n= 13.851) have been distributed according to the representation of caribou and musk ox. Unspecified bird bones have been distributed according to the representation of the individual bird species.

For all sites, unidentified mammal bones are distributed according to the representation of terrestrial and marine mammals.

	Itinnera		Tingit		Nipisat		Qeqertas-susuk		Qajaa		Adam C. Knuth Site		Bight Site		Gull Cliff		Cold Component		Uming-maq	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Walrus					553	0.8														
Harp seal	124	1.9	435	32.2	1035	1.6	10440	32.3	10282	67.9			66	2.4						
Harbour seal					14103	21.4			28	0.2										
Ringed seal			410	30.3	26	+	7314	22.6	3614	23.9	17	2.8	2081	76.3	509	62.3	928	81.5		
Bearded seal	16	0.2			177	0.3	94	0.3	28	0.2	11	1.8	334	12.3	31	3.8	49	4.3		
Hooded seal			45	3.3			97	0.3												
Caribou	6140	95.0	7	0.5	17355	26.4	62	0.2	10	0.1			2	0.1	7	0.9	9	0.8		
Musk ox											180	29.5	127	4.7	4	0.5			27617	94.0
Arctic fox	6	0.1	53	3.9	131	0.2	2155	6.7	22	0.1	268	43.9	12	0.4	229	28.0	92	8.1	1126	3.8
Other mammals					920	1.4	70	0.2	22	0.1	28	4.6	17	0.6	35	0.8	1	0.1	153	0.5
Fulmar, shearwater			16	1.2	426	0.6	2966	9.2	16	0.1	18	2.9	73	2.7						
Eider, duck, goose	75	1.2	7	0.5	11264	17.1	100	0.3	85	0.6	65	10.6			2	0.2	59	5.2	370	1.3
Ptarmigan			7	0.5	210	0.3	1149	3.6	35	0.2										
Gull	7	0.1	9	0.7	16272	24.7	1176	3.6	860	5.7	9	1.5	8	0.3						
Alcid	93	1.4	364	26.9	1054	1.6	6310	19.5	131	0.9			3	0.1			1	0.1		
Other birds	1	+			791	1.2	65	0.2	18	0.1	1	0.2	3	0.1					62	0.2
Fish					1483	2.3	324	1.0			14	2.3							57	0.2
NISP	6462	99.9	1353	100.0	65800	99.9	32322	100.0	15151	100.1	611	100.1	2726	100.0	817	100.0	1139	100.1	29385	100.0
TOTALS %																				
Marine mammals		2.1		65.8		24.8		55.5		92.2		5.1		91.0		66.9		85.8		
Terrestrial mammals		95.1		4.4		27.3		7.1		0.3		77.5		5.2		32.9		9.0		98.3
Birds		2.7		29.8		45.6		36.4		7.6		15.2		3.2		0.2		5.3		1.5
Fish						2.3		1.0				2.3								0.2
Total %		99.9		100.0		100.0		100.0		100.1		100.1		99.9		100.0		100.1		100.0
Diversity (no. species)	9		15		42		41		20		12		17		10		9		17	

mented at Qeqertasussuk. The sheer mass of bones in the midden is far greater than in the earlier and the later period (Figure 9.2), and the impression of a constant and massive deposition of refuse in the midden area is substantiated by Böcher and Fredskild (1993) who found plant and insect documentation for intensive wear and tear on the site surface during this period.

The high intensity of site use may reflect an increase in the number of inhabitants at the site during the summer half of the year. This is in accordance with the hypothesis of an emerging communal harp seal hunt which would have necessitated a seasonal, especially spring and early summer, immigration of hunters from other sites.

Hunting camp period, 1900-1700 BC

The tendency to specialize which we saw emerging during the base camp II period (2100-1900 BC) comes into full development. The hunters' focus on fewer species and diversity decreases from 32 species in the previous two base camp periods to 24 in the hunting camp period (Table 9.1). The relative importance of winter and early spring hunting for ringed seals and foxes decreases as compared to the selective hunt for harp seals which were primarily taken during their spring-early summer migration. The selective hunting for groups of harp seals becomes absolutely dominant and the young-of-the-year are simply absent from the hunting bag in this period.

The importance of bird hunting relative to harp seal hunting also decreased in this period. Among the birds especially the fulmar decreased in importance relative to Brünnich's guillemot and little auk, indicating a shift towards fall fowling.

The general intensity of use of the site decreases in this period, as documented both by the smaller volume of bones in the deposits (Figure 9.2) and by entomological and palynological indicators (Fredskild and Böcher 1993).

Taken together, these lines of evidence indicate that Qeqertasussuk is developing into a seasonal hunting camp with its main emphasis on spring and early summer harp sealing. During this season it is likely that hunters from other sites joined in on what appears to have been a lucrative harp seal hunt. Also, capelin fishing, which for taphonomic reasons is difficult to document archaeologically, may have been part of the attraction for hunters from other parts of the bay to come to Qeqertasussuk.

Even though spring and early summer appears to have been the prominent season at Qeqertasussuk during the seasonal camp period, there are also other interesting seasonal developments. The relative shift in focus from summer/early fall to fall as indicated by the bird data is a case in point. Also, the observation that caribou hunting was a relatively frequent occupation around 1700 BC indicates that the site though keeping a specialized profile had several seasonal roles to play.

Probably what we see is the result of a general change over centuries towards a seasonal site status superimposed by adaptational changes relating to natural fluctuations in the resource base. Qeqertasussuk had become a seasonal hunting camp in a subsistence settlement system which supported several other seasonal hunting camps and perhaps a base camp in another part of Sydostbugten. But it seems that it had also become a seasonal hunting camp of regional importance, as it probably was used as harp seal hunting camp by hunters from other parts of the bay.

