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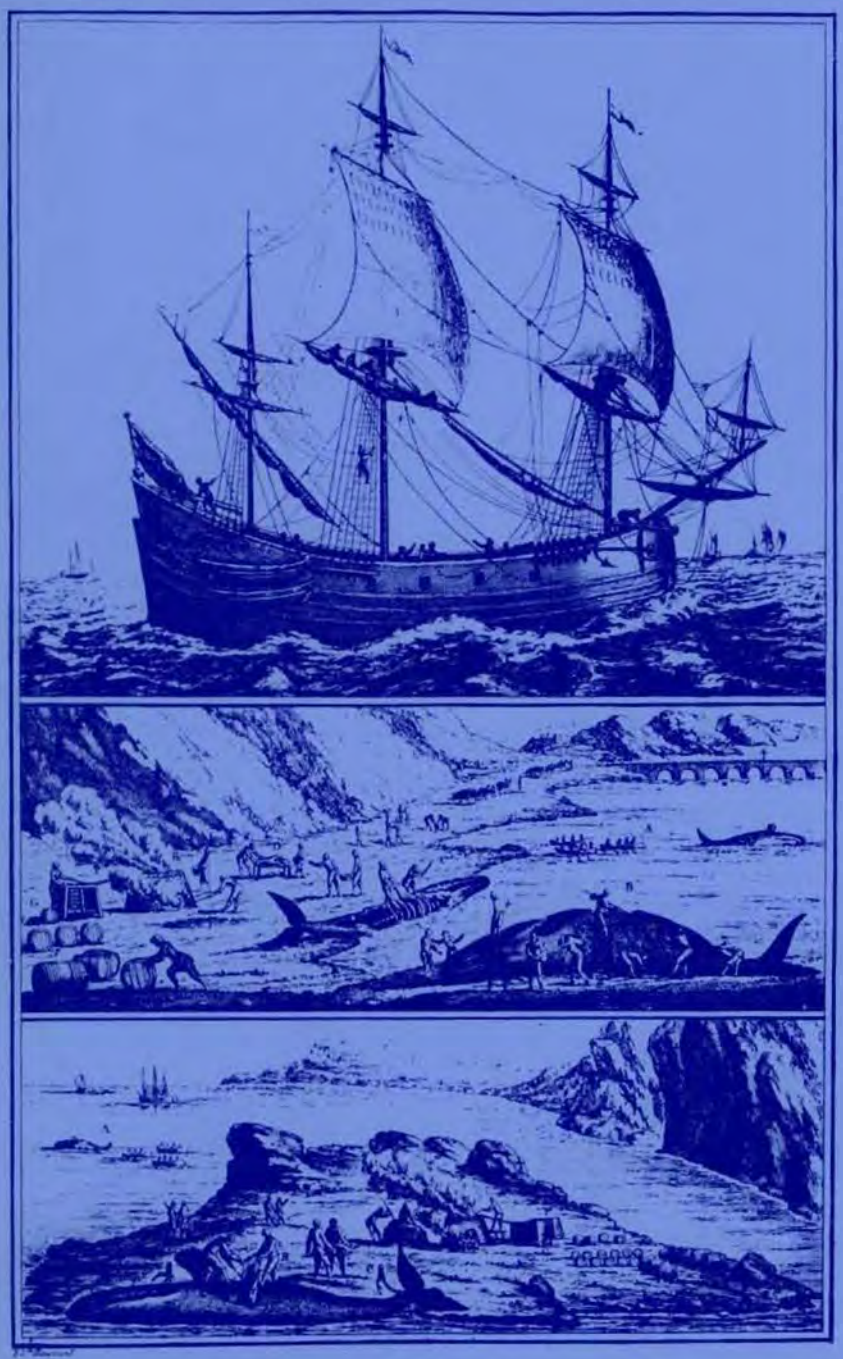
# RAPPORTSERIE



## SMEERENBURG SEMINAR

Report from a symposium presenting results from research into seventeenth century whaling in Spitsbergen

Nr. 38 - Oslo 1987

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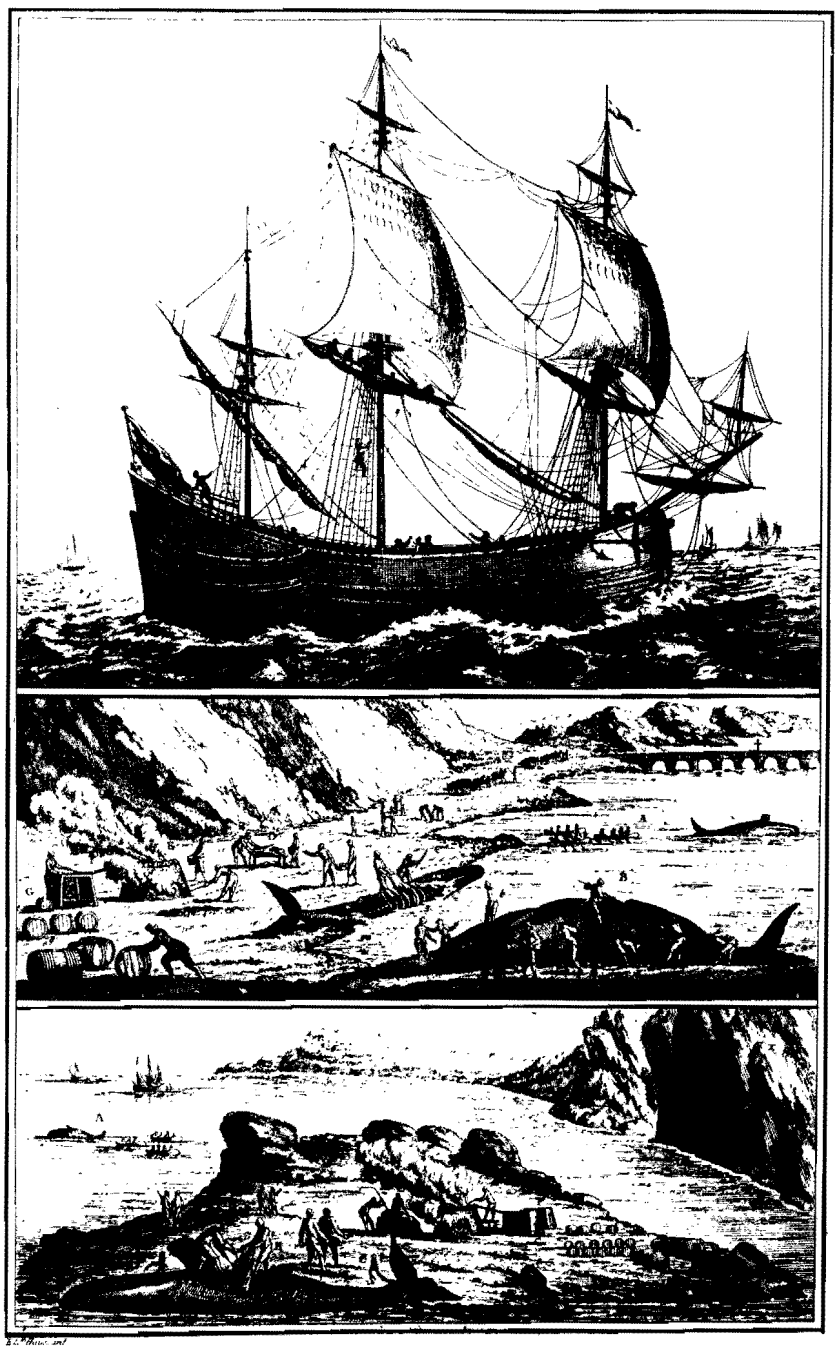

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Report from a symposium presenting results from research into seventeenth century whaling in Spitsbergen

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# INTRODUCTION

Smeerenberg - "Blubber Town" - has long been one of the most exciting historical features in Svalbard's many-faceted history. Many more-or-less factual accounts of its heyday have been published and this seemingly barren spit of land off north-west Spitsbergen has attracted visitors ever since the birth of tourism to Svalbard. It seems that anyone with an opinion has been able to offer a description of the 17th century whaling station of Smeerenburg, but none could vouch that it really was just so.

The Regulations concerning the protection of cultural remains in Svalbard (1974) opened for Dutch scientists to apply for the dispensation to carry out an extensive scientific investigation of the remains of this Dutch land station. Field work for the "Smeerenburg project" took place during the summers 1979-81, under the leadership of Louwrens Hacquebord.

The Smeerenburg project produced exciting results. This is due in particular to three aspects: the multi-disciplinary nature of the investigations - as will be seen in the papers presented in this volume -, the combination of archaeological investigations and studies of a multitude of historical records, particularly contemporary Dutch records, and the fact that the Dutch scientists have been able to use examples from their own country to elucidate and evaluate various finds.

Situated close by the site of Smeerenburg - on Danskøya - an apparently Danish/Norwegian burial site from the whaling period has recently been studied by Danish and Norwegian scientists. This investigation was partly inspired by the Smeerenburg project and it contributes to a widening of our newly-acquired knowledge of 17th and 18th century whaling in and near Svalbard. Scientific leader for this project was Danish archaeologist Svend Erik Albrethsen, in cooperation with the office for the protection of historical remains in Svalbard (Kulturvernet for Svalbard) at Tromsø

cooperation with the office for the protection of historical remains in Svalbard (Kulturvernet for Svalbard) at Tromsø Museum.

At the end of April 1986 a seminar was held in Oslo to provide a forum for the exchange of results and discussion between participants in these two projects and other interested parties. The "Smeerenburg Seminar" was arranged by the Norwegian Polar Research Institute (Norsk Polarinstitutt) within the context of the Norwegian-Dutch Cultural Agreement. It took place at the Norwegian Maritime Museum (Norsk Sjøfartsmuseum) 28-29th April, at the same time as an exhibition of finds and results from the Smeerenburg project was on display in the museum. The seminar was opened by the Dutch Ambassador to Norway.

Seven of the eight main papers from the seminar are presented in this publication. Thor Bjørn Arlov from the History Department of the University of Trondheim opens with an analysis of the various published descriptions of Smeerenburg. Louwrens Hacquebord describes the Smeerenburg project and his historical-archaeological investigations, while George Maat, Sandra Vons-Comis, Jan Peter Pals and Louise van Wijngaarden-Bakker present their results from this project with regard to investigations within osteology, textile analysis, paleoethnobotany and zooarchaeology respectively. Ingrid Lütken's paper is an analysis of textile finds from Danskøya.

Svend E. Albrethsen's report of the archaeological investigations of graves by Jensenvannet, Danskøya was unfortunately not submitted for publication.

It is our hope that this publication will help to bring the wealth of information presented at the seminar to a wider public.

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# THE HISTORICAL WRITING ABOUT SMEERENBURG

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## INTRODUCTION

Since the beginning of historical writing about Svalbard and 17th century whaling, the important Dutch land-station Smeerenburg has held a prominent position in literature. To a large extent this position is well-deserved: No doubt Smeerenburg represented the best example of organized whaling and the establishment of more or less permanent industrial, or rather pre-industrial activity on Svalbard. The very size of the station with 7 or 8 whale oil cookeries in operation is, not considering Jan Mayen, parallelled only by the tryworks on the south shore of Ytre Norskøya, a station which by the way has received less than its due of attention by scientists and historians. The greater part of Svalbard literature has attributed to Smeerenburg the prospects of a busy town with hundreds of ships at anchor and thousands of inhabitants, a number of dwelling-houses, a church, a fort, bakers, blacksmiths and pedlars of various kinds. Some writers even introduce women of dubious respectability. Elements of such descriptions can be found in scientific historical writing as well.

The purpose of this paper is to trace the development of the historical writing about Smeerenburg and to examine the basis for the widely differing views on the size of the station. I shall have to limit the survey to include only a few works which hopefully may be regarded as fairly representative of scientific and popular writing. It will also be necessary to operate with the term "historical writing" in a broad sense, not only limited to specifically scientific historical works.

## SOME PROBLEMS IN THE HISTORY OF SMEERENBURG

Dating the foundation of Smeerenburg does not seem to have caused the greatest differences of opinion among writers. Nor have the motives for the Dutch Noordsche Compagnie's establishing their main station in the north-western region of Spitsbergen been the object of much historical debate. However, opinions differ greatly concerning the ups and downs of Smeerenburg, what could be called the short-term fluctuations of the activity at the station. This problem is of course intimately related to the question of structural development in whaling, the economy of the Noordsche Compagnie and her competition with Dutch and foreign whalers and the effects of bay-whaling upon whale resources. Very few are specific about the closing date of Smeerenburg, probably with good reason. The question of when Smeerenburg was abandoned is linked with the developement towards open-sea and ice-fishery. Here various opinions are put forward in the literature. There seems to be general agreement that Dutch and North German whaling expanded after the discontinuation of the Noordsche Compagnie's octroi in 1642. Whether this expansion took place during the existance of Smeerenburg, and what extent and speed the expansion had, has been much discussed and various explanations have been offered. Smeerenburg was undoubtedly a big whaling station. The question is how big?

The subject is clearly of interest to the historian. In working with the reconstruction of Svalbard's past we must consult the works of earlier writers, which normally will be termed secondary sources. When, as in the particular case of Smeerenburg, significantly different information and explanations are put forward one inevitably has to ask why. Is the reason to be found in an inadequate source material? Have the individual writers hidden or explicit motives for presenting reality in a certain way? Or can the historiographical development simply be explained by the overall improvement of scientific methods in history during, say, the last hundred years or so?

In my dissertation "Svalbard 1596-1650 in a historiographical light" (Arlov 1986) I have studied some of these problems. To a large extent the views presented below are the results of this

work and the initial gathering of sources in connection with the project "The History of Svalbard 1596-1814" which was started at the Department of History in Trondheim in February 1986.

## THE WRITING ABOUT SMEERENBURG

Broadly speaking the historical writing about Smeerenburg may be divided into four categories. Firstly, there are the contemporary descriptions, the most prominent among which undoubtedly are the wintering journal of Jacob Segersz van der Brugge (1633-34) and Friderich Martens' description from 1671. These books may be regarded as part of the primary source material. Secondly, we have what I would call the "classics" of Svalbard literature, here represented by Zorgdrager (1720), Scoresby (1820), Muller (1874) and Conway (1906). With the exception of Muller all these writers visited Svalbard, and probably the remains of Smeerenburg as well. Thirdly, there is the category of popular writing, works which I with a musical term would call "light classics". This literature is seemingly inexhaustible, but some books have of course had greater impact in historiography than others. For my purpose I have chosen works by Nansen (1920), Ingstad (1948), Hoel (1966) and Torkildsen et al. (1984). The fourth category comprises recent scientific works, represented by the doctoral dissertations of Dalgård (1962), De Jong (1972) and Hacquebord (1984). Although this division into categories may seem unnatural and arbitrary, it will be seen to be helpful in exposing trends of development. You will also note that I have chosen to examine the writing in an approximately chronological order.