This shift towards a more seasonal use of the Qeqertasussuk base camp is in accordance with Olsen (1998) who argues, especially on the basis of chronological changes in Saqqaq house types in Sydostbugten, that the period around 2000-1700 BC is characterized by increased population density and mobility and by related changes in settlement pattern. Thus Olsen proposes a development from a system with residential base camps and special purpose/seasonal camps towards a system of less differentiated seasonal site types where base camps of a more residential nature also takes on a more seasonal role (Olsen 1998:123-124).

High activity period, 1700-1400 BC

Unfortunately there are no faunal remains preserved from this period. During excavation, however, it was noted that large patches of layer 14 (Area C just below the layer in point) were very sticky and smelly and difficult to excavate. Probably, these seepages represent blubber that came from the high activity period and

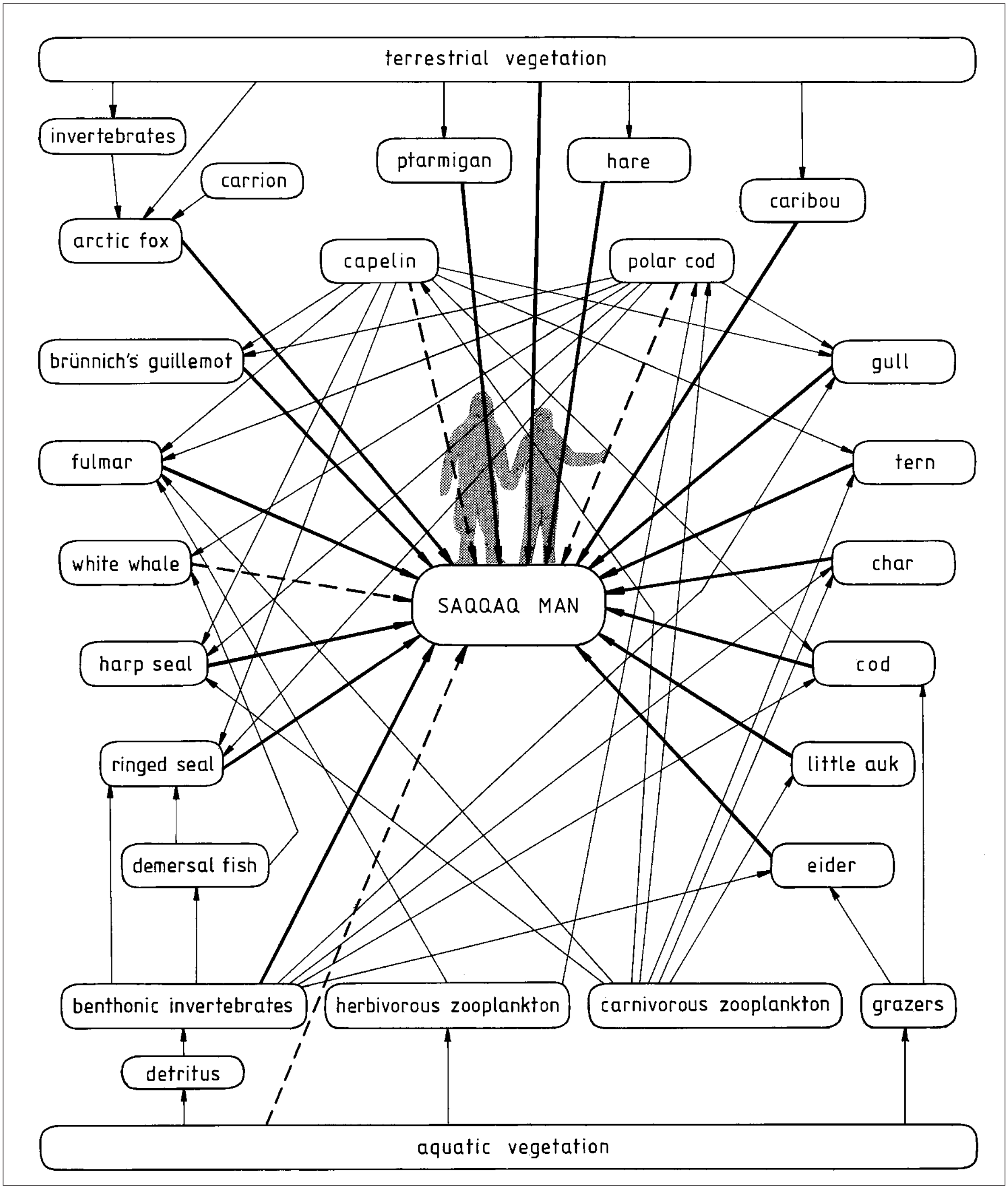


Fig. 10.6. The food web of Sydostbugten during Saqqaq times. It illustrates the key role that species such as capelin and polar cod play, and how environmental change that affects these species has profound effects up through the system. The decline and abandonment of the Qeqertasussuk settlement may have been triggered by a shift from a more atlantic "capelin climate" to a more arctic "polar cod climate".

thus are an indication of a continued sea mammal hunt. The cultural layers are characterized by very high densities of stone tools and other cultural remains indicating heavy use of the site (Grønnow 1994). There are no changes in tool type frequencies or other parameters that could be taken to indicate a change in seasonal use of the site in this period (Grønnow 1994).

By the end of this "high activity period" the site had been occupied through 1000 years. Grønnow (1994) found only minor indications of technological changes during these many years, and it is clear that the Saqqaq people in Sydostbugten had a technological approach that was sufficient to deal with the seasonal and inter-annual variations in resource density, distribution, and availability.

Decline and abandonment 1400 BC

After 1000 years of use the Qeqertasussuk site is abandoned some time after 1400 BC, never to be reoccupied again. Earlier studies indicated that the Saqqaq people for several centuries continued to inhabit sites towards the North in Disko Bay (Meldgaard 1983), however, a re-evaluation of Saqqaq C-14 datings show that also the larger Saqqaq sites at Qajaa and Sermermiut may have been abandoned around 1500 BC (Jensen in press). However, further south along the west coast of Greenland in the Sisimiut district, C-14 datings show that there may even be continuity between Saqqaq and Dorset (Møbjerg 1997, Jensen in press). But why did they leave Qeqertasussuk?

A few species play an important part in Sydostbugten's food-web. Especially the capelin and the polar cod play critical roles as primary food sources for many marine mammals in the area (Figure 10.6). As such they may be designated keystone species in Sydostbugten's food-web. Any factors that influence the abundance and distribution of these species could also be expected to have a significant effect on their predators, including Saqqaq Man.

During the last 700 years of its use, Qeqertasussuk appears to have served primarily as a spring and summer camp and the harp seal was the most important game. A shift towards a more arctic climate around 1500-1400 BC would have severely affected the availability of harp seals in spring and summer in Sydostbugten, and it could be speculated that such a shift could have been the impetus for the inhabitants of Qeqertasussuk to move elsewhere. The last occupational layer has a relatively high percentage of caribou bones and was in the field designated "the caribou layer". Caribou benefit from a more stable arctic climate and the occurrence of caribou near the end of the occupation seems to support the hypothesis.

A general shift from more atlantic to more arctic conditions may to some degree have improved the winter resource situation by securing a more permanent ice cover and thus access to ringed seals. At the same time arctic cod, the keystone species of this more arctic food web (Figure 10.6), would become increasingly important, especially in fall and winter. The spring and early summer resource situation would, however, deteriorate. The capelin, which was the keystone species of the more subarctic food web, would decrease in numbers and with it the spring migration of harp seals into Sydostbugten would lessen. In general, the biological productivity would go down.

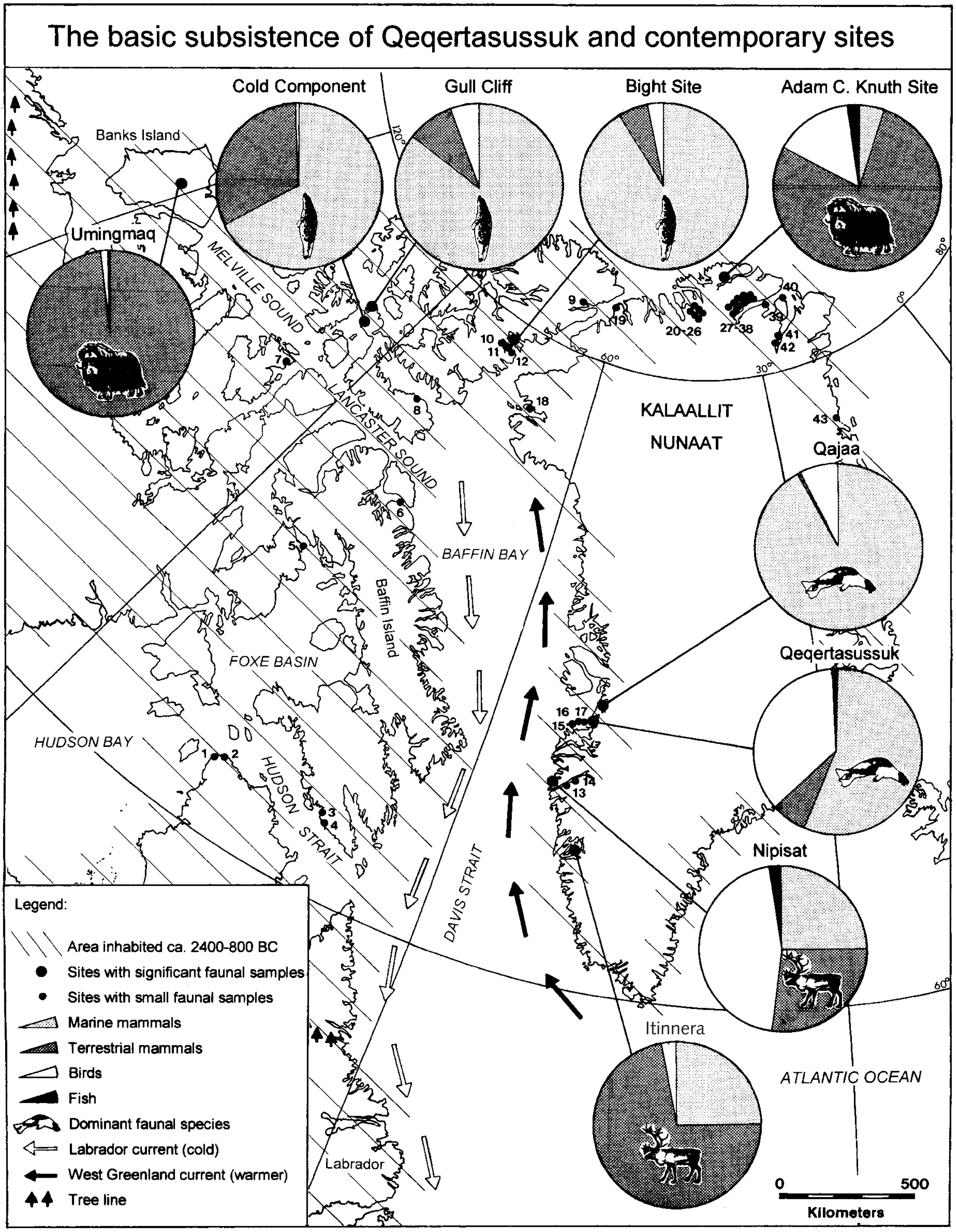
Thus, it does seem plausible that there may have been a causal relationship between the general cooling around 1500 BP and the negative impact that this cooling may have had on the availability of key resources, particularly harp seal and capelin.