## TRENDS IN THE HISTORICAL WRITING

The extraordinary journal of Jacob Segersz van der Brugge from the wintering at Smeerenburg in 1633-34 was probably published in Delft shortly after the happy return of the seven winterers (Naber 1930, introduction), although the surviving Saeghman reprint dates from some 30 years later. There is, however, no reason to doubt the authenticity of the journal. The author is obviously an accurate and rather objective observer of events and

an important informant about the situation at Smeerenburg in the early 1630s. According to van der Brugge only five chambers of the Noordsche Compagnie had tryworks here at this moment. There were both dwelling houses and storehouses, still called "tents". The Middelburg tent where the winterers stayed measured 21 by 16 feet, and was 7 1/2 foot tall.It was made of half-brick, outwardly clad with wood and had a brick floor. The dwellings had ovens which were fired with coal, wood and peat from the Netherlands. Most of the food was also brought up from the mainland, supplemented only by a little fresh meat from reindeer, foxes and birds and the famous "salad" - probably cochleare - collected on Amsterdamøya in the autumn. From the many reports about freezing cold which inflicted frozen toes and noses even indoors, it is clear that the houses were rather primitive and not very suited for wintering. There is mention of a fort behind the Danish tent, and a churchyard, but not of any church, bakery or other shops. The impression one gets from reading the journal is that Smeerenburg is a modest settlement primarily designed for the summer activity. The houses were small and could hardly have accomodated a great many people, but Brugge gives us no indication as to how many really lived in Smeerenburg during the season.

Incidentally there is a certain Kersten Andriesz from Fredrickstadt mentioned among the winterers in Brugge's journal, later thrice referred to as "ons Noorman" - our Norwegian or Norseman. Naber supposes that he must be a Dane from Frederiksstad on Fyn, but is it not possible that he really is a Norwegian (Karsten Andersen?) from the town of Fredrikstad in Østfold? At that time Frederikstad was a great exporter of timber to the Netherlands and frequently visited by the Dutch. A closer examination of local documents could perhaps shed some light upon this - from a Norwegian point of view - most interesting detail.

The Hamburg physician Friderich Martens visited both Smeerenburg and the "Harlinger Kocherey" in Virgohamna in 1671 and his now famous report was published four years later. At this time Smeerenburg was obviously deserted, although those of the houses which had not been burned down by the whalers were still standing and some equipment was left. Martens in 1671 still refers to Smeerenburg as "ein Dorff" and writes (Martens 1675, p. 22):

> The houses are now from year to year deteriorating and burned. This year various houses were still standing, as if it were a village, whereof some were burned.

If it was normal that every other summer some of the houses were burned, then we may suppose that the station was abandoned not very long before 1670. Martens does not give an accurate number of houses, but his admittedly not very detailed drawing (Martens, tafel C) suggests some 8 or 9 buildings. There is nothing in his book that indicates the activity of thousands of workers at Smeerenburg. But then again Martens is not very historically oriented and is mostly concerned with the contemporary whaling at Svalbard. On the other hand, it is likely that a huge Smeerenburg as described by later authors would have left more significant remains than Martens reports, at least in the form of ruins.

The first of the classics to give an historical account of the early bay-whaling on Svalbard was C.G. Zorgdrager. Although his book was first published in 1720, the activity he describes and his experiences are probably from around the turn of the century. The heyday of Smeerenburg is consequently not too distant for the author. Zorgdrager even assures us that he has the best of information from persons whose relatives sailed to the whale-fishery during the time of the Noordsche Compagnie. Ironically Zorgdrager has become an often quoted source for those who give Smeerenburg the greatest dimensions. This is, however, a bit unfair towards a writer who more often than not is critical, accurate and detailed - although a trifle too enthusiastic and rash in his assessments. It is indeed true that Zorgdrager is the one who describes Smeerenburg as a busy place with a number of dwelling houses, pedlars selling tobacco and spirits and bakers who sounded a horn when the bread came out of the ovens. "One could make a good purchase (in Smeerenburg)", he tells us (Zorgdrager 1720, p. 192). And although he has some reservations in comparing Smeerenburg to the Dutch commercial bridgehead in Indonesia, Batavia, it seems clear that the likeness has struck him. It is also true that Zorgdrager estimates the number of whalers going to Svalbard after the discontinuation of the octroi of Noordsche Compagnie to some 2-300, but he is not precise in dating this expansion, nor does he explicitly attribute this

large number to Smeerenburg alone. It must be concluded, though, that his description of Smeerenburg contains fantastic elements.

When William Scoresby published his widely recognized "Account of the Arctic Regions" in 1820 he certainly used a lot of information from Zorgdrager. It is, however, doubtful that he employed an original issue, and he refers to the anonymous "Beschrywing der Walvisvangst", published in 1784-86 and later in 1791, illustrated by de Jong et al., when he describes Smeerenburg as an Arctic Batavia with thousands of sailors (Scoresby 1820, p. 143-44). He states that the Dutch had "very great expenses" in building up Smeerenburg, which acquired the looks of "a respectable village". Based on the numbers of whaling ships given by Zorgdrager he calculates the number of people employed to 12-18.000 soon after 1642. But even Scoresby does not explicitly say that all these people worked in or nearby Smeerenburg simultaneously, although it is reasonable to believe that his idea of the size of the station is coloured by his own estimations of the whaling fleet.

Samuel Muller was the first who critically examined the development of Smeerenburg in his important study of the Noordsche Compagnie from 1874. He immediately warns against exaggerations concerning the size and importance of Smeerenburg - "fairytales" (sprookjes) he calls them. He estimates the number of ships going to Smeerenburg every year to about 20 on average, and the number of inhabitants to a thousand at most. Nevertheless he accepts by and large Zorgdrager's depiction of the little "town" with bakers and all, and even adds a church to the place (Muller 1874, p. 144-48). According to Muller Smeerenburg was abandoned before mid-century and consequently played little or no role in the great expansion of whaling activity. Although Muller does not mention Zorgdrager or Scoresby as directly responsible for the exaggerated ideas about Smeerenburg, his reassessment stands in contradiction to them.

One of the historians influenced by Muller is certainly Martin Conway. His monography "No Man's Land" (Conway 1906) is still in my opinion the best synthesis of the the history of Svalbard. Obviously in keeping with Muller, he assesses the number of

inhabitants in Smeerenburg to 1.000 or 1.200 at most. Interestingly he quotes Zorgdragers description without comments, and he seems to believe that the houses were somewhat bigger than Brugge reports - up to 80 feet long, like the Dutch "tent" in Bellsund (Conway 1906, p. 136-38). Conway agrees with Muller that the peak expansion of Smeerenburg occured in the late 1630s, but he thinks the decay set in later, closer to mid-century.

The 20th century has witnessed numerous popular accounts of Svalbard, many of which also include historical information. It is perhaps not surprising that the fantastic elements are more frequent, but it is indeed astonishing that a sober and thorough scientist like Fridtjof Nansen accepted uncritically the less-than-probable conceptions of Smeerenburg. Here is what he writes in his otherwise very entertaining book "A voyage to Spitsbergen" (Nansen 1920, p. 223):

> Here was an entire city with shops and streets (...). Some ten thousand people in summer with the noise of packhouses, and the train-oil cookeries, gambling halls, of smithies and workshops, of pedlars', and dance halls. Along this flat beach a throng of boats with sailors just coming from the exciting whale-hunt and of women in gay colours on man-hunt.

It is not easy to pin-point Nansen's sources in this context, but it is reasonable to believe that he has read both Scoresby and Zorgdrager, added a little and exaggerated a little more. Nansen, being a respected scientist and widely read even outside of his native Norway, thus became influential for writers in the more popular vein.

The former sysselmann on Svalbard and writer of many popular books from the Arctic, Helge Ingstad, fits easily into this category. In his book "The land with the cold coasts" (Ingstad 1948, p. 70) he writes about whaling at Smeerenburg:

> (...) in the 1630s the Dutch main station Smeerenburg stood at its highest. It was an entire little town with som fifteen hundred people during the busiest season. The coast and the flat were crowded with huts, storehouses, workshops, pedlars, shops, a church and a fort. Yes, even a house for loose women was supposed to have been there. In the harbour about two hundred whaling ships could be assembled.

The standard Norwegian work on the history of Svalbard is still the three volume book by Adolf Hoel, published posthumously in 1966. The history of 17th century whaling is only sketchily described, and we find the same old elements from Zorgdrager's description of Smeerenburg. He believes there were at times 200 ships at Smeerenburg, but quite originally he reduces the number of inhabitants to 2.000. Like Conway he dates the stagnation of the station at around 1650 when bay-fishery was abandoned.

A return to the fantastic may be found in a recently published and beautifully illustrated book about Svalbard, issued by the Norwegian Svalbard Society, from which I shall briefly quote (Torkildsen et al. 1984, p. 37):

> In the years after 1617 the Dutch build Smeerenburg on Amsterdamøya, an entire small town society with tryworks, warehouses, cooper shops, bakeries and so on. In the best years of the fishery Smeerenburg might be visited by 200 to 300 ships with crews totalling 12 to 18 thousand men.

You will mark the similarity to the descriptions of Nansen and Ingstad. Obviously Scoresby, and most likely Zorgdrager, are the main sources for this writer.

Turning now to the scientific literature it is not the least surprising that Muller's views have been influential. In his doctoral dissertation from 1962 on Danish-Norwegian whaling, Sune Dalgård readily accepts Muller's estimate of 1.000 inhabitants in Smeerenburg. He does not, however, include Zorgdragers description, for reasons he does not reveal, but which may be explained by the overall critical and sceptical tendency of his work. Dalgård is not definite as far as the abandonment of Smeerenburg is concerned, but suggests the probability of a gradual transition to open-sea fishery which gained momentum around mid-century (Dalgård 1962, p. 243-47). We may note in passing that Dalgård is the first to employ archaeological material (Feyling-Hanssen 1954), although this seems to have had little influence on his evaluation.

Another doctoral dissertation was published in 1972, namely C. de Jong's "Geschiedenis van de oude Nederlandse walvisvaart". He

believes bay-fishery was continued up to about 1670, that is, some 10 or 20 years longer than earlier historians have reckoned, but from 1635 it took place parallel with open-sea fishery. Consequently Smeerenburg was in use nearly up to the time when Martens visited Svalbard. De Jong characterizes Scoresby's estimate of thousands of inhabitants as "pure fantasy" (De Jong 1972, p. 191-92). He calculates that an average of 20 Noordsche Compagnie ships would mean a total crew of some 1.600 men, but he is not specific as to whether all these people really worked ashore in Smeerenburg.

The most recent work is of course Louwrens Hacquebord's dissertation, which was published last year. From a historiographical point of view the most interesting is naturally his rather drastic reassessment of the number of inhabitants in Smeerenburg, which he thinks could have been 200 at most and only exceptionally. It is also worth noting that Dr. Hacquebord employs both written and material sources which he believes can be harmonized to support his hypothesis. Like de Jong he thinks land stations were in use as late as the 1660s (Hacquebord 1985, p. 37, 237-38).

## CONCLUSION

Finally, some perspectives in the historical writing about Smeerenburg. There seems to be support in the material to argue that the literature may be divided roughly into a popular and a scientific trend, where fantastic elements are frequent in the former and present in a moderate way in parts of the latter. Scoresby, or rather his interpretation of Zorgdrager, seems to be the basis for many exaggerated descriptions, but popular writers have added to it and combined elements from other sources. Muller's reassessment in 1874 had its greatest impact on the scientific literature of our century and Hacquebord's recent research may well turn out to be influential for the literature to come. It is, however, too optimistic to believe that the popular vein will incorporate the latest scientific results in the short term, if we are to judge by experience up to now.

The inevitable question is why there are such dramatic differences of opinion among the writers of history as far as Smeerenburg is concerned. I believe there are numerous reasons. Firstly, modern scientific methods in archaeological and historical research have only quite recently been applied to these problems. Even Muller remarked the lack of such investigations. Secondly, and this is especially true for the popular literature, the rather scanty source information available has led to the formation of myths. Zorgdrager and Scoresby, who have been directly or indirectly responsible for the image of an enormous Smeerenburg, both wrote long after the station had been abandoned and at a time when respectively Dutch and British whaling had reached a high point. It is probable that they projected the contemporary extent of whaling into the 17th century activity, ably assisted by oral tradition and sailors' tales. The image of a booming Arctic industrial town is of course apt to appeal more to the imagination of non-scholarly readers. My third point concerns the division of labour in whaling and the problems of calculation. Essentially the differences of opinion are not so great as far as the number and size of the whaling ships and their crews are concerned. It is generally agreed that whalers had double crews in the bay-fishery period. If there were, say, 40 ships at Smeerenburg in the early 1650s, then the number of men could have been anywhere from about 1.500 to 2.500. Perhaps only a half of these were directly engaged in the whale hunt, the making-off and oil cooking, and even fewer actually stayed ashore. The difference between being <u>at</u> and being <u>in</u> Smeerenburg may seem subtle, but it perhaps explains the varying estimates and at least makes Muller's, Conway's, Dalgård's and de Jong's assessments more acceptable. None of them says explicitly that everybody on board a whaler was engaged in the work ashore. It seems clear, though, that the figures of 200 and even 300 ships at Smeerenburg are due to a misconception of the speed with which Dutch and German whaling in particular expanded after the fall of the Noordsche Compagnie.

A problem which is is rarely touched upon is whether Smeerenburg was typical - as far as whaling-stations on Svalbard go - or atypical, that is, an anomaly. So far, research and writing has concentrated upon Smeeerenburg while other stations and tryworks

have been neglected. This is very unfortunate as it severely limits the possibilities of comparison and therefore the understanding of Smeerenburg in particular and Arctic whaling in general. I shall, however, have to leave this question hanging.

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# A HISTORICAL-ARCHAEOLOGICAL INVESTIGATION OF A SEVENTEENTH-CENTURY WHALING SETTLEMENT ON THE WEST COAST OF SPITSBERGEN IN 79° NORTH LATITUDE

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## Introduction

In 1978 the Arctic Center of the University of Groningen started a multidisciplinary research project in which the sojourn of Dutch whalers on the west coast of Spitsbergen in the seventeenth century was studied. This research project was carried out in cooperation with several research institutes in the Netherlands and the Tromsømuseum in Tromsø, Norway. Besides research in written and printed sources in Dutch archives and libraries, parts of the Dutch whaling settlement Smeerenburg in Amsterdam Island and a graveyard on Ytre Norskøya were excavated. The research was focused on gaining more insight into the activities of the Dutch whalers on the west coast of Spitsbergen, the structure of their settlement on Amsterdam Island and their impact on the natural environment. Special attention was also given to the adaptations of the whalers to Arctic conditions. Moreover, the research contained theoretical and methodological elements; for the conclusions of the archaeological research on Spitsbergen were compared with historical information from Dutch archives. The nature of the settlement lend itself admirably to this purpose. Smeerenburg was used as a whaling settlement for only forty years. It should therefore produce artifacts which are characteristic for the first half of the seventeenth century and according to Binford (1983) its artifact assemblage should be dominated by tools which are related to with the aim of the settlement. On the other hand except for two attempts at winter, this camp was a summer camp, and this should be evident from the composition of the artifact assemblage. As far as we know no people had ever lived on this site before, nor did they afterwards. This shows us that we are here concerned with an exceptional circumstance comparable with those of shipwrecks.
The field research was carried out in the years 1978-1981 in the northwest corner of Spitsbergen. The research in the archives in the Netherlands started in 1979 and is still in progress. In 1987 this research will be continued in the archives in south-west France to find out more about the role of the Basque whalers on board the Dutch whalers.
In 1984 an interim report was published in Dutch and in 1986 a final excavation report and a list of the finds was compiled in order to inform the Norwegian participants in the project. Some research is still continuing and some is finished.
This publication also gives a survey of the results of several subsidiary studies which formed part of in the Smeerenburg project.

The Noordsche Compagnie

Although voyages of discovery took place as early as the sixteenth century, Dutch whaling only began in the second decade of the seventeenth century. High prices for grain resulted in the stagnation of production of vegetable oils and fats. The increasing demand for these products caused merchants to decide to switch to animal oils and fats.
Only when the supply of whale-oil from the original areas of production dried up and the English had successfully attempted whaling, did Dutch merchants also decide to launch out into whaling in 1612.
At first there were many problems in Spitsbergen with the English, which led to the founding of the Noordsche Compagnie. This company was an association of independant enterprises (called chambers in Dutch) from several Dutch ports, which obtained a collective charter from the States-General. In 1614 the Dutch ports Enkhuizen, Hoorn, Amsterdam, Rotterdam and Delft had a chamber in the Noordsche Compagnie, Middelburg, Vlissingen and Veere joined the company in 1617 and Harlingen and Stavoren in 1636. In this way a cartel of whaling enterprises was formed and agreements were made fixing catches and prices, and the Dutch whaling trade became a reasonably well organised enterprise. The fleet of the company was protected against competitors from other nations by several men of war, and Basque harpooners were hired to make up for the Dutchmen's lack of knowledge of whaling.
The company existed from 1614 to 1642 and every year several ships were fitted out for northern waters. Soon after the Dutch discovery of Jan Mayen in 1614 Dutch whaling was concentrated there and continued for several years. Only a few ships sailed on for the west coast of Spitsbergen in the period up till 1625.
Soon it became clear that whaling was not as lucrative as some great merchants had expected, and a number of important investors turned their backs on this trade. In the years 1625-1630 the company went through a crisis.
In the beginning of the thirties some of the former interest revived as a result of high whale oil prices. In this period the fleet was divided into two parts, one for Jan Mayen and one for Spitsbergen. However, soon after the extension, in 1634, of the charter granting its monopoly, the company went rapidly downhill. In 1636 the States of Holland declared the extension of the charter null and void and in 1638 the town council of Delft let it be known in the name of the Delft chamber that it was withdrawing from the charter.
After 1635 the chambers of Rotterdam, Delft and Veere virtually stopped fitting out whalers, and soon afterwards Vlissingen and Middelburg also stopped whaling on a regular basis (Hacquebord 1984 p.57). Because of this the company broke up sometime before 1642, and no further extension of the charter was requested in that year.
The fact that in 1641 the Dutch participants in the Dutch-Danish negotiations in Stade claimed that the Noordsche Compagnie no longer existed confirms this development (Mulder 1878 p. 283). While the Amsterdam and Harlingen chambers of the former Noordsche Compagnie continued their whaling trade for several years after the extension of the charter, whaling became accesible to every Dutch entrepreneur after 1642. Many commanders and harpooners formely serving the Noordsche Compagnie now voyaged to the Arctic seas on their own account. These small-scale part ownerships took over the Dutch trade and whaling entered in a new phase

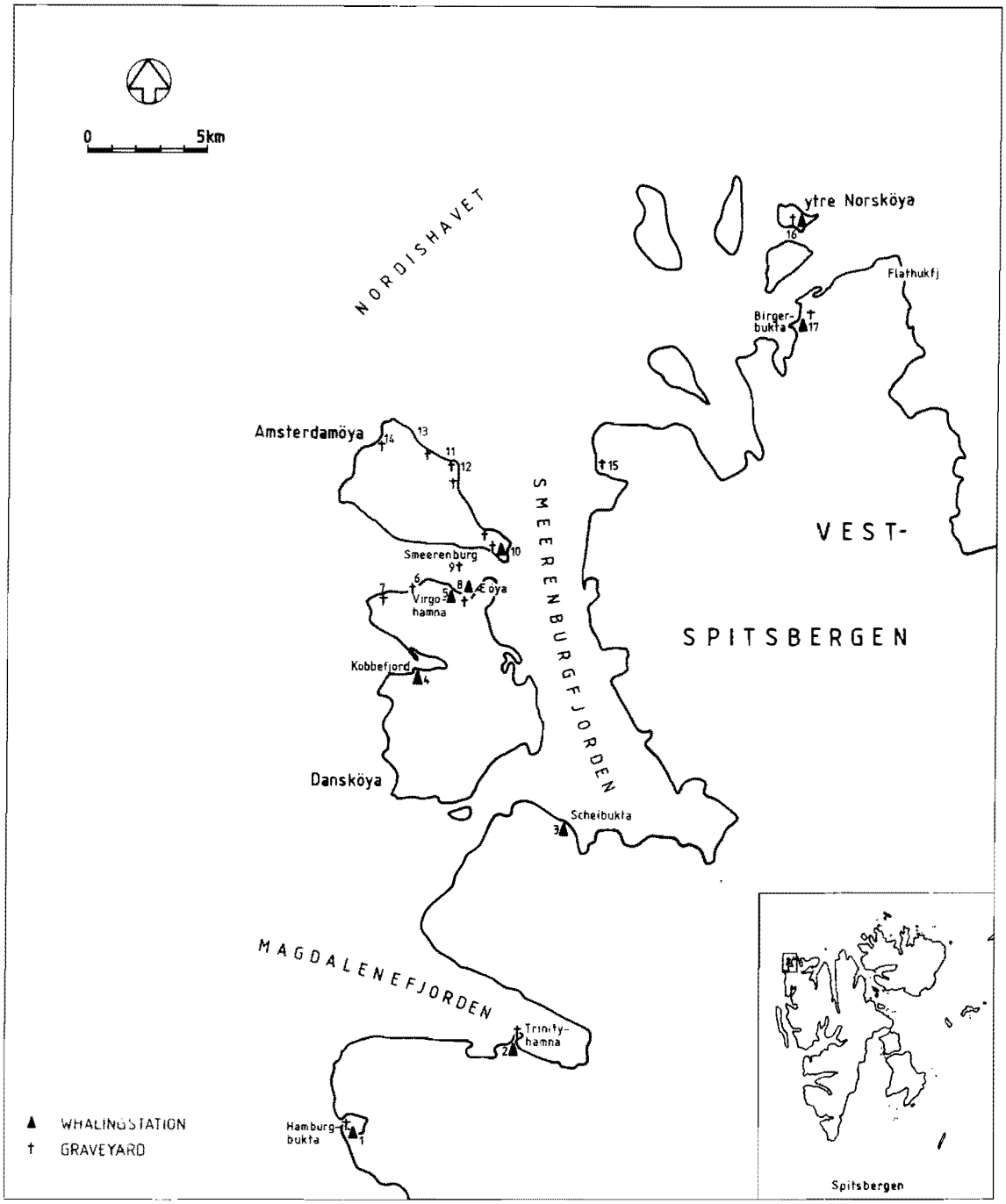


Fig. 1. The north-west corner of Spitsbergen; registered are the places where remains of shore stations and graveyards were found.

of development. In this phase it was soon clear that the shore stations were very difficult to maintain. Not only was there a lack of organisation but the number of so-called south ice years increased in which the bays of Spitsbergen were covered with ice much longer. Whale-oil was tried out on the beaches of Spitsbergen until about 1670. Although the Dutch were still whaling in the bays of Spitsbergen until well in the eighteenth century, the shore stations were abandoned one by one in this period.

## Cultural remains in the north-west corner of Spitsbergen

The Smeerenburg project was started with a reconnaissance carried out in the north-west corner of Spitsbergen. All the places where the establishment of a shore station was possible were surveyed as were the places where one could dig a grave.
From historical sources it became clear that the European shore stations were established in every possible place on the west coast of Spitsbergen in the first years of the Spitsbergen whaling trade. In the area surveyed here shore stations were found in nine and graves in fourteen different places (see figure 1).
In the twenties of the seventeenth century Dutch whaling was concentrated in this area. On the sandy beach of the south-east spit of Amsterdam Island a settlement composed of several shore stations came into existence. This settlement which was called 'Smeerenburg', in English 'Blubbertown', was used by Dutch whalers from 1614 to around 1660 more or less regularly. On this place a Danish shore station was also established. This shore station was used from 1619 to 1623 by whalers sent by the Danish whaling company in which even the Danish King Christian IV participated.
While the Basques along the south coast of Labrador established their shore stations in rocky places in a harbour or bay, the Dutch prefered a sandy or gravel beach as a place to build their installations.
On the totally unsheltered beach of Amsterdam Island eight horse-shoe shaped, mostly double ovens were established. This sandy beach was situated approximately one meter above mean high water level. It measured only 150 by 300 meters and was limited on the southern and eastern side by the sea and on the northern side by a fresh-water lagoon. In many ways this location resembled the situation in the Netherlands and it must have appeared familiar to the Dutch whalers.
It was also an excellent place for maritime and technical trade reasons. It was known as a good and safe anchorage and it was also possible to reach the roadstead with wind from almost any direction. It was a natural slipway for the captured whales and a easy place to land a shallop.
In addition the composition of the substrate made it possible to build houses in the Dutch way by sinking posts into the ground.
An archaeological survey of the site made it clear that at least seven shore stations had been established in this place, and the remains of seven furnaces were located here. One furnace, number eight, which belonged to the Amsterdam shore station, was eroded by the sea. This furnace could still be observed on the beach in 1928.

Behind the furnaces the remains of the dwellings of the landmen and the storehouses were found.
The information obtained from this survey is contradicted by the first printed map from this area. Dating from 1651, it shows only five shore stations on the south-east spit of Amsterdam Island.

## The excavations on Amsterdam Island: the houses and the furnaces

From the excavations it appears that Smeerenburg had three periods of habitation, reflected by three culture layers. The first culture layer was mostly approximately 60 cm below the surface and contained hardly any evidence of buildings. In this layer, coloured dark by refuse from the whale slaughtering and the trying out process, wood fragments such as chips, willow twigs, oak staves, oak barrel headpieces and sawdust were found. In some places these willow twigs were found in a criss-cross arrangement with baleen fragments, forming a floormat. It seems that these mats were made to create an insulatation layer in the tents.
In area SMB-I two cow horns were discovered in the first culture layer. This discovery points to the use of sail canvas shelters, because sail makers on board ships usually carried their needles in these cow horns. However, the best evidence of the use of these shelters in the first stage of the settlement came from area SMB-II. Here a fragment of sail canvas and some tent pegs were excavated.
In two areas, SMB-II and SMB-III, hearths were located in this culture layer. These hearths had been made of stones and bricks, placed in a layer of boulder clay. It is not certain whether they were inside or outside the shelters, since in both areas it was difficult to determine the outline of the shelters. This first culture layer contained an enormous quantity of baleen refuse, sometimes with and sometimes without traces of use, indicating that in this initial phase of the Spitsbergen whaling trade there was no market for baleen. On the other hand several baleen artifacts were found in this layer, which shows that the whalers were trying to find a way of using this material.
Some baleen fragments were carved into different figures, others were found with nails in them, showing that baleen was being used as a construction material. Other artifacts were found less often in this layer than in the second and third layers, but because of the digging activities of whalers in later periods of habitation some more recent artifacts were added to the artifact assemblage of the first culture layer.
In two places on the Smeerenburg spit the remains of a furnace belonging to this first period were found. These furnaces were small, round structures each capable of heating one cauldron. Circles of bricks cemented with boulder clay not only supported a copper cauldron, but also formed a firebox for it with a firehole placed on the side facing the sea. The diameter of the firebox was approximately one meter and no traces of a chimney were found.
No definite construction elements were excavated near these small furnaces, except a few posts and a number of possible post moulds without any obvious connection with each other. This information, obtained by excavation, is in full agreement with the historical information we have from this period.

According to Robert Fotherby (1613) and Thomas Edge (1622), both masters of English whalers, it was customary to place a shallop on each side of the furnace. One shallop was used to gather the minced blubber and the other to cool the whale oil produced. In later periods of habitation, when the whalers used specially made rectangular wooden boxes, they probably used their boats as firewood and after the boats had disappeared in this way nothing was left behind in the soil except some posts and stones which had supported the boats.
According to archeological information this first culture layer dated from 1610 to 1630. With the help of historical information, however, we were able to give more precise dates, namely 1614 to 1623. In this period only the Amsterdam chamber of the Noordsche Compagnie and a Danish whaling company had shore stations on Amsterdam Island. This first culture layer was separated from the second layer by a layer of yellow sand. Obviously the whalers raised the ground-level before they built the wooden houses. The identification of shells found in this sand layer showed that this sand was ballast sand of Dutch origin.
The second stage of Smeerenburg probably started in 1624, when William Pedy, the master of a whaler fitted out by the Rotterdam chamber, demolished the houses of the Danish whaling company and built a new shore station on that spot. However, according to the dated tobacco pipes, the thickest part of this layer was accumulated in the 1630's. This layer was found to contain a large number of artifacts and house structures were excavated as well.
It became clear that a shore station usually comprised a double furnace directly adjoining what was probably a working place and usually two buildings.
In area SMB-I the remains of two such buildings and a forge were revealed in this culture layer. Building number one was a timber building 12 meters long and almost 6 meters wide. It was divided into several rooms. In the rear part of the building a kitchen was found in which the foundations of a baker's oven were excavated. In the middle part a typical working room and a storage room were uncovered, and in the front part a living room was found with a slightly raised fire place and a wooden floor. There was a long, fairly wide (1.70 meter) passage beside the living room which led to a front door. In front of the building there was once a porch under which the cooper probably worked.
The roof frame of this building was made of wood and, because hardly any tile fragments were found, it is likely that the roof was covered with sail canvas or caulked planks rather than tiles. In the main, the roof was gabled; but the rear part of the building was a lean-to.
The second building of this shore station was 8.70 meters long and 5.10 meters wide. It was a simple structure built in the Dutch tradition with seven cupboard-beds along the walls and around the fireplace. This fireplace was set up right in the middle of a brick floor. The style and roof covering was the same as of building number one. Between buildings one and two a footpath paved with rubble led from the back to the front of the buildings.
Joined to the long western wall of building number two, the remains of a small shed (measuring 3 by 3 meters) were excavated in which the brick foundation of a forge was found. The bricks were again laid in boulder clay and, surrounding a solid fired-brick floor, the remains of above-ground masonry were found. The floor of the shed was paved with bricks which in one place were found lying on planks, as if this part had borne

a heavy weight. This was probably the place where the anvil was located. Around the shed a thick layer of forge coal as well as a large quantity of iron fragments were excavated. Among these iron fragments three pieces of a big anvil were found, so that there is no doubt about the presence of a blacksmith in this shore station.

In front of the buildings at a distance of about 12 meters from the walls, the remains of a double furnace were excavated. The outer wall of this furnace was horse-shoe shaped and was made of stone. This wall was primarily designed to support a scaffold made of timber. Inside this circle of stone, at a distance of about 30 cm from it, another ring wall was excavated. This time the wall was made of bricks cemented with boulder clay. This brick wall encased the sand furnace body, which was crossed by a tunnel, also made of bricks. The cauldron rested on this furnace body and was built into the brick wall. Just in front of the entrance to the tunnel was a fireplace. An opening in the brick furnace wall opposite the stoke hole ensured that it would draw properly and the hot air and smoke would go through the tunnel under the cauldron. Because the chimney was most probably placed above the fireplace, high in the brick wall and without a direct connection with the fire, the hot air and smoke had to circulate around the cauldron before it could escape through it. This system, which the whalers probably learned from the ceramic industry, ensured that the cauldron was evenly heated. The diameter of the furnace itself was 2.40 meters at the level of the furnace body. It is possible that the cauldron was a little smaller, probably something like 2 meters in diameter. This furnace, dating from the second and third stages of habitation, was a very sophisticated one. It was well adapted to the weather conditions of the north-west corner of the Spitsbergen archipelago, a region which not only has many windy days, but where the average air temperature is also fairly low, even during the summer months (4 - 5° C in July and August). For fuel the whalers used almost everything possible: wood, both driftwood and imported wood, peat, whalebone fragments, pieces of overboiled blubber and even coal. Judging from the concentration of coal found, this was the most important fuel used by the Dutch at Smeerenburg. Between the furnace and the buildings, the first and second culture layers shade off into one another, forming a black layer 20 cm thick. In this layer, apart from the foundations of an early furnace, shallop fragments (ribs and ceiling planks), woodchips, barrel fragments (both staves and barrelheads), sawdust, nails, flensing knives, mincing knives and other blubber-cutting tools were found; but there were only a few ceramic and clay pipe fragments. It is clear from the artifacts that this was a working area, where the strips of blubber were sliced, chopped and rendered.