Of course the harp seals returned to Sydostbugten during more atlantic periods, but for some reason the Saqqaq people did not choose to resettle on the island. Not one trace reveals later occupations on Qeqertasussuk. Olsen (1998) has documented a similar pattern of early Saqqaq occupation in the southwestern part of Disko Bay. Jensen (in press) is of the opinion that after *ca.* 1400 BC groups of Saqqaq hunters only sporadically visited the Disko Bay area.

Harp seal hunters of Disko Bay

The pioneers that spread across the Canadian high arctic islands *ca.* 2500 BC and approached the gateway to Greenland adapted their hunting techniques and strategies to a high arctic fauna where ringed seals were the main marine, and musk oxen the main terrestrial prey (Figure 10.7). In fact, the refinement of ice hunting techniques allowing successful ringed seal winter and spring hunting may have been the main impetus that opened this vast region to human occupation.

Moving into northern Greenland only a few generations after they left Alaska, these early explorers managed to make a living in the northernmost land on earth. Even though their stay in Peary Land was of a relatively short duration, they seem to have developed a system of base camps and hunting camps that were adapted to the distribution and availability of the area's resources (Darwent 2001; Jensen 2003).



While these high arctic hunters were concentrating on ringed seal and musk ox hunting they managed to keep afresh the knowledge of a hunting technology which probably was developed in the open water areas of the Bering Strait, a technology which allowed them, from the start, to take full advantage of the rich atlantic resources which they encountered in West Greenland.

Fig. 10.7. Early sites with significant faunal samples are rare in the Eastern Arctic. The map provides an overview of the subsistence economy of nine sites based on total number of bone fragments. The Pre-Dorset sites Umingmaq (Münzel 1987) and Gull Cliff the Independence I sites Cold Component (McGhee 1979) and Adam C. Knuth Site (Knuth 1983), and the Saqqaq sites Bight Site (Schlederman 1990), Qajaa (Møhl 1986), Nipisat (Godtfredsen 1998), Tingit (Godtfredsen 1997a), and Itinnera (Møhl 1972) (Table 10.1).
Early sites with smaller faunal samples are: (1) Meeus Site (Taylor 1962), (2) Pita Site (Taylor 1962), (3) Killilugak Site (Maxwell 1973), (4) Davidee Site (Maxwell 1973), (5) Kaleruserq (on file at Zoological Museum, Copenhagen), (6) Mittimatalik (Mary-Rousseliére 1976), (7) Back Bay (Ramsden & Murray 1995), (8) Ice Breaker Site (Helmer 1991), (9) Lonesome Creek (Knuth 1983), (10) Rastodden (Schledermann 1990), (11) Lakeview (Schlederman 1990), (12) Skraeling Island (Schledermann 1990), (13) Ulosaq (unpublished), (14) Umiatsiavilinnguaq (unpublished), (15) Tupersuai (Jensen 1998), (16) Kuup Qalorsaa & Niivertussannguaq (Jensen 1998), (17) Ikamiut (Jensen 1998), (18) Qorluulasupaluk (unpublished), (19) Solbakken (Knuth 1981), (20-26) Tokanten, Portfjeld, Skurenæs, Pearylandville, Bob´s Site, Martins Site (Knuth 1967; Elling 1988), (27-38) Deltaterasserne, Søhuset, Kildebukhus, Lagunehøj, Galleriet, Gammel Strand, Vandfaldsnæs, Kølterasserne, Midternæs, Walcott Delta, Vendenæs (Knuth 1967; Elling 1988) (39) Kap Peter Henrik (Knuth 1967; Elling 1988), (40) Kap Ludovika (Knuth 1967; Elling 1988), (41) Kap Holbæk (Knuth 1967; Elling 1988), (42) Den Blå Flints Boplads (Knuth 1967; Elling 1988), (43) Sønderland (unpublished).

Further south in West Greenland Saqqaq hunters settled in areas with quite different resource compositions and with much better access to inland terrestrial resources (Gulløv in press). But they seem to have adapted to the local conditions and developed a subsistence settlement system shaped after the seasonal changes in resource distribution and availability (Godtfredsen 1992, 1997a, 1998; Møhl 1972).

In Disko Bay these early people skilfully combined ice hunting technologies with open water hunting technologies and thus accessed a combination of resources that allowed them to develop an economy that was sufficiently flexible to cope with an ever changing resource base. The Disko Bay Saqqaq economy was also based on a subsistence settlement system that involved base camps and hunting camps where harp seals in combination with ringed seals formed the solid foundation. The Saqqaq harp seal hunters of Disko Bay flourished continuously for more than 1000 years, a long span of time by most standards, and they represented what is probably some of the most well-adapted and successful marine mammal hunters in the world.

It is also fascinating to see how the basic structure and economy of the settlement system and the heavy reliance on marine mammals, especially harp seals, that was developed 4500 years ago is, in many respects, comparable to the situation 50 years ago, despite the fact that major cultural changes had taken place in the intervening millennia.

Appendix 1

Stratigraphic description

Soil characterisation of sections in excavation Area B and C

Abbreviations in the following soil characterisation – undertaken by Dr. Charlie Christensen of the Danish National Museum (1990) – follow J. Troels-Smith (1955:42 ff): nig. (*nigor*), the degree of darkness; strf. (*stratificatio*), the degree of stratification; elas. (*elasticitas*), the degree of elasticity; and sicc. (*siccitas*), the degree of dryness. All estimated on a 5-class scale. Descriptions of the composition of the Peat or *Turfa* is abbreviated T and the various *Turfa* categories are; Tb, *Turfa bryophytica*; Th, *Turfa herbacea*; Tl, Turfa lignosa. The category of mineral particles is subdivided into mineral particles < 0.06 mm.; Argilla, and mineral particles > 0.06 mm; Grana. As, *Argilla steatodes* – consists of colloids or grains < 0.002 mm; Ag, *Argilla granosa* – consists of grains the size of which ranges from 0.06-0.002 mm. *Grana* consists of solid particles > 0.06 mm. Ga, *Grana arenosa* – 0.06 to 0.6 mm; Gs, *Grana saburralia* – 0.6 to 2 mm; Gg (min), *Grana galareosa minora* – 2-6 mm; Gg (maj), *Grana galareosa majora* – 6 to 20 mm.