In the third stage the station was extended with a building measuring 10 by 5 meters. The front part of this brick building was divided into a living room and a passage. On the eastern wall of this living room a large fireplace was excavated with a firedog and a peatbox still standing in the original position. The floor of this living room was made of large oak timbers which rested on shallop ribs and oars. The rear part of the building was a shed with timber walls which was built to store equipment. On the western side of the building many staves were found, forming a pavement alongside the wall. Evidently the forge had been

demolished and the space between the new building and the existing building number two was raised with ballast sand and paved with stones covered by planks, which were nailed onto upturned gutters. Alongside the brick building post fragments of a porch were uncovered, in which the cooper probably made barrels.
Buildings one and two were repaired and enlarged in this last stage of the shore station. The floors in both buildings were raised, again with ballast sand, and the path between them was newly paved with stones. A side-walk paved with bricks was excavated in front of the buildings alongside a road which was paved with stones. On the furnace side of this road a paved brick working floor was found. In this floor some big post molds - a fragment of a thick post was still present in one of them - indicated the site of an industrial structure which was close to the double furnace and must have had a function in the trying process, as too had the gutter system which was excavated on the western side of the furnace.
According to a description of the whale fishery at Spitsbergen by Mr. Gray in 1663, at this later date the trying process was much more sophisticated than in the early days (Conway 1900). The shallops were replaced by a rectangular wooden table, which adjoined a rectangular wooden box into which the sliced blubber was thrown. Later the pieces of blubber were taken out of this cooler and brought to the furnace, where the landsmen rendered the oil. On the other side of the furnace two oil coolers were placed, partly filled with water to cool the oil. These containers were also rectangular and were made of timber. The oil coolers were connected with each other by a wooden gutter. After the oil was cooled and cleaned it ran through another wooden gutter into a barrel. According to archaeological data, this third stage can be dated from 1630 to 1660. Most of the tobacco pipe fragments date from the period 1650-1660 and the dating of the other artifacts, as far as that is possible, agree with this. Using historical information, this stage most probably lasted from 1640 to 1660.

Besides the shore station, the remains of which are described here in detail, buildings of other shore stations at Smeerenburg were also excavated.
In area SMB-II, which is located on the western side of the former settlement, a so-called double building was uncovered. This measured about 8 by 5 meters. In the center, the remains of a large fireplace were excavated, founded on whale vertebrates and ribs. These were the remains of a typical Dutch brick fireplace, which was even decorated with Delft tiles. A large amount of coal was found beside it. However, because of the elevated position of the remains of this building, their preservation was not as good as in the other excavated areas, and it was therefore hard to get a good impression of its structure. It probably closely resembled the houses which can still be found in the Netherlands in the region north of Amsterdam. For this reason, and because of the origin of most of the tobacco clay pipe fragments, it is probably the shore station which the chambers of Hoorn and Enkhuizen owned for their joint use. This station is marked on the western side of Smeerenburg on a printed map of 1651.
In area SMB-III the remains of a building were excavated, the ground plan of which was very similar to that of building number one of the

SMB-I area. Both buildings very much resembled the houses which still exist in Middelburg and Vlissingen in the Dutch province of Zeeland.
In the center of the settlement a rectangular platform built of stones was excavated. This platform, which measured 6 by 6 meters, had a slope on the side nearest the sea and next to this slope the foundation of an early furnace was excavated. It is therefore possible that the platform was built as a working floor on which the coopers made the barrels. The wood chips and barrel fragments found around this platform suggests such a function. From the historical records, however, we know that the Dutch built a fortress to protect their settlement against foreign competitors. Underneath the platform a culture layer was excavated at the same level as the first culture layer elsewhere. It was surprising that in this layer the outline of a structure, measuring 10.20 by 5.30 meters, was found. Altough the function of this structure is not quite clear, it is possible that there were indeed some wooden structures in the first stage of the settlement. Because besides wood chips and barrel parts almost no artifacts were found in and around this structure, it was probably only a roof under in which the coopers worked. Because of its location on the Smeerenburg spit, it is possible that this structure belonged to the Danish whaling company.
If this was the case, then the fortress-hypothesis becomes very attractive, because according to historical information, the Dutch built their fortress on the site of the Danish shore station.

## The artifact assemblage of Smeerenburg

The artifacts found in and around the structures excavated at Smeerenburg were both numerous and varied. Although artifacts were found inside the buildings, the greater number were uncovered in the refuse deposits behind the buildings and in the low-lying marshy areas between the stations of the different chambers of the Noordsche Compagnie. A relative sparseness of finds seems to characterize the intensively used places. Because of low air temperature and the water logged situation in which they were found, the state of preservation of the artifacts was excellent.
The artifact assemblage was analysed to obtain answer to the following questions. Firstly, what kind of objects did the whalers bring with them to Spitsbergen according to historical sources and what objects are found in the excavations? Secondly, is there a difference in composition of the ceramic artifact group of Smeerenburg and that of Dutch town centres of the same period? Thirdly, is there a difference between the household artifacts used on board ship and those used in the households in the settlements or was the settlement only an annexe to the ship as far as the material culture was concerned? In the fourth place is it possible to identify the functions of different buildings. Fifthly, is it possible to recognize the special aim and the seasonal character of the settlement in the composition of the artifact assemblage. And finally, did the artifact assemblage give any indications concerning the presence of Basques in the settlement of the Noordsche Compagnie?
A comparison between the objects excavated and an inventory of a shore station abandoned in 1662 found in a Dutch archive showed that only refuse, that is to say objects which were broken and thrown away during occupation of the settlement, was excavated (R.A. Leeuwarden Hs PB

1088). Whaling equipment would have been valued more or less highly and is therefore not likely to have become part of the refuse deposits. It must have been removed when the shore stations were abandoned.
More then 58% of the tools listed in the inventory could be considered as whaling equipment, while 18% of the excavated tools and tool fragments had a function in the whaling trade. If we discount the kitchen tools because of their great speed of circulation, the proportions are 68% and 39%.
It is clear that the artifact assemblage at Smeerenburg was not dominated by artifacts directly related to the aim of the settlement. The re-use of material was too frequent and all undamaged objects associated with whaling were taken along when the whalers left the place.

Table 1.
A comparison of the tools in the 1662 inventory and the tools and tool fragments excavated in area SMB-I at Smeerenburg, with an without kitchen tools.

| Tools | 1662 Inventory | | | Excavation SMB-I | | |
|---|---|---|---|---|---|---|
| Carpenter's tools | 13 | 6.2 % | 7.2 % | 25 | 7.1 % | 15.5 % |
| Cooper's tools | - | - | - | 16 | 4.1 % | 9.9 % |
| Blacksmith's tools | 21 | 10.0 % | 11.6 % | 22 | 6.3 % | 13.7 % |
| Kitchen tools | 28 | 13.4 % | - | 191 | 54.3 % | - |
| Ship equipment | 24 | 11.5 % | 13.3 % | 34 | 9.7 % | 21.1 % |
| Whaling equipment | 123 | 58.9 % | 67.9 % | 64 | 18.0 % | 39.8 % |
| | 209 | 100. % | 100.0 % | 352 | 100.0 % | 100.0 % |

The ceramics of Smeerenburg was composed of brownish, brown-greenish, greenish and green-yellow lead and copperglaze red- and white ware as the most frequent material group, salt-glaze stoneware as the second and majolica as the third group. The red- and -white ware mostly originate from local production centres in the Netherlands. The stoneware is of German origin, being derived from the stoneware production centres in the Rhineland. The majolica originates from both local and foreign Mediterranean production centres (Italy and Portugal). Two pots, a jug of stoneware and a jar of leadglaze redware with two broad Mediterraenean handles were probably made in southwest France.
The two pots are similar to ceramics excavated in Red Bay, southern Labrador. The origin of these pots indicates Basque presence in Smeerenburg as did an excavated Spanish gold lustreware sherd. This gold lustreware was not used in Holland any more after 1570 (Baart 1977 p.267). If the Basques brought their own pottery with them, and the Smeerenburg data and the discovery of a sherd of a drinking vessel of the buccarotype in Scheibukt seem to prove this, they had to travel more then 4000 km with breakables in their kitbag (Molaug 1968, p.28).
A comparison of the composition of the ceramic found in Smeerenburg with that of Dutch town centres of the same period shows that porcelain and Delft plainware were not found in Smeerenburg although this pottery was used in Holland in that time (Thyssen 1985, p.115).

Although there is no typical Smeerenburg variant it is striking that the

Table 2.
Comparison of ceramic groups of Smeerenburg with those known from town centers in the Netherlands.

| Pattern | Lead glazed ware count | % | Stone ware count | % | Majolica count | % | China ware count | % |
|---|---|---|---|---|---|---|---|---|
| Smeerenburg | 128 | 69 | 35 | 19 | 22 | 12 | - | - |
| West Holland | 818 | 85 | 90 | 4 | 99 | 10 | 9 | 1 |

percentage of stoneware is rather high in the ceramic group of Smeerenburg (see table 2). The fact that the inhabitants of Smeerenburg were sailors and both stoneware pitchers and glass bottles were used to contain liquor must be the reason for this high percentage. This high percentage of drinking vessels and glass bottles corresponds with the high ratio of wine-bottles found in revolutionary war military sites in South Carolina in the U.S.A. (South 1977a, p.151). This seems to be characteristic for a group of people only composed of men.
The relatively great number of excavated clay tobacco pipe fragments has probably the same reason. As archaeological research of 17th and 18th century cod fishermen sites at Damariscove Island off the coast of Maine (USA) also showed sailors and fishermen adopted the habit of smoking tobacco very fast (Faulkner 1985, p.76).
An attempt was made to date the different buildings from the clay tobacco pipes. Comparison of the results of this with historical information showed that it is possible to date clay pipe fragments by bowl shapes, designs and maker's marks accurately to within ten years or so. Based on 446 dateble clay pipe fragments Smeerenburg existed from 1610 to 1670 and based on historical information the settlement was used from 1614 until 1660. The great number of clay pipe fragments found in the settlement dating from 1630 to 1640 is however contradicted by the information from written sources. Possibly clay tobacco pipes are dated too readily in this decade because a new fashion in bowl shape and design started in Holland around 1640. When this kind of clay pipe was made is not known exactly because clay pipe makers mostly used their pipe-moulds for a relatively long period.
The analysis of the clay tobacco pipe fragments and the comparison of these fragments with clay pipe fragments from Dutch town centres makes it clear that the use of dating methods based on bore diameters by Binford (1961) and the dimensions of the bowl as developed by Friedrich (1975) must be discounted as far as 17th century Dutch clay pipes are concerned.
A comparison of the ceramics found in Smeerenburg with those in the inventory of a whaling ship dating from the period after the shore stations were abandoned, shows clear differences (Martens 1710). No stoneware and no majolica were listed on the inventory only some red-and-white ware pots and pans and some wooden bowls. The inventory gives a very practical impression. In the Smeerenburg artifact assemblage both practical and decorative objects were found. The discovery of fragments of Delft blue tiles and hangings also shows that this settlement was not

an annexe to the ship. It was considered at least by the whalersthemselves as a permanent outpost to which they would return every year.
Although the material culture, which was left behind as refuse when the whalers abandoned their stations, did undergo a number of concealing and destructive processes of natural and human origin, it was still possible to determine some differences of functions between the various buildings by considering the composition of the artifact assemblages as a reflection of human behavioral activities. Based on pottery, glass and clay pipe fragments it was possible to identify building number one in area SMB-I at least partly as a public house, and building number two of SMB-I as a dwelling for the landsmen. The shed in area SMB-I was clearly a forge and the brick building was also a dwelling, but this time most probably for the officers. The other excavated buildings were multifunctional with a distinct living and working part.
In the same way as was done by South in the U.S.A. (1977), an apportionment of the functional groups within the artifact assemblage of the Smeerenburg sites was made.
The empirical artifact assemblage for the Smeerenburg sites showed an architecture group as the most numerous class in all the five Smeerenburg sites. Only the SMB-1.3 assemblage did not have such a dominating architecture group. From the archaeological context we know however that SMB-I.3 was a yard with only in the second stage of the settlement a shed used as forge. The forge was evident from the large percentage of artifacts pertaining to activities (see Table 3).

Table 3.
The empirical artifact profiles for 5 Smeerenburg sites.

| | SMB-I.1 | | SMB-I.2 | | SMB-I.3 | | SMB-II | | SMB-III | |
|---|---|---|---|---|---|---|---|---|---|---|
| Group | count | % | count | % | count | % | count | % | count | % |
| Kitchen | 76 | 3.8 | 72 | 4.7 | 43 | 3.0 | 54 | 3.5 | 36 | 4.6 |
| Architecture | 1663 | 82.8 | 1013 | 66.9 | 642 | 45.4 | 1029 | 67.2 | 555 | 71.2 |
| Furniture | 1 | 0.1 | 7 | 0.5 | 25 | 1.8 | 10 | 0.7 | 4 | 0.5 |
| Arms | 12 | 0.6 | 12 | 0.8 | 9 | 0.6 | 4 | 0.3 | 12 | 1.5 |
| Clothing | 111 | 5.5 | 161 | 10.6 | 86 | 6.1 | 103 | 6.7 | 48 | 6.2 |
| Personal | - | - | 13 | 0.9 | 2 | 0.1 | - | - | 2 | 0.3 |
| Clay tobac.pipes | 97 | 4.8 | 159 | 10.5 | 123 | 8.7 | 134 | 8.8 | 74 | 9.5 |
| Activities | 48 | 2.4 | 77 | 5.1 | 485 | 34.3 | 196 | 12.8 | 49 | 6.3 |

A rough comparison between the Smeerenburg assemblage and South's artifact assemblage from 18th century domestic and military sites in the United States was attempted. For obvious reasons, especially difference in age and cultural background, we have to be careful with such a comparison (see table 4).
The difference between the artifact profiles of the American sites on the one hand and the Smeerenburg artifact profile on the other is in the size of the kitchen and architecture group. All the Smeerenburg sites have a small percentage of kitchen artifacts and a large one of architectural objects, while South's Carolina pattern exhibits the opposite. The Frontier pattern of South gives a figure intermediate between the figures mentioned above.