Section 10-15/23 in excavation Area B

Layer 1. Living vegetation and recent peat.
The vegetation is dominated by *Empetrum nigrum*, *Equisetum arvense*, *Salix glauca* interspersed with grasses, sedges and mosses. The surface has a hummock-structure (diameter *ca.* 60 centimetres) probably created by permafrost action.

Characterisation: nig. 3, strf.+, lim.s. 1. *Colour*: redbrown, downwards more greyish. When dried up the layer is light greyish-brown. *Struc.:* cohesive, coarsely matted with many recent rootlets primarily of *Equisetum* and *Salix*. When dried up, the layer is seen to be sandy. *Composition:* Th$^{1\text{-}2}$3, Tl^{1}++, Th$^{\circ}$1, Tl$^{\circ}$+, Ga ++. The sand component must originate from the blowouts at the ridge of the raised beaches. There are no cultural remains in the layer. The layer's lower limit follows the hummock's curvature.

Layer 2. Brown, decomposed silty peat.
Characterisation: nig. 2 (the light silty parts) to 3, strf. 1, elas. +, sicc. 2-3, lim. s. 1. *Colour:* Olive-brown to chocolate-brown, the silty parts light yellow-brown. *Struc.*: Relatively homogeneous except for lighter silty 1-3 cm. wide bands that follow a horizontal course in the lower part of the layer while they follow the curvature of the hummocks in the upper part of the layer. In places the light bands are folded or discontinued as a result of solifluction. Only few plant remains are found in the relatively decomposed layer. *Composition:* Th^{3}4, Tb^{2}+, Tl^{3}+, Ag+++, Ga+, Th^{0}++. *Fos. vege.:* Some rootlets and small fragments of herbs. In the lower part with better preserved plant remains. Some woody twigs or roots of which only the bark remains. Recent *Equisetum* rootlets are common in the upper part. A few moss fragments are present. *Fos. anim.:* Macrofossil analyses have documented the presence of insect remains (Böcher and Fredskild 1993). *Rud. cult.:* none.

The upper two thirds of the layer from 10 to 14/23 and the whole layer from 14 to 15/23 is disturbed by cryoturbation and solifluction.

Layer 3. Brownish-black, decomposed peat.
Characterisation: Nig. 4 – (dry: 3 –), strf. 1, elas 1+, lim.s. 1-3. *Colour:* brownish-black (dry: dark brown, slightly grayish). Darker downwards. *Struc.:* Fairly homogeneous and fine grained layer composed primarily of small plant fragments. The layer is relatively decomposed and does not appear as matted as the underlying layer. The greyish colour in dry condition is probably a result of a slight silt content. *Composition:* Th^{2}4, Tb^{2}++, Tl^{2}+, Ag+, [rud. cult. (+)]. *Fos. vege.:* Many small herb fragments, only few larger plant remains. Few twigs. Some moss fragments. Many *Empetrum* seeds (macrofossil analysis document very large numbers, possibly remains of human excrements (Böcher and Fredskild 1993). *Rud. cult.:* Very few stone artefacts, no bones.

The layer can be followed from 10-14/23. From 14-

15/23 the layer merges with the overlaying layer as a consequence of cryoturbation. The layer presents itself very prominently because of its dark colour.

The high degree of decomposition of the uppermost cultural layer (layer 3) made excavation easy. The annual thaw of the permafrozen soil reached the upper parts of this layer and accordingly no organic material was preserved here.

Layer 5. Blackish-brown, slightly decomposed grass-peat with some cultural remains.
Layer 5 is from 10-11,20/23 not separated in layers 5c and 5d because in this area there is a perfectly gradual change in character down through the layer, while the content of culture remains is fairly constant from top to bottom. Lim. s. 1.

Layer 5a. Dark brown, dense, matted peat.
Characterisation: nig. 3 (dry: 3-), strf. 1, elas. 2-, lim. s. 2-3. *Colour*: dark brown (dry: somewhat lighter). *Struc.:* dense matted layer of primarily finer plant remains, but more coarse than in layer 3 and less decomposed. *Composition:* $Th^{I++}4$, $Tb^{I++}+$, $Tl^{I+}+$, Ga (+), [rud. cult. +]. *Fos. vege.:* Matted roots and some coarser plant remains. A few twigs. Some moss fragments. Many *Empetrum* seeds. *Rud. cult.:* A few bones, fire-cracked rocks and a few other cultural remains.

This layer can be followed from 10 to 12,4/23 where it merges with layer 5c and becomes 5e.

Layer 5b. Blackish, charcoal bearing peat.
Characterisation: nig. 4- (dry: 3+), strf. 1-, elas 1, lim. s. 1-2. *Colour:* Almost black (dry blackish-brown). *Struc.:* dense, matted layer made up of finer plant remains and some twigs. Characterised by a high content of large and small pieces of charcoal, that gives the layer a loose structure. *Composition:* $Th^{I+}4$, $Tb^{I+}(+)$, $Tl^{I}+++$, [rud. cult. 1]. *Fos. vege.:* Felted roots and a lot of coarser plant remains. A good deal of *Empetrum* and *Betula* or *Salix* twigs. Moss fragments are rare. Many *Empetrum* seeds. *Fos. anim.* Some fly pupparia. *Rud. cult.:* Mammal bones, stone tools and debitage, fire-cracked rocks and very large amounts of charcoal.

This layer can be followed from 10 to 12,4/23, but there is no doubt that layer 5f (from 13,25-15/23) is a continuation of layer 5b.

Layer 5c. Blackish-brown, matted-felted grass-peat.
Characterisation: nig. 3+ (dry: 3), strf. 1, elas. 3, lim. s. 2. *Colour:* Blackish-brown (dry: dark brown). *Struc.:* Very matted-felted, relatively well preserved layer of grass and other herbs without a finer matrix. *Composition:* $Th^{I}4$, $Tb^{I}(+)$, $Tl^{I}+$, [rud. cult. +]. *Fos. vege.:* Solely consisting of stems and roots of grasses, but with a few twigs. Moss fragments are rare. Macrofossil analysis show local but high concentrations of *Empetrum* leaves and *Vaccinium* seeds. *Fos. anim.:* many fly pupparia. *Rud. cult.:* Only few cultural remains.

This layer can only be separated from layer 5d from *ca.* 11,2-12,4/23 on the basis of a lighter appearance and a much smaller content of cultural remains.

Layer 5d. Brownish-black, relatively decomposed grass-peat with many cultural remains.
Characterisation: Upper part: nig. 3 (dry: 3-), strf. 1, elas. 3, lim. s. 1-2. Lower part: nig. 4 – (dry: 3+), strf. 2, elas. 2. *Colour:* upper part: blackish-brown (dry: dark brown), lower part: brownish-black (dry: blackish-brown). *Struc.:* Upper part: relatively coarse, matted-felted, relatively well preserved grass-peat, in places with a matrix of decomposed organic matter and few cultural remains. Lower part: more incoherent and decomposed grass-peat dominated by the large content of cultural remains, especially twigs and bones. Ice inclusions occur. *Composition:* Upper part: $Th^{I}+4$, $Tb^{I}+(+)$, $Tl^{I}+++$, Ga(+), [rud. cult. +++]. Lower part: $Th^{2}3$, Tl^{I}, Ga(+), [rud. cult. 1-]. *Fos. vege.:* Upper part: matted roots and many larger plant remains, especially grasses (*e.g.* lyme grass). Some twigs and bark, and a few fragments of moss. Lower part: Some decomposed grass-peat can be identified, but otherwise the peat exists in the form of a decomposed matrix between many small and large twigs and other cultural remains. *Fos. anim.:* In the lower part there are numerous fly pupparia, in some places they occur in mats. Insect remains are present. *Rud. cult.:* There are only few cultural remains in the upper part, while the lower is completely dominated by cultural remains, including numerous twigs. The cultural remains are represented by bones, charcoal and wood, stone tools and debitage, fire-cracked rocks etc.

The layer can be traced from 11,2-15/23.

Layer 5e. Dark brown, dense matted peat.
This layer can be traced 12,40/23, where layer 5a and

5c merge., to 14,25/23, where it is disturbed by cryoturbation. In the section the layer appears much lighter than the overlaying layer 3 and the underlying layer 5f. Lim.s. 1-4.

Layer 5f. Black, charcoal bearing peat.
The layer is identical to layer 5b, but because of the large rock in the section around 12,85/23 the two layers can not be separated along one meter of the section, and therefore they do not appear as one continuous layer in the section. Lim. s. 1-3.

Layer 5g. Blackish-brown, matted-felted grass-peat with many cultural remains.
The layer has the same composition as layer 5c, but it contains many more cultural remains. Lim. s. 1-2.

The well preserved, matted peat of the layers 5 and 5a to 5d was very coherent, but it was easy to separate in horizontal pads that could be fragmented further with a trowel or with the fingers. Usually the peat would separate nicely if an object was embedded, thus making it easy to discover and preserve articulated bones or hafted tools.

Layer 6. Black decomposed peat with high concentrations of cultural remains.
Characterisation: nig. 4 – (dry 3++ to 4 – (lower part)), strf. 2, els. 2, lim. s. 1. *Colour:* almost black (dry: blackish-brown to brownish-black (lower part)). *Struc.:* very loose peat dominated by the high concentration of cultural remains, that mainly consist of twigs, bones, char coal, and fire-cracked rocks. Ice lenses occur. *Composition:* Th^{2}2+, Tb^{2}++, Tl^{1}2, Ga+, [rud. cult. 1+]. *Fos. vege.:* Relatively decomposed rootfelt and coarser herbal parts. Some moss fragments. Many twigs of *Empetrum, Betula*, and *Salix*, often with the leaves "in situ". The *Empetrum* twigs are dominant. Macrofossil analysis show, especially in the lower parts of the layer, scales and fruits of *Betula nana*, leaves and fruits of *Empetrum nigrum*, leaves of *Ledum pallustre*, and capsules of *Cassiope tetragona*. *Fos. anim.:* Many fly pupparia, locally in mats. *Rud. cult.:* cultural remains are represented by twigs, bones, charcoal and wood, stone tools and debitage, fire-cracked rocks etc. The amount of cultural remains increase uphill, i.e. from northwest to southeast in profile 10-15/23.

Layer 6 could be followed throughout the section. The delimitation between 5d and 6 in the section is made where the amount of small twigs decreases and where bone composition changes from a "dominance of birds" in layer 5d to a "dominance of seals" in layer 6. The borderline between the two layers is diffuse. However, the shift from layer 5d to layer 6 was quite clear to the excavator. The matted peat disappeared and the structure of the deposit became "looser" and dominated by twigs and bones. The concentration of finds was generally so high that the trowel could not be used (Figure 6.9). Instead it was necessary to work through the sediment with the fingers.