The average percentage relationship between the Smeerenburg kitchen and architecture artifact group compared with the available historical information from this site makes it clear that the real difference

Table 4.
Comparison of the Smeerenburg artifact pattern with the "Frontier pattern" and the "Carolina pattern"of sites in the U.S.A.

| | Smeerenburg pattern | | Frontier pattern | | Carolina pattern | |
|---|---|---|---|---|---|---|
| | mean % | % range | mean % | % range | mean % | % range |
| Kitchen | 4.2 | 3.5- 4.7 | 27.6 | 22.7-34.5 | 63.1 | 51.8-69.2 |
| Architecture | 72.0 | 66.9-82.8 | 52.0 | 43.0-57.5 | 25.5 | 19.7-31.4 |
| Furniture | 0.5 | 0.1- 0.7 | 0.2 | 0.1- 0.3 | 0.2 | 0.1- 0.6 |
| Arms | 0.8 | 0.3- 1.5 | 5.4 | 1.4- 8.4 | 0.5 | 0.1- 1.2 |
| Clothing | 7.3 | 5.5-10.6 | 1.7 | 0.3- 3.8 | 3.0 | 0.6- 5.4 |
| Personal | 0.3 | 0- 0.9 | 0.2 | 0.1- 0.4 | 0.2 | 0.1- 0.5 |
| Clay tobac.pipes | 8.4 | 4.8-10.5 | 9.1 | 1.9-14.0 | 5.8 | 1.8-13.9 |
| Activities | 6.7 | 2.4-12.8 | 3.7 | 0.7- 6.4 | 1.7 | 0.9- 2.7 |
| Average Length of occupation | | 7 years | | 11 years | | 43 years |

between the Frontier pattern and the Carolina pattern of South (1977a) is simply the length of time people lived there. The average occupation of the Carolina sites is 43 years, that of the Frontier sites 11 years and that of the Smeerenburg sites about 7 years and probably even shorter (South 1977b, p.138 and Zierden & Calhoun 1986, p.32). True the Smeerenburg sites were occupied for circa 46 years but this was only during the two summer months.
The duration of the occupation compared with the relationship of the average percentage of the kitchen and architecture artifact group shows that the longer the occupation, the bigger the kitchen artifact group and the smaller the architecture group.
Only slight variations from the Carolina Artifact Pattern is shown in the other artifact groups. Due to the good preservation conditions the clothing group is better represented in the Smeerenburg artifact assemblage.
The industrial character of the Smeerenburg sites is shown rather vaguely by a relatively high percentage of artifacts to pertaining to activities. However this percentage is not higher because of the recovery of a large amount of whaling equipment but because of the presence of a great number of blacksmith's tools and iron work refuse.

## Epilogue

In the early days of the Spitsbergen whaling trade, the whale was killed in the coastal seas around and processed on the coast of that Arctic archipelago. Shore stations of the nature of temporary hunting camps were established in many places on the coast of West Spitsbergen.
Basque whalers taught English and Dutch sailors how to kill whales. The method of whaling was a continuation of the way the Basques had hunted and processed the whale for hundreds of years in the Bay of Biscay and the seas of southern Labrador (Grenier and Tuck 1981).

However very soon after they started their whaling trade, the English and the Dutch built themselves more substantial accomodation. The whaling trade very soon acquired a commercial and capitalistic character with industrial features such as selling on the international market, monopolisation, speculation on the stock exchange and staying in business in the future. It became an organisation with a specialised staff, a well organized production process and attempts to develop techniques to find commercial outlets for the baleen, were also features of the 17th century Dutch and English whaling trades.
Traces of this development were found in the main settlement of the Dutch whaling Company; Smeerenburg.
Although the reaction of the inhabitants of Smeerenburg to their environment were influenced by such consideration as topography, a limited amount of land, and an arctic climate, many of the adaptations to their environment were not unique.
They started with a division of the narrow piece of land into lots. On these lots the furnaces and buildings were erected on a row along the shoreline just as occurred in the settlements in their home country. Therefore it is not surprising that the structure of the settlement corresponds with that of a Dutch single street village. From west to east the shore stations of Hoorn/Enkhuizen, Delft, that of the Danish whaling company, Veere (after 1635 used by Hoorn/Enkhuizen and in 1637 used for one season by the Danes), Vlissingen, Middelburg and Amsterdam made up the settlement at Smeerenburg: seven independant shore stations in a line and strictly separated from each other as the structure of the Noordsche Compagnie indicated.
Possibly there was a fort in the middle of the Danish area but no traces of a church were found. In the Middelburg shore station (SMB-I) traces of a forge were found and some objects found in the shore station of Hoorn/Enkhuizen also indicate the activities of a blacksmith.
Most of the buildings were used for several purposes but some structures had a special function. So a public house and two dwellings could be recognized. The unremitting nuisance from water was overcome by raising the dwellings with ballast sand and the scarcity of building-materials was solved by making use of the abundantly available natural stone and whale bone. The scarcity of fuel was remedied by burning the remains of the carcasses of the whale in the furnace.
Archaeological and historical information indicates that the number of inhabitants of Smeerenburg fluctuated around two hundred. More often than not, however this number would not have been reached.
The financial impact of the shore stations was substantial and constituted about thirty percent of the entire outlay of the Noordsche Compagnie. This outlay was however less than has been assumed to date. It appears from a calculation of the total costs of the company that 100 whales had to be caught each year to cover expenses. Only years of a yield of more than 5000 kwartelen of train oil were profitable and it appears from historical sources that such years were infrequent. Thus it is understandable that in the Netherlands most high finance investors rapidly turned their backs a whaling and left the trade to smaller entrepeneurs and people whose main income was derived from a non-commercial source.

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# OSTEOLOGY OF HUMAN REMAINS FROM AMSTERDAMØYA and YTRE NORSKØYA

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## INTRODUCTION

This paper represents a retrospection on the physical anthropological investigations proceeding from the so-called "Arctic Centre-Carl Denig-Spitsbergen-expedition 1980", a research program of the Arctic Centre of the University of Groningen (Hacquebord 1984). To obtain a picture of the men involved in the Dutch whaling enterprise during the 17th and 18th centuries a wide ranging osteological study was focussed on human remains found at former whaling stations on Svalbard (Dutch: "Spitsbergen"). Most interesting observations were done at burial places on the island of

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Amsterdamøya (Dutch: "Amsterdameiland") and on the islet of Ytre Norskøya (Dutch: "Zeeusche Uytkyck"). A detailed review of the excavations and of the first scientific results after the expedition was presented in : Human remains at the Dutch whaling stations on Spitsbergen (Maat 1981). Presentations on specialistic points of interest are referred to in the following text.

## MATERIALS AND METHODS

The graves were determined by exploration and were mapped. Each burial was photographed in situ, measured, examined and recorded. Samples were taken of hair, dried tissue remnants if present, burial soil and coffin timber. The contents of the coffins were marked and recovered for laboratory analysis. All graves were returned to their original condition.

The skeleton length in situ, the distance from the lowest point of the tuber calcanei to the highest point on the vault of the skull, was measured with an anthropometer. The skeleton length in situ offers the best approximation to the stature of the living body (Maat 1984a).

Skeletal age and sex determination was done according to the recommendations of the so-called "Workshop of European Anthropologists" (1980). Metric and non-metric sex traits were taken from the pelvis.

Harris's lines (transverse lines), horizontally arranged bone strands in tubular bones, were recorded by antero-posterior

X-rays of one of the distal tibiae of each whaler. Only lines extending at least halfway across the shaft were taken into account.

Samples for microscopy were taken from sites with obvious pathological changes. Microscopic sections (30-60 mu) were made and processed for routine anatomical microscopy and for immunoenzymatic detection of hemoglobin (Maat & Uytterschaut, in press).

Dental attrition and pathology was recorded according to Brothwell (1981).

## RESULTS

### Amsterdamøya

Six burial places with a total of 101 graves were discovered on the spit of land of Amsterdamøya, the former site of the whaling station of "Smeerenburg" (Fig. 1). There was a distinct tendency for an alignment of the graves in series with the heads to the West. As all graves had been severly disturbed, it was decided to investigate only a mass grave at burial place nr. 3 (see Fig. 1), because its under-surface appeared to be partially intact.

By coincidence this mass grave was discovered on July 16. It had been disturbed a very long time ago, as it was found completely overgrown with moss. It contained 7 juxtaposed coffin-bottoms, 20-30 cm below the surface. A number of human bones lay still in their anatomical context. After reconstruction of the postures of the individuals in the coffins it appeared that

three had died in an extended position, one had a flexed left knee, two were in a hunched position, and the last was kneeling in a reversed position (Fig. 2). On top was a layer of scattered bones. The coffins had been made of unsuitable timber, and were surrounded by boulders which originally had covered the grave. It was the only grave for seven on the spit of land. The bones of five of the individuals had features of severe scurvy, as will be expounded below. The other two were too incomplete for proper osteological examination.

Ytre Norskøya

The central burial place of this islet was situated along the Southern coastline, North of the second blubber-oven from the West (Fig. 3). It consisted of 185 burials. Scattered over the islet ten additional graves were mapped. The graves were aligned with the heads to the West. Previously, only sixteen had been disturbed. Fifty were chosen at random for excavation, examination and restoration. The depth of the burials varied from 12 to 100 cm. They were covered with many boulders for protection from polar bears. Along the heads of the coffins remains of the bases of crosses were found. The coffins were nailed, frequently made of recycled timber, and almost always contained sawdust and/or wood shavings as packing material for the dead. Clothing was found on many whalers, e.g. 31 knitted caps. Except for one, all individuals had been interred in an extended position.

As was expected all 50 individuals revealed masculine degrees of sexualization. Eight of the men appeared to be unadult. Skeletal ages ranged from 14 to 69 years. The distribution of ages at death, arranged in five-year intervals, is shown in figure 4.

Many pathological changes were seen on the skeletons. A review is found in table 1. Remarkable was the total number of healed fractures of the tibia (eight), of the clavicle (six) and of the costae (eleven). An approximately 68 years old man had even 12 healed fractures: crushed knees, three collapsed vertebrae, and

Table 1. Pathologic changes in bones of 50 whalers

| | Number of individuals affected | Number of changes |
|---|---|---|
| Unhealed skull injuries | 2 | 2 |
| Unhealed fractures | 1 | 1 |
| Healed fractures | 14 | 40 |
| Severe osteoarthritis | 4 | |
| Rickets | 5 | |
| Scurvy - manifest | 39 | |
| - healed | 1 | |
| Lumbosacral anomalies | 12 | 15 |

fractures of the right femur shaft, right radius, three left metacarpals and two right costae. As a matter of course the man showed osteoarthritic changes due to faulty posture. The exceptional preservation of the bones due to polar conditions made it possible to study scorbutic bone changes. Almost 80% of the men had macroscopical features of manifest scurvy when they died: black stained articular surfaces, longitudinal infractions of long bones surrounded by black maculas due to subperiosteal hematomas (Maat 1984b). Without exception the long bones of the lower extremities were symmetrically affected at predilection sites. Sometimes the bones of the upper extremities were also involved. Traces of periodontal bleeding were also found. Microscopically, the positive immunoenzymatic staining of hemoglobin left no doubt as to the nature of the black maculae (Maat & Uytterschaut, in press). Constantly an open connection between the marrow cavity and the original subperiosteal surface in case of infractions proved that blood from the marrow could have easily contributed to the related subperiosteal bleeding. Absence of microscopic repair activities along the margins of the infractions, characteristic for scurvy (Fig. 5), were found together with osteoclastic activity at the site of the subperiosteal hematomas. Only in one whaler features of healed scurvy, symmetrical subperiosteal bone appositions, were found.

Antemortem tooth loss was 6.75%, postmortem only 3.6%. The overall incidence of carious teeth was 13.4%. Molars had the highest incidences. It appeared that the percentage of carious molars

decreased considerably when the degree of dental wear increased (Maat & Van der Velde, submitted for publication). Besides, at the occlusal surface the decay was almost exclusively located in the natural fissures and pits of teeth, not in the exposed dentine due to wear. Almost all individuals suffered from calculus, thirty-five of them having periodontal disease. Enamel hypoplasia was a general finding. The attrition of the first, second and third molars was arranged for various age intervals to obtain a tentative reflection of the progress of attrition during life (Fig. 6). In addition a total of 139 distinct wear-channels were recorded in the occlusal plane of 38 men.

In the X-rays of the distal tibias 128 Harris's lines were counted, 101 in case of the adults. Thirty-seven were so-called type III lines, lines assumed to be the result of serious health insults (Maat 1984c). The incidence of type III lines was 0.75 per whaler.

The average skeleton length of 41 adult extended whalers was 166.0 cm (s.d. = 6.9 cm).

## DISCUSSION

### Amsterdamøya

The graves dated from the onset of whaling in the surrounding waters at the beginning of the 17th century up until the termination of open sea fishing at the end of the 18th century. The latter way of fishing was introduced about 1670 AD (Hacquebord 1984).

The ongoing disturbance of the burials on Amsterdamøya made the Queen of the Netherlands decide in 1906 to dispatch HM "Friesland" to "Spitsbergen" to empty the graves around "Smeerenburg" and to create a huge charnel-pit with a memorial stone for all the whalers (see: Fig. 1, nr. 4; Snethlage 1907; Scheepsjournalen, Min. van Marine, 1906). In 1980 it appeared that the emptied graves were still only partially overgrown with moss, in contrast with the above-mentioned completely overgrown mass grave for seven (Fig. 1, nr.3). Consequently, the latter must have been disturbed long before 1906. The Navy-journals did not mention this grave, although they stated that it was searched for (Maat 1981). Also a prior "Willem Barents"-expedition of 1878 made an unsuccessful search for it. They left behind a memorial stone near the site of the later monument in honor of the so-called "seven winterers" who died during their winter encampment of 1634-1635. In September 1634 the Dutch "Groenlantsche Compagnie" left, for the second time, seven men at Smeerenburg to protect the settlement from demolition by rivals in the following early spring. The wintering became a catastrophe, among other things because the men failed to collect scurvy grass before it had gone to seed. Already in November the men started to suffer from scurvy. They all died. Most facts of the case are known because of the existence of an abstract of the journal of the whaler who found the seven men in spring 1635 together with the wintering-journal (l'Honoré Naber 1930). The striking resemblance between the data of the old journals and the present research concerning the positioning of the coffins, the postures of the men, and the features of manifest scurvy prove the identity of the interred (Maat 1981). In addition,

the following passage on the unsuccessful wintering from the famous atlas of Bleaus (1664) reveals that disturbance of graves had happened from the very beginning: "Their corpses, which have been buried for more than twenty years, are still fresh and intact, as if the soul had left not more than an hour ago; so free is this frigid region of all putrefaction and rot".

## Ytre Norskøya

Ytre Norskøya was used for burial practices from about 1642 until the end of the 18th century (De Jong 1978, Dekker 1971).

The way in which the whalers were buried in their coffins corresponded well with findings from the same period in the Netherlands, e.g. in Leiden (Maat 1982). The only difference was the frequent use of sawdust and wood shavings as packing material. Probably this was related to the shipment of the dead to the burial place. Besides, it is an absorbant of putrefaction exudates.

Although skeletal age will not correspond exactly with calendar ages, the related distribution of ages at death in a diagram will be very informative if compared to the ages of the "living" (Fig. 4). There seemed to have been three clusters of dead: youngsters, men in the prime of their lives, and elderly men. From an investigation by Hacquebord (1984) on the ages of 612 living whalers who signed notarial acts between 1610 and 1664 we see, that the middle group of dead corresponded with the oldest men of the main group of participants in the fishing. That fitted in well. But at the same

time youngsters and elderly men seemed to be overrepresented in the burial field. Concerning the youngsters this might not only reflect their incompetence to sign legal deeds, but also their more vulnerable health because their growing bodies required better nutrition, and possibly also their lack of experience. The elderly men too, although being a small group of participants, will have been a physically high risk group under polar conditions. Plausible reasons for their presence might have been low wages and experience in whale fishing.

Paleopathologically the whalers are of great interest. Very informative was for instance a comparison with a collection of citizens of the same period from the "Hoogland" Church in Leiden (Maat et al. 1984). Notwithstanding these citizens must have had a higher average age at death, the whalers had 3.4 x more healed fractures (2.5 x more tibia fractures). Tibia fractures and clavicle fracture are notorious complications of winter conditions. The high incidence of fractures must be due to occupation accidents in the North. A similar assumption was made by Christiansson et al. (1967), who investigated the skeletal remains of Russian hunters at Russekeila on Svalbard. The multiple fractures of the about 68 years old man were only explicable by assuming a sudden severe axial stress on the body, such as resulting from a fall from the mast.