Clear ice was often encountered in cavities beneath stones and between bones and twigs. When melted, the soil itself was saturated with water. During the melting process strong odours were released and they mostly reminded one of the stale odours of "sour" urine. Probably they resulted from prehistoric decomposition processes that were being resumed. This was confirmed by the fact that the odours attracted the dungfly *Scathophaga furcata* (Say, 1823) which laid its eggs in the surface of the midden. Also the arctic foxes in the area were attracted by the scent, and they left their personal marks on the plastic bags with midden samples.

Layer 7. Gravel lenses in layer 6.
In the lower part of layer 6 there are sharply delimited lenses of gravel, small pebbles and rounded mollusc fragments. The lens is partly divided by a thin (ca. 1 cm.) intrusion from layer 6. The gravel lenses do not appear in section 10-15/23.

Layer 8. Blackish-brown, felted-matted grass-peat.
Characterisation: nig.: 3+ (dry: 3), strf. 3, elas. 3, lim. s. 2. *Colour:* blackish-brown (dry: dark brown). *Struc.*: felted-matted 1-2 cm. thick layer of only slightly decomposed grass-peat that can be pealed off the underlying beach like a mat. *Composition:* Th^{1}4, Tb^{1}++, Tl^{1}(+), Ga++, [rud. cult.(+)]. Fos. vege.: Root-felt, stems and leaves primarily of grass. Many leaves of lyme grass can be seen, also some moss and a few thin twigs or roots. *Rud. cult.* Very few, especially bones, probably trodden down.

Layer 9. Yellowish-grey, slightly gravely beach sand.
The subsoil consists of yellowish-grey, slightly gravely sand, stratified and with horizons of gravel and round-

ed stones. Especially on the surface 10-20 centimetre large stones can be observed. These deposits represent raised beach-ridges developed between the island and the small knoll.

Section 85/252-255 in excavation Area C

Layer 9. Living vegetation and sandy peat.
The vegetation is dominated by *Empetrum* with many grasses, sedges, *Salix glauca* and *Equisetum arvense*. Only few mosses.

Layer 10. Living vegetation and recent peat.
The vegetation is dominated by *Empetrum nigrum, Equisetum arvense*, *Salix glauca* interspersed with grasses, sedges and mosses. The surface has a hummock-structure probably created by permafrost action.

Characterisation: nig. 3, strf.+, elas. 3, lim.s. 1. *Colour*: redbrown, downwards more greyish. When dried up the layer is light greyish-brown. *Struc.:* cohesive, coarsely matted with many recent rootlets primarily of *Equisetum* and *Salix*. When dried up, the layer is seen to be sandy. *Composition:* $Th^{I-2}3$, Tl^{I}++, $Th^{o}1$, Tl^{o}+, Ga ++. There are no cultural remains in the layer.

Layer 11. Brown, decomposed silty peat.
The upper part of the layer is disturbed by cryoturbation. The upper limit of the permafrost level is situated in the lower part of the layer. Cultural remains, in the form of few stone artefacts and some charcoal, are found in the lower part. Insect remains are preserved.

Characterisation: nig. 2 (the lighter silty areas) to 3, strf. 1, elas. +, sicc. 2-3, lim.s. 1. *Colour:* Olive brown to chocolate brown, the silty areas are light yellow-brown. *Struc.:* Homogenous layer with lighter silty 1-3 cm. thick bands. The silty bands are linear in the deepest part and cryoturbated in the upper. Only the most evident of these bands are registered on the profile drawing. *Composition*: $Th^{3}4$, Tb^{2}+, Tl^{3}+, Ag+++, Ga +, Th^{o} ++, rud. cult. +. *Fos. vege.:* Some roots and minor herb fragments. Recent horsetail roots are present in the uppermost layers. In the deepest part the bark from some roots and twigs are preserved. *Fos. anim.:* Remains of insects are present. *Rud. cult.:* Few charcoal bits and chips of killiaq are present in the lower part.

Layer 14. Black, charcoal bearing peat.
Characterisation: nig. 4- (dry: 3+), strf. 1–, elas. 1, lim.s. 2-3. *Colour:* Almost black (dry: black to brownish with more light peaty areas). *Struct.:* The layer has the appearance of being totally sintered, completely dominated by the high content of charcoal and fire-cracked rocks. The organic contents appear to be blubber encrusted. *Composition:* $Th^{2}4$, Tb^{2} ++, Tl^{2}(+), Ga ++, (rud. cult. 1) *Fos. vege.:* Most consisting in decomposed roots mainly from grasses. A minor content of mosses and a few badly preserved twigs. *Rud. cult.:* Large amounts of charcoal, and boiling stones. Many bones, flakes and stone tools.

In the transect the layer is quite thin and well defined, at some places *e.g.* in 85/257-260 it disappears or can only be found as thin lenses. In the northernmost section the layer is thick and almost reaches the surface due to cryoturbation. In excavation Area C the layer is thick and highly dominated by cultural remains, including boiling stones and stones from destroyed structures.

Layer 14a. Blackish-brown peat with cultural remains.
This layer is separated in the northern part of the transect from 85/263,5-267. A transitional layer between layers 14 and 15 with better bone and wood preservation than 14. 14a thus contains feather, hair and baleen.

Layer 15. Bright brown, fibrous-felty peat with some cultural remains.
Culture layer with some artefacts and well preserved bones in a light brown, slightly decomposed, matted peat.

Characterisation: Nig. 2 – (dry 2+), strf. 1, elas. 3 lim.s. 1-3. *Colour:* Bright brown when fresh (Dry: brown). *Struc.:* Compact fibrous-felty peat. *Composition:* $Th^{I-}4$, Tb^{I-}(+), Tl^{I-}+, Ga (+), (Rud. cult.++). *Fos. vege.:* Dominated by roots, stalks and leaves from grasses. Some twigs in the lower part, very few mosses. Locally there are many seeds from *Empetrum*. *Fos. anim.:* Many fly pupparia as well as other insects. *Rud. cult.:* some wood, charcoal, fire-cracked rocks, lithic tools and debitage in particular in the lower parts. Good conditions for organic preservation, hair and feathers are preserved.