Concerning deficiency diseases, the incidence of rickets (10%; see Table 1) is very high if compared to citizens of Leiden of the same period (ca. 1%; Maat et al. 1984), or to e.g. medieval populations in England (3-4%; Dawes & Magilton 1980), and in Denmark (1-2%; Møller-Christensen 1958). It is caused by vitamin

D deficiency during growth, and results in bowing of especially the weight-bearing long bones. The accessibility of vitamin D is dependent on the dietary intake of adequate amounts of fat of animal origin, and on the availability of sunlight. Scurvy, having an extreme high incidence among the whalers, is due to a deficiency of vitamin C. Sources were: fresh fruit, vegetables, liver and scurvy grass (Cochlearia officinalis). Actually, the latter grows at some places on Svalbard. Concerning the etiological, epidemiological and the pathologic-anatomical aspects of this disease special papers were presented (Maat 1984b, Maat & Uytterschaut, in press). The preservation of the bone tissue offered a unique opportunity to study this oblivious disease. It was concluded that, although one had a rather correct notion about cause and treatment of this affection, it stayed a dreadful affliction for the whalers on their relatively short missions in the North. Main causes, especially in case of men annually joining the crews were: the sub-scorbutic status of the population in the native land in general; the seasonal trend of the missions by which spring and summer with its vitamin C-rich foodstuffs were missed year after year (potatoes became readily available not until the end of the 18th century); the processing of vitamin C-rich products reducing its effectiveness; the so-called open sea fishing by which the direct availability of scurvy grass from Svalbard became problematic; the attitude of the men to treat the disease not until its symptoms were obvious.

The antemortem tooth loss (6.75%) was rather low if compared to e.g. London in the same period (ca. 13%; Brothwell 1981). The well-known tooth loss due to scurvy is an advanced complication

resulting from additional infection. Its minor occurrence here indicated a relatively short course of the disease. This conclusion was affirmed microscopically, as no repair activity of the bone tissue was found at the infractions, together with the onset of bone resorption at the site of subperiosteal bleedings. The caries incidence and dental attrition rate appeared to be characteristic for an intermediate phase between (pre-)medieval times and the 19th and 20th centuries (Maat & Van der Velde, submitted for publication). It was confirmed that the rise in caries incidence since medieval times was competitively associated with an ongoing fall of dental attrition. The rise in occlusal lesions in the period under study could hardly be the result of sugars added to the diet, as such change in diet did not become important until the 19th century (Burema 1953). The decrease in attrition will have been the result of a decrease in coarseness of food. We know, for instance, that finer flours became available, as by now it was bolted through fine cloth sieves after grinding.

Harris's lines, so-called growth-arrest lines, are most probably the result of periods of starvation or disease during growth (Steinbock 1976). Adult whalers appeared to have more than twice as much lines (Maat 1984c), as for instance men from medieval York (Dawes & Magilton 1980). The latter are known to have had a moderate degree of health. The finding of many of such signs of physical strain corresponded well with the rather small stature of the whalers. Stature, being very much dependent on socio-economic growth conditions, can be used as a parameter for the health status of a population (Van Wieringen 1986). The stature of the whalers, and also of the citizens of Leiden of the same period,

indicated growth conditions to be more or less equivalent to those at the onset of the industrial revolution in the 19th century ( Maat 1984a). But the very high score for rickets in case of the whalers suggested that these men were recruited from a part of the population with a less than average health.

From a historico-economic point of view it is of interest to realize that the whalers appeared to have been smoking clay pipe habitually in days when tobacco was a very expensive stimulant.

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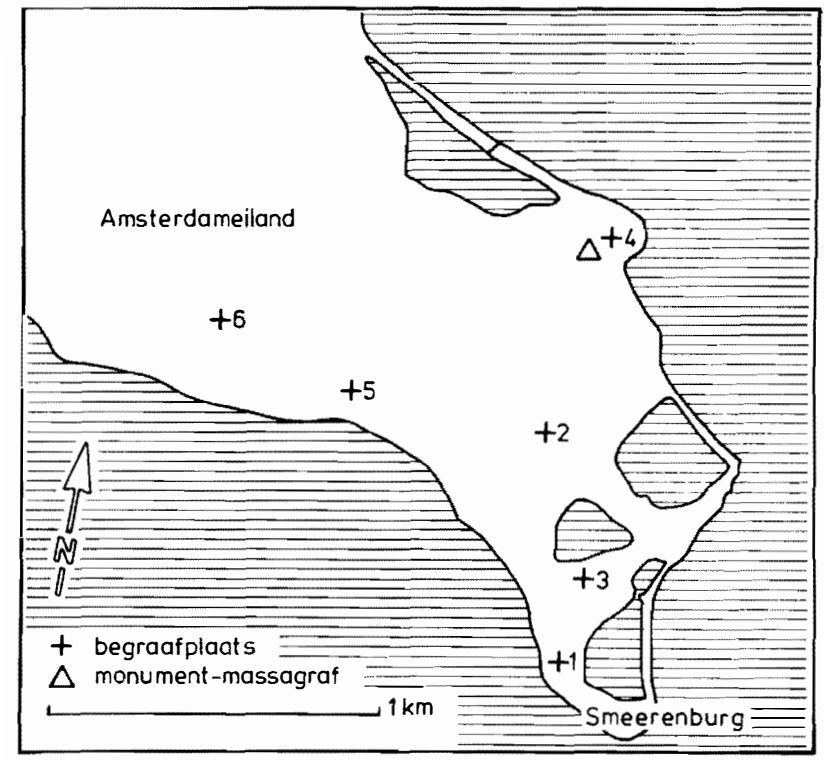


Fig. 1. Map of the spit of land of Amsterdamøya ("Amsterdam-eiland"). Note the site of the burial places ("begraaf-plaats") and of the memorial-charnel pit ("monument-massagraf"). Redrawn map, Arctic Centre.

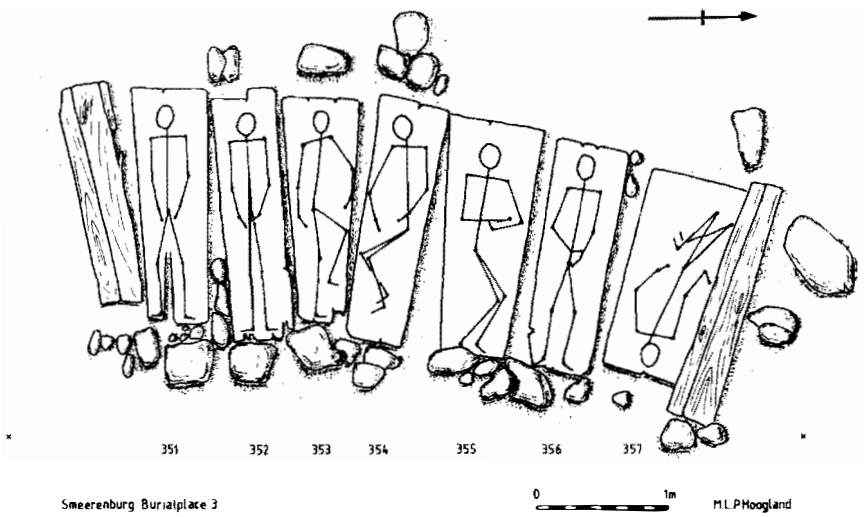


Fig. 2. Postural reconstruction of the seven winterers.

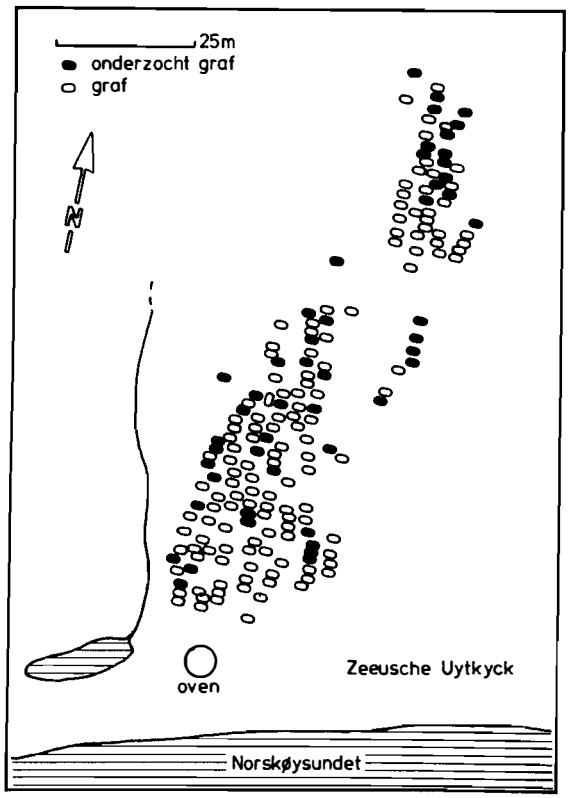


Fig. 3. Map of the central burial place at Ytre Norskøya ("Zeeusche Uytkyck"). Excavated graves ("onderzocht graf") are black.

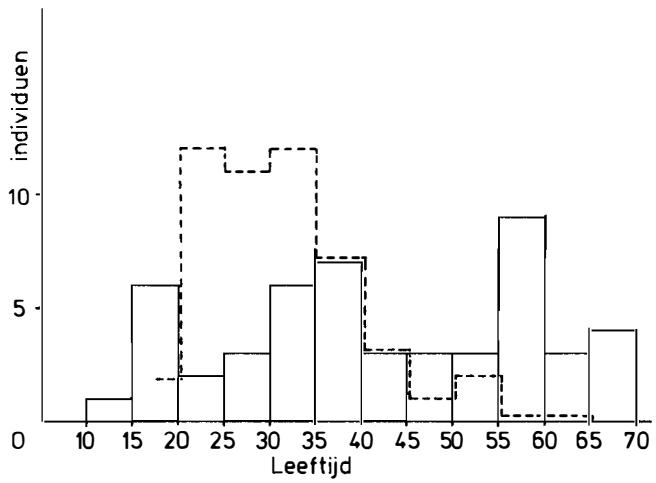


Fig. 4. Distribution of ages at death ("leeftijd") of 50 whalers, and of ages of those alive between 1610 and 1664 reduced to the same total (interrupted line). Data of those alive are from notarial acts (Hacquebord, 1984).

Fig. 5. The interior surface of an infraction in a transverse section (40-60 mu) of a right fibula. Polarized light. Note the abrupt interruption of the histo-architecture of the osteons. Magnification 135 x.

Attrition of 45 whalers, scored according to Brothwell (1981)

| age interval (years) | | | | | | |
|---|---|---|---|---|---|---|
| 14-17 | 17-25 | 25-35 | 35-45 | 45-55 | 55-65 | 65-70 |
| molar | | | | | | |
| M1 M2 M3 | M1 M2 M3 | M1 M2 M3 | M1 M2 M3 | M1 M2 M3 | M1 M2 M3 | M1 M2 M3 |
| numerical classification | | | | | | |
| 2* 1*/2* | 2*/3* 2 1/1* | 3/3 2/2* 2/2 | 3/4* 2/3* 2/2* | 3/4* 2/3* 2* | 4* 3/3 2/3* | 5* 4/4 3/3* |
| wear pattern | | | | | | |

Fig. 6. Molar attrition of 45 whalers scored according to Brothwell (1981).

# ZOOARCHAEOLOGICAL RESEARCH AT SMEERENBURG

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## Introduction

The animal remains recovered during the excavation campaigns of the Smeerenburg project 1979 - 1981 (Hacquebord, 1984) were studied at the Albert Egges van Giffen Institute for Prae- and Protohistory (IPP) of the University of Amsterdam. The zooarchaeological research was directed by the author with assistance from Marion Seeman for a detailed study of the fish remains and from C.H. Maliepaard who identified the bird remains (van Wijngaarden-Bakker & Pals, 1981; van Wijngaarden-Bakker, 1984a, 1984b; Seeman, 1986).
Identification of the animal remains was carried out with the aid of the IPP reference collection. Quantification of the zoological material was done by fragment count, bone weight and by estimation of the minimum number of individuals. Measurements were taken after von den Driesch (1976). The age of the animals was assessed through the study of dental eruption and wear and through epiphyseal closure. The pattern of fragmentation of the bones and the accompanying cut- and saw marks have been carefully studied, as well as the traces of carnivore gnawing.
Finally, the data on taxonomic identification, state of fusion, fragmentation and modification were analysed with the aid of a database management system.
A survey of the feeding habits of the 17th to 19th century Dutch whalers was made through the study of relevant historical records, such as victualing lists and log-books.
The present paper focuses on four research problems relating to the zooarchaeological research that was carried out so far. The first problem is to get an insight into the taphonomic conditions under which the bone assemblage was formed. Secondly, diagnostic patterns will be put forward for the recognition of meat preservation techniques in archaeological faunal material. The adaptation of the 17th century Dutch whalers to the high arctic ecosystem will be discussed. Finally a palaeonutritional reconstruction of the diet of 16th to 18th century sailors will be attempted.

## Taphonomy

Taphonomy can be defined as the detailed study of the passage of organic remains from the biosphere into the lithosphere. The post-mortem relations between the organic material and its environment are subject to two kinds of processes: biostratinomic processes that take place between death and burial and diagenetic processes that take place between burial

and excavation. An evaluation of these processes may provide relevant information on post-mortem information losses.
On Amsterdam Isand the local circumstances for the preservation of organic material are extremely favorable. The permafrost layer is located at a depth of ca.50 to 60 cm below the surface. From July to September only the mean temperature rises above the freezing point (Reimers, 1977). During the remaining months the topsoil is also frozen. Finds of textiles, leather, hair, egg shells, feathers, baleen, nuts, fruits and fragile bird bones illustrate the excellent conditions for the preservation of organic material. These items were deposited in a highly dynamic environment that changes continually. High storm frequencies would result in a rapid soil covering of the refuse that was discarded by the former inhabitants of the whaling settlement and thus help along the preservation of the organic items. That the bones were relatively shortly exposed to open air is shown by their surface, which is generally smooth, sometimes even glossy, without cracks or superficial flaking.
From these observations it may be concluded that at most a very minor information loss took place as a result of weathering of the bones.
A second biostratinomic process that can lead to information loss is butchering technique. The degree of fragmentation of the bones in connection with the butchering method can result in either overrepresentation of skeletal elements (for example in the case of the fragmentation of the carcass into many identifiable parts) or in an underrepresentation (as in the case of heavy fragmentation into unidentifiable splinters).
There is evidence for a high variation in the degree of fragmentation of the Smeerenburg bones. This is partly due to small sample sizes for species such as polar bear and polar fox, and partly to differences in butchering techniques. A high frequency of complete bird bones points to a technique whereby the bird carcasses were left intact in the course of preparation and consumption. An analysis of the degree of fragmentation of the bones of the main mammal species, cattle and reindeer, shows that here only a few complete bones are present, while all the remaining bones are more or less heavily fragmented. A discrepancy has been observed in the frequency of fragmented ribs for the two species. The high frequency of fragmented ribs of cattle as opposed to a corresponding low frequency of fragmented reindeer ribs reflects differential butchering methods (van Wijngaarden-Bakker, 1984b).
A third taphonomic process that could be studied among the Smeerenburg animal remains is carnivore gnawing. Carnivores follow a distinct, recurrent pattern whenever bones are gnawed (Binford, 1981). For small species information loss can occurr when their remains are gnawed so extensively that the bones disappear altogether from the archaeological record. For larger species information loss can essentially occurr when epiphyses of long bones are lost through gnawing, thus preventing the observation of epiphyseal closure.
At Svalbard three potential originators of carnivore gnawing are present: the dog, the polar bear and the polar fox. So far only one definite observation of gnawing by polar bear on an excavated bone could be made. The remaining traces have been ascribed to the domestic dog. The frequency of affection by carnivore gnawing of the Smeerenburg bones is low when compared to that in zooarchaeological assemblages from Dutch sites (van Wijngaarden-Bakker, 1984b).

On the basis of the above considerations, the general conclusion is that only minor information loss took place in the faunal assemblage from Smeerenburg as a consequence of taphonomic processes.

## Food storage

The controlled set of conditions under which the bone assemblage from Smeerenburg was formed, has been used to recognise some diagnostic patterns related to specific techniques of food preservation.
A whaling journey to Spitsbergen took four to five months and during such a trip food for a crew averaging 42 men had to be taken along (Bruijn, 1981). The rich historical documentation of accounts for the provisioning of the ships and of loading lists and log-books kept during the period give us a good idea of the victualing. Food that was taken on board ship was selected on the basis of its suitability for long-term storage. In the historical records there is evidence for four methods of preservation of food of animal origin. Salting was undoubtedly the most widely used method. Salted meat was stored in barrels and sometimes additional barrels of salt were taken along. Whenever salted meat is mentioned in the historical records it seems to refer to beef. Salted pork is rarely mentioned.
In his 'Household Dictionary' Chomel (1743) mentions that for the salting of cattle carcasses one has to select "rib-pieces, the sirloin and in general those pieces that have a lot of bone" (translation by the author).
The zooarchaeological analysis of the cattle bone assemblage from Smeerenburg provided evidence for the selective introduction of skeletal parts to the site. The most noticeable fact was the total absence of skulls, mandibles, metapodials and phalanges of cattle. On the cattle bones that were present, three types of butchering marks have been observed: saw marks, mainly through the vertebrae, which split the carcass longitudinally into two halves (figs. 1, 2); heavy chop marks dividing the carcass into standardized portions of about 25 cm in length; and light chop marks to open up the smaller marrow cavities.
The cattle bones from Smeerenburg site III were subjected to a further quantitative analysis. The bones were first grouped into six categories: vertebral column, rib cage, shoulder, foreleg, pelvis and hindleg. Within each category the bones were weighed and the relative frequency

Table 1. Relative proportion (%) of the bone weight in different portions of the carcass of Smeerenburg and recent cattle (after van Wijngaarden-Bakker, 1984b)

| | SMB-III | recent |
|---|---|---|
| vertebral column | 14.1 | 24.4 |
| rib cage | 49.3 | 21.2 |
| shoulder | 7.7 | 5.0 |
| foreleg | 9.3 | 16.3 |
| pelvis | 8.6 | 9.1 |
| hindleg | 11.0 | 23.7 |

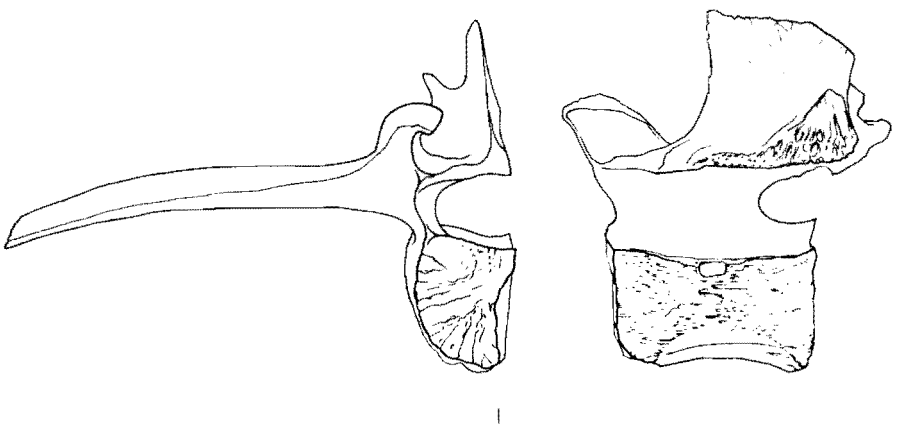

Fig. 1. Split lumbar vertebra of cattle, scale 1:2, SMB-I.

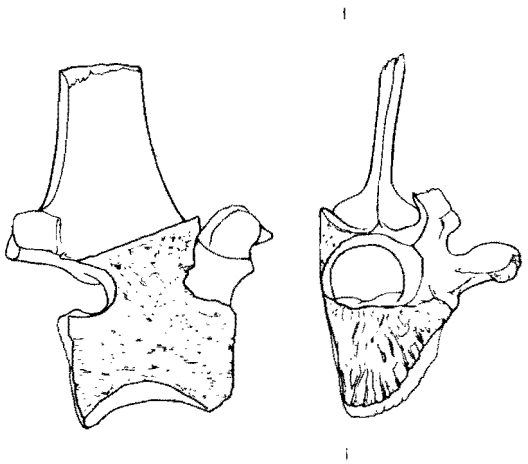

Fig. 2. Split thoracic vertebra of cattle, scale 1:2, SMB-II.

the six categories was estimated. The resulting distribution has been compared to the corresponding frequency distribution of bone weights in the carcass of recent cattle (Bergstrom, 1974) - see table 1.
The Smeerenburg data suggest a heavy overrepresentation of ribs and parts of the sternum. This selection corresponds to the above mentioned recommendation of Chomel of "rib-pieces" as first choice for the salting of beef.
The zooarchaeological analysis of the Smeerenburg cattle remains has furnished conclusive evidence that the absence of skull and lower leg bones coupled to a high frequency of fragmented ribs can be used as a positive indication for the presence of salted beef.
Herring was taken along on the whaling expeditions in barrels as salted herring. Since the 14th century the Dutch mode of salting herring consists of making a cut behind the gills, after which, by a twist of the knife, the gills and stomach are removed. The herrings are then salted and placed in barrels. Here again, the zooarchaeological research provided a usefull diagnostic pattern in the distribution of the herring bones: three bones of the skull, the cleithrum, scapula and coracoid were found to be absent from the Smeerenburg herring bone assemblage (Seeman, 1986). They are the bones that are removed in the course of the typical Dutch curing method.
Another method of preservation that was used for the provisioning of the 17th century whalers was drying. Large quantities of dried cod or stockfish figure on the available victualing lists and there is not a single record for the consumption of fresh cod. The technique to obtain stockfish consists of the removal of the head and entrails of the fresh cod and to let the gutted fish dry in the open air. In the analysis of nearly 3500 cod remains from Smeerenburg bones of the skull were found to be absent from the assemblage (Seeman, 1986). Again, the controlled set of conditions at Smeerenburg provided a diagnostic pattern for the recognition of the presence of dried cod in archaeological contexts.
A third technique of meat preservation is by smoking. The historical records mention bacon, ham and shoulder of pork. Only a very low proportion of the Smeerenburg animal remains consisted of pig bones. Here however, all skeletal elements are present, including the bones of the skull, the mandible (fig. 3) and the lower feet or trotters. So far

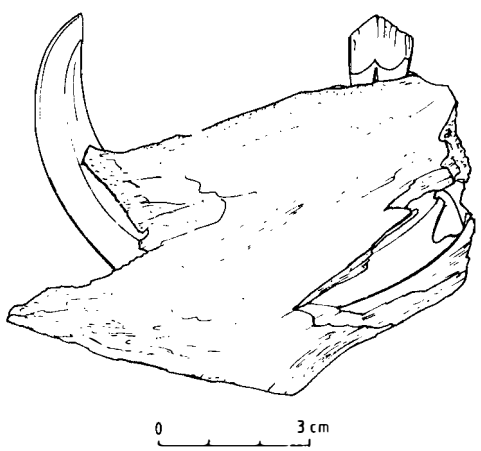


Fig. 3. Fragment of a lower jaw of pig. SMB-III.

no diagnostic pattern could be discerned in the relative frequency of the skeletal elements nor in their weight distribution. The records rarely refer to salted pork and so far it has not been possible to determine whether pigs heads were ever salted. A few scapulae are present that could perhaps come from smoked shoulders of pork. Bacon does not usually contain any bones, so that its presence is difficult to discern in the archaeological record.
The fourth technique of preservation consists of taking along live provisions. Live chicken were taken along on board ship and three of them at least survived to the end of the whaling season, because they were left behind at Smeerenburg as provisions for the overwinterers in september 1633 (L'Honoré Naber, 1930). This evidence is supported by the find of a single chicken bone that was identified by C.H. Maliepaard among the several thousand bird bones from Smeerenburg.

## Adaptation to the high arctic ecosystem

On Svalbard only three indigenous land mammals are to be found: one herbivore, the reindeer and two carnivores, the polar fox and polar bear.
The Spitsbergen reindeer, Rangifer tarandus platyrhynchus is characterized by its small size (shoulderheight 75-94 cm) and a skull with distally expanded nasals and a distinct supraorbital trench (Banfield, 1961). Both the general small size and the presence of a trench above the orbit are apparent in the excavated reindeer remains.
A study of the age structure of the reindeer bone assemblage reveals that the hunting was concentrated on yearlings and very old individuals (figs. 4, 5) and on less mobile animals (van Wijngaarden-Bakker, 1984b). The yearlings were killed between 15 and 17 months of age, which suggests the late summer - early autumn for their capture. At the end of the whaling season provisions might have been low and fresh reindeer meat would be a wellcome addition to the diet. In his log-book Jacob Segersz van der Brugge mentions a special hunting trip to the "Rheenevelt" (the present day Reinsdyrsflya) on september 12 of the year 1633 (L'Honoré Naber 1930).
A detailed study was made of the butchering marks on the reindeer bones. All skeletal elements are present, which suggests that complete carcasses were brought to the site. The vertebrae show heavy chopmarks that originate from the longitudinal splitting of the carcass. All long bones and even some of the lower jaws were fractured to extract the marrow.
In comparison to reindeer, the exploitation of polar fox and polar beer played a minor role. Polar foxes were rarely eaten: it was only during overwintering of 1633-34 that the men resorted to the killing and eating of foxes to cure their scorbut (L'Honoré Naber, 1930). The few bones of polar fox that were found at the excavation do not seem to bear any definite trace of butchering.
Among the remains of the polar beer mainly jaws and phalanges are present. The jaw fragments bear heavy chop marks that were apparently directed at the removal of the canines, while the phalanges bear no butchering marks at all. The finds at Smeerenburg of butchered jaws and complete phalanges of polar bear are direct evidence of the uses of these animals that are mentioned in the historical records. De Veer in 1596-1597 (L'Honoré Naber, 1917) and Martens in 1671 (Martens 1710) both

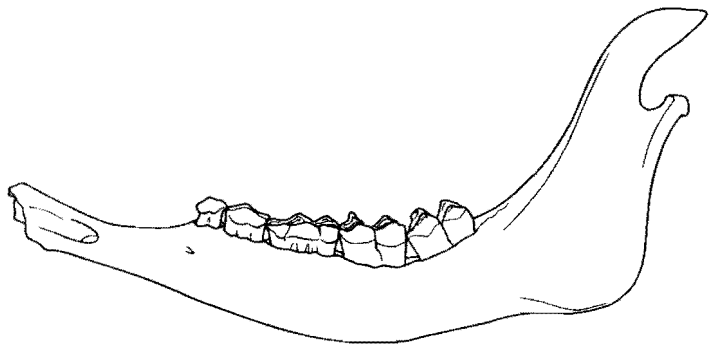

Fig. 4 Lower jaw with milkdentition of a juvenile reindeer, scale 1:2. SMB-I

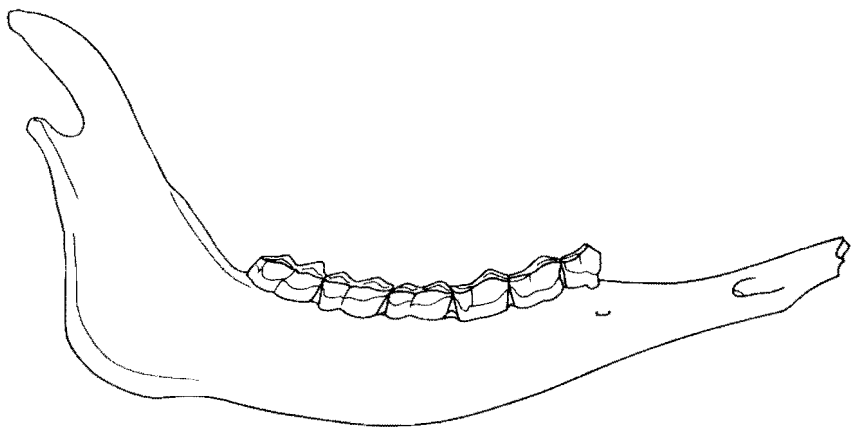

Fig. 5 Lower jaw of a mature reindeer, scale 1:2. SMB-I.

state that polar bears are hunted for their furs, clawfat and teeth and that their meat should not be eaten.
The arctic avifauna was rather intensively exploited by the whalers during their stay on Amsterdam Island. Bones of the following species have been identified: fulmar, kittiwake, ivory gull, glaucous gull, Brunnich's and black guillemot, little auk, eider, arctic tern, goose (brent or barnacle) and chicken (van Wijngaarden-Bakker, 1984b).
The whale carcasses at the site obviously attracted numerous scavenging birds. Bones of these species - fulmar, kittiwake, ivory and glaucous gull - have turned up in the excavation. At SMB-I over 110 complete carcasses of fulmar, Fulmaris glacialis were found, apparently dumped there by the former inhabitants of the site (fig. 6). A few of the bones

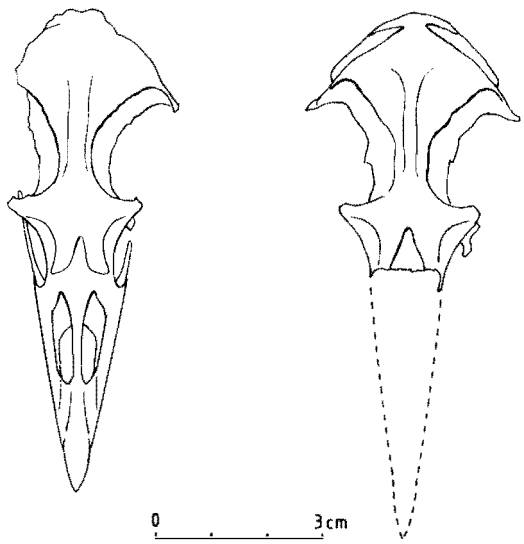


Fig. 6. Two skulls of fulmar from the deposit in SMB-I.

of scavenging species bear cutmarks which suggest that occasionally these birds were consumed.
The historical records specifically mention the consumption of guillemots, eiders and little auks by the whalers. From the presence of bones of these species at Smeerenburg evidence can be constructed for special trips to the rocky cliffs of Amsterdam Island and the neighbouring islands to take the guillemots and little auks. Eiders could easily have been captured at their breeding places on the small, low islands in the Smeerenburg Bay.
The log-book of Jacob Segersz van der Brugge gives us an impression of the perception of nature by the 17th century whalers. These people showed a profound interest in their environment and the behaviour of different animal species. Their observations are often related to what they were used to see "at home" and again and again they wonder at apparent differences.
Quite remarkable is the almost total absence of whale and seal bones among the Smeerenburg food refuse. These species were obviously only exploited for industrial purposes and not for direct human consumption. It is curious to realise that if no historical records had been available, the animal bone assemblage from Smeerenburg would barely have indicated

that the excavated site was a whaling station (see also Hacquebord, this volume).