The layer can be followed through the entire transect. In excavation Area C, 85/248,8-249,9, there was a compact layer of wood shavings.

Layer 16. Black peat with a large content of cultural remains, especially twigs.
Characterisation: Nig. 4– (dry 4–), strf. 2, elas. 2, lim.s. 1. *Colour:* Almost black, (dry: brownish-black). Struct.: Loosely structured peat dominated by a high content of cultural remains which in particular is made up by twigs. The basal substance is only found as thin coatings on twigs. Due to the open structure, ice lenses are common. *Composition:* Th^{2}1, Tb^2++, Tl$^{1-2}$3, Ga+, [Rud. cult.1]. *Fos. vege.:* Many *Betula, Salix* and *Empetrum* twigs often with leaves. *Empetrum* is dominant. There are many felty roots, herb fragments and stalks of mosses in the lower part. High content of *Empetrum* seeds fruits and leaves of *Betula* and leaves from *Vaccinium*. *Fos. anim.:* Locally large amounts of fly pupparia.

Rud. cult.: The many twigs are probably cleaned out matting from sleeping platforms in excavation Area C, which might be supported by the fact that the twig component decreases towards north. Charcoal, wood (in the form of tools as well as debitage from driftwood) fire-cracked rocks, mammal and bird bones as well as lithic tools and debitage are present in large quantities.

The layer can be separated from 85/249-258.7, where it becomes thinner, but it reappears in a couple of places in the northernmost part of the profile. In the northernmost sections, the twig content is low (*composition*: Th^{2}3, Tb^2++, Tl^{1}l, Ga +, [rud. cult. 1–] and the layer is more difficult to separate from the overlying layer 15 and the underlying 15a. In this area the three layers become very similar in composition and appearance. Upper and lower limits are blurred (lim.s. 1) From 85/253-254 a transitional layer is separated between layer 15 and 16.

Layer 15a. Brown, fibrous-felty, moss bearing peat with relatively few cultural remains.
Characterisation: nig. 2, (dry: 3), strf. 1, elas. 3, lim.s. 1. *Colour* : light brown when fresh (dry: dark brown). *Struc.*: Dense fibrous, felty only slightly decomposed peat with a structure comparable to the structure of layer 15. *Composition:* Th^{1-}3, Tb^{1}1, Tl^1++ Ga (+) [rud. cult. ++]. *Fos. vege.*: Consist of roots, stalks and leaves of grasses including *Elymus*. In some areas moss stalks with leaves around half of the substance. Locally there are some twigs. *Empetrum* seeds and leaves are present. *Fos. anim.*: Fly pupparia. *Rud. cult.:* Some worked wood, charcoal, bones, fire-cracked rocks, lithic tools and debitage. Very good conditions for preservation. The location of cultural remains changes over the transect. In most areas they are located in the top of the layer, but in the northern most section, where layer 15a rests directly on the sterile subsoil, there are also cultural remains in the lower section (though not in the lowest 3-4 cm.). The layer is only separated in the southern part of the transect, where it rests on layer 18 and in the northern part of the transect, where it rests on the subsoil. At places it is difficult to separate from layer 18.

Layer 18. Black, relatively decomposed, felty peat with few cultural remains.
Characterisation: nig. 4– (dry 4–), strf. 1, elas. 2, lim.s. 1. *Colour:* Almost black (dry brownish-black). *Struc.*: Fibrous-felty peat with a basal substance of decomposed peat. Not as tough and coherent as layer 15 and 15a, of which it appears to be a more decomposed version with smaller plant remains and with more roots. *Composition*: Th^{2}4, Tb^2++, Tl^2+, Ga++ (rud. cult. ++). *Fos. vege.*: Felty roots and some more coarse plant remains. Some mosses, seeds and many leaves from *Empetrum*. Some twigs. *Rud. cult.*: At places artefact bearing with same cultural remains as layer 15a. The lowest few cm constitute an almost sterile horizon. the layer can be followed from the southernmost part of the transect towards north to 85/262,6, from where layer 15 a constitutes the lowest layer. The layer is easily detached from the subsoil, thereby exposing the fossil cobblestone beach that forms the sterile substratum.

Appendix 2

Informants

In 1986 eight informants were interviewed to throw light on the distribution, occurrence and availability of the living resources in Sydostbugten. They were former inhabitants of the Akulliit settlement and had all been active hunters and fishermen until the settlement was abandoned in 1963. Akulliit is situated *ca.* 10 kilometres north of Qeqertasussuk.

The then students at Ilisimatusarfik, Maria Steenholt and Elisa Evaldsen, undertook the interviews in Greenlandic and taped them. Later the interviews were transcribed and translated into Danish by Maria Steenholt. The transcriptions are kept op file at Qasigiannguit Museum.

In the text reference is given to the informants by stating their full names followed by "inf. 1982 or 1986".

The following informants were interviewed in 1986: Søren Frederiksen*, Kasper Didriksen*, Henrik Iversen, Lars Johansen, Jens Vetterlein*, Villads Olsvig, Søren* and Kathrine Thorning, Kristian Jeremiassen.

Interviews were also undertaken in 1982 by Emil Rosing, The National Museum in Nuuk and we were allowed to transcribe and translate these interviews. The following informant was interviewed: Frederik Jensen*.

Persons marked with an * are mentioned in the catch statistics for Akulliit.

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This monograph presents one of the best preserved Paleoeskimo sites in the Eastern Arctic. Its environmental setting and subsistence system is laid out, and a unique Saqqaq culture economy is exposed, as it developed through time.

This case study has implications for the understanding of arctic prehistory and for the interpretation of prehistoric hunting societies in general.

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