## Diet reconstruction

A palaeonutritional reconstruction of the animal component of the diet of the 17th century whalers is greatly constrained by the lack of quantitative zooarchaeological data. The research has resulted in data on the range of fooditems in the diet as well as in a number of qualitative data. The diet consisted of salted meat of cattle, some pork (either smoked or salted), stockfish and salted herring, supplemented with fresh meat from reindeer and arctic birds. As far as could be observed most of the long bones of cattle have fused epiphyses and consequently come from adult animals. Additional evidence in the form of fused vertebrae, highly ossified cartiliganous ribs and one case of a pathologically altered tibia indicates that most of the cattle may have been considerably older when slaughtered (van Wijngaarden-Bakker, 1984a). The conspicuous large size of the bone fragments suggest that at least part of the bones may come from oxen. In the 17th century the pastures of western Holland were famous as an area for the fattening of oxen. These animals were specially imported from Jutland to answer the high demands for meat from the inhabitants of the Dutch towns and for provisions from the extending merchant navy (Wiese, 1963). It is a matter of opinion if the meat from these mature oxen was considered tasty. Rules made out for navy crews sometimes state that complaints on the food were not allowed... (Tjassens, 1670). In contrast to the cattle remains, the pig bones from Smeerenburg were found to come from young, immature animals. The bird bone assemblage from SMB-III is quite remarkable in that only bones of the wing are present. It looks as if here only the meat on the breast of the birds was selected for consumption (van Wijngaarden-Bakker, 1984b).

As has been stated above, a quantitative reconstruction of the whalers diet is constrained by the lack of suitable data. The relative proportion of the different fooditems is difficult to assess, although there are some indications that the importance of beef was at least four times higher than that of reindeer meat (van Wijngaarden-Bakker, 1984b). But the proportion of marine fish and of the different birds in the diet remains unknown.

To further this research a study of historical records in relation to the food habits of whalers was undertaken. The following records have been analysed:

1594-95 A victualing for the trip to the North of Jan Huyghen van Linschoten (L'Honoré Naber, 1914)

1633-34 A list of provisions for the overwinters in the log-book by Jacob Segersz van der Brugge (L'Honoré Naber, 1930)

1710 A victualing list in the Dutch edition of the account of a trip to Spitsbergen by Martens (1710)

1720 Victualing lists in the survey on arctic whaling by Zorgdrager (1720)

1784 List of provisions for the entire whaling fleet in a survey on the economic importance of whaling (Walvischvangst, 1784)

The 16th to 18th century measures for volumes and weights that are used in the victualing lists have first been converted to metric standards.

From these data the relative proportion, on the basis of the weight, of the different fooditems in the diet has been calculated. Finally, the separate food items have been grouped into three main components: vegetal, terrestrial animal, marine animal, and the relative proportion of these components in the diet has been calculated (van Wijngaarden-Bakker, 1986).
The animal component in the victualing lists was found to be composed of the following items: salted meat, bacon, ham, stockfish, salted fish, butter and cheese. The mean relative proportion of these items in the animal component of the diet is listed below (see table 2).

Table 2. Mean relative proportion of the main fooditems of animal origin in the animal component of the diet of Dutch whalers. Source: historical records.

| | rel prop. % |
|---|---|
| Salted meat | 32.5-38.9 |
| Bacon | 6.3-10.1 |
| Ham | 1.3 |
| Stockfish | 13.0-16.0 |
| Salted fish | 1.3- 4.4 |
| Butter | 19.2-23.7 |
| Cheese | 15.2-16.3 |

The results of the quantitative analysis of the victualing lists show that there are only minor variations in the relative proportions of the various fooditems. This means that over two centuries the diet remained essentially the same. Some minor shifts however do occur. Ham, for example is no longer mentioned after 1633-34. The category of salted fish consisted of salted cod between 1594 and 1633 and of herring in 1710. After the last date this item does not figure any longer among the provisions.
Important fooditems that show up in the victualing lists and not in the zooarchaeological data are the dairy products butter and cheese. Together they constitute ca. 35-40% of the animal component in the diet. On the other hand the zooarchaeological record shows that local ressources were used, such as reindeer and birds, and these items do not turn up in the lists.
The main conclusion that can be drawn is that a quantitative approach towards a palaeonutritional reconstruction should be considered with the utmost caution (van Wijngaarden-Bakker, 1986). The historical records show a remarkable continuity in the constitution of the animal component of the diet. This is less the case for the vegetal component, where at the beginning of the 17th century there is evidence for a shift from bread to a higher proportion of groats and pulses. However, the relative proportion of the animal and the vegetal component in the diet remains essentially the same over the whole period. This again reflects the stability of the diet composition on the Dutch whaling expeditions.
Further research on the vitamin and mineral content of the whalers diet is now in progress with the aim to single out the limiting factors and deficiencies (van Wijngaarden-Bakker, in manuscript).

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# PALEOETHNOBOTANY IN THE ARCTIS; ARCHAEOLOGICAL AND HISTORICAL INFORMATION ON FOOD- AND INDUSTRIAL PLANTS IN SMEERENBURG

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## Aims and methods

The macroscopic plant remains recovered during the excavations in 1979, '80 and '81 at Smeerenburg on Amsterdam Island, Spitsbergen, were examined at the Botany Department of the IPP, and for a small part at the Rijksdienst voor het Oudheidkundig Bodemonderzoek (ROB) in Amersfoort. Preliminary results of the botanical investigation are presented by Buurman (1980) and Van Wijngaarden-Bakker & Pals (1981).
The aim of the botanical investigation, apart from the general object of the excavation (comparison of archaeological and documentary evidence, adaptation of the whalers to the arctic environment) was to gather information about the diet of the whalers, and to establish the character and possibly the place of specific activities.
The plant remains were generally well preserved and consisted of (fragments of) waterlogged and incidentally carbonized seeds, fruits, leaves and buds, wood and charcoal, largely derived from soil samples taken from the various features. In SMB-I and SMB-III areas, samples with a volume of 0.3-2 litres were taken from the dark brown culture layer and refuse deposits inside and outside the huts. Samples from SMB-I area had a volume of c.30 litres and were taken from the light coloured, sandy culture level and the hearth. Samples were wet-sieved through meshes of 3, 1 and 0.5 mm; the finest fractions were only partly investigated. Sorting and identifying of the plant remains was carried out with the help of a Wild M5 stereo microscope and the reference collections of ROB and IPP. Large seeds and fruits (nuts, plum stones) were occasionally picked up during the excavation.

## Problems in the interpretation

Before the botanical information can be related to the questions posed in the previous section, firstly the origin, the manner of deposition and the possible relation between the material deposited and eventually recovered, should be established.
The species of which seeds are found in Smeerenburg are, with two exceptions, Phippsia algida and Cochlearia officinalis, if at all capable of growing at this latitude, not able to form ripe fruits. This implies that these seeds arrived here by ship. For food plants this is not surprising, but for the wild plants it has interesting consequences: the only way seeds not used as food or for industrial purposes could have arrived at Smeerenburg, is by way of admixture in food or straw. The

plant remains from Smeerenburg thus give us the opportunity to study the weed associations of that time without admixtures of other species of possibly local origin, as is often the case in medieval and post-medieval material from town centres (Paap 1983 and others).
The samples were generally poor in seeds: with the exception of the samples 1012 en 1013 of the SMB-I area (1012 consisted almost exclusively of buckwheat chaff, 1013 of unthreshed oats) the number of seeds did not exceed the 200 per litre. A number of samples were even totally sterile. This is related to the manner of deposition of the plant remains: cesspits or latrines, always rewarding to the paleoethnobotanist, were not found at Smeerenburg. So the plant remains are to be considered 'de facto' refuse (Schiffer 1972).
Since carbonization can only be caused by contact with fire, at Smeerenburg that is only during food preparation, the preservation condition of seeds of food plants and weeds (waterlogged or carbonized) may give information about use and/or way of preparation. Since most remains of food plants were uncarbonized, there is a reason to assume that large weed seeds richly represented in carbonized form have been treated in a special way or for a special purpose. Prepared food that is consumed entirely (cereals, beans) will leave hardly any traces after consumption, in contrast to food containing pips, scales or bones. The larger the refuse, the greater the chance that it will be present in the archaeological record. Plum stones, for instance, will be overrepresented among the seeds. The smaller pips of raisins and figs will be spat out only occassionally, but have a greater chance to become incorporated in the material than cereals or beans. The latter will only be found after spilling or accidents during the food preparation.
The relations put forward above are of course not quantifiable. Therefore, conclusions with a quantitative character may only be drawn with caution. Results of SMB-I and II are comparable, despite the differences in soil conditions of the features from which the samples were taken: the permafrost caused the preservation conditions to be more or less equal throughout the settlement. Comparison of SMB-III with the other two areas is difficult because of the low number of samples from SMB-III.

Charcoal (Esther Jansma)

In Smeerenburg, pitcoal originated from Scotland was largely used as fuel. However, the results from a sample from the hearth in SMB-II (no. 2154) show that other kinds of fuel were also available. This sample contained some charcoal-like material, of which 14.2 gram was investigated. 7.4 gram of it consisted of charred peaty material mixed with fragments of plant roots, apparently the remains of a burnt block of peat. Incidental finds of bog peat elements during the seed analysis, such as Scirpus, Eleocharis, Menyanthes and Potamogeton, as well as a piece of Atlantic moor peat identified by pollen analysis, also indicate the use of peat as fuel.
The remainder of the sample consisted of 146 pieces of charcoal, which could be identified as follows:

| | |
|---|---|
| Salix spec. (willow) | 98 (5.2 gram) |
| Quercus spec. (oak) | 46 (1.5 gram) |
| Pinus sylvestris (pine) | 2 (0.1 gram) |

The pieces of willow are derived from twigs; they are rich in mould and clearly rounded.
The oak charcoal is from trunkwood, without mould, and not rounded.
The two pieces of pine are only partially carbonized.
The mould in the willow charcoal shows that the wood was exposed to damp conditions before carbonization. The rounding indicates erosion. The willow wood could have arrived at Amsterdam Island as driftwood (mould is able to develop in sea water), but the fact that we are dealing with twigs favours the interpretation as remains of brooms. Buds of willow and leaves and sprigs of heather, regularly found during the seed analysis, also point to the use of brooms. During the excavations seven brooms made of willow twigs were found in the SMB-I area and two in the SMB-II area (Hacquebord 1984, p. 192).
In oak wood, development of mould is impossible due to the presence of preservatives. Pieces of oak charcoal are not strongly rounded by erosion: they break easily along the medullar rays. The oak wood is probably waste from ships or houses.
The significance of the two pieces of partly carbonized pine is not clear.

Seeds and fruits

Apart from the samples 1012 and 1013, the excavations did not yield more than 1500 seeds, largely from food plants. A synopsis

Table 1. Synopsis of plant categories in SMB-I, II and III (excl. Avena and Atriplex in 1013; buckwheat chaff not quantified).

| | SMB-I (20 samples) | SMB-II (22 samples) | SMB-III (3 samples) |
|---|---|---|---|
| Food plants | | | |
| Cereals & pulses | 94 (10.1%) | 55 (11.6%) | 58 (30.2%) |
| Fruits | 103 (11.1%) | 48 (10.1%) | 1 (.5%) |
| Nuts | - | 2 (.4%) | - |
| Condiments | 319 (34.3%) | 198 (41.6%) | 5 (2.6%) |
| Buckwheat chaff | * | - | - |
| Medicinal plants | 86 (9.2%) | 70 (14.7%) | 11 (5.7%) |
| Weeds | 171 (18.4%) | 86 (18.1%) | 96 (50.0%) |
| Varia | 157 (16.9%) | 17 (3.6%) | 21 (10.9%) |

of the various categories of plants of which remains were found in SMB-I, II en III is given in table 1. Full results of the seeds analysis are presented in tables 2-5.
Table 1 shows a remarkable conformity in the relative importance of the various groups of food plants in SMB-I and II: staple food ca 10%, fruits ca 10% and condiments (i.c. mustard) ca 40%. Apparently many mustard seeds were spilled during the grinding.
Differences between buildings and within a building may be observed: buckwheat and linseed, present in SMB-I, are lacking in SMB-II, and broomcorn millet, scarce in SMB-I and absent in SMB- II, is abundant in SMB-III.

Table 2 (* means: not quantified)

| | 1000 | | | | | | | | | | | | | | | | | 1100 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SMEERENBURG I | 113 | 114 | 188 | 216 | .04 | .05 | .12 | .13 | .17 | .18 | .20 | .51 | .53 | .54 | .58 | .71 | .72 | .74 | .02 | .09 | |
| FOOD PLANTS | | | | | | | | | | | | | | | | | | | | | |
| Avena sativa | - | 1 | 2 | - | - | - | - | * | - | - | - | - | - | 1 | - | - | - | - | - | - | oats |
| Hordeum vulgare | 2 | 8 | 8 | 5 | - | 7 | 10 | - | - | - | 2 | - | - | - | 10 | 4 | 1 | 1 | - | - | barley |
| Secale cereale | - | - | 1 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | rye |
| Triticum, rachis fragm. | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | wheat |
| Panicum miliaceum | - | - | 1 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - | broomcorn millet |
| Pisum sativum | 6 | - | 1 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | pea |
| Vicia faba | - | 8 | - | - | - | - | 2 | - | - | - | 1 | - | - | - | - | - | - | - | - | 6 | bean |
| Ficus carica | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | fig |
| Prunus insititia | 10 | 2 | - | - | 14 | 14 | - | - | 39 | - | - | 1 | 9 | 7 | 1 | - | - | - | 1 | - | bullace |
| Vitis vinifera | - | 1 | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | raisin |
| Linum usitatissimum | - | - | 2 | - | - | - | - | - | - | 1 | - | - | - | - | 1 | - | - | - | - | - | linseed |
| Fagopyrum esculentum | 1 | 16 | - | - | - | 2 | * | - | - | - | - | - | - | - | 2 | 8 | 4 | 3 | 3 | - | buckwheat (chaff) |
| Brassica nigra | - | 1 | 165 | 11 | - | 15 | - | - | 50 | 1 | - | - | - | 1 | 4 | - | 5 | 5 | - | - | black mustard |
| Sinapis alba | - | 4 | 1 | 2 | 5 | 13 | 6 | - | - | - | 1 | - | - | 12 | 9 | - | 8 | - | - | - | white mustard |
| MEDICINAL PLANTS | | | | | | | | | | | | | | | | | | | | | |
| Cochlearia officinalis | - | 1 | - | - | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | scurvy grass |
| Galium aparine | 2 | 9 | 5 | - | - | 1 | 3 | 20 | - | - | - | - | - | - | 19 | 13 | - | 3 | - | 6 | cleavers |
| Humulus lupulus | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | hop |
| WEEDS | | | | | | | | | | | | | | | | | | | | | |
| Aethusa cynapium | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | 1 | - | - | - | - | |
| Agrostemma githago | - | 1 | - | - | - | - | 1 | - | - | - | - | - | - | 2 | 3 | - | - | - | - | - | |
| Alopecurus myosuroides | - | 3 | - | - | - | - | 22 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Atriplex spec. | - | - | - | - | 1 | 3 | 1 | * | - | - | - | - | - | 1 | - | - | - | - | - | - | |
| Bromus secalinus | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | |
| Centaurea cyanus | - | 1 | 1 | - | 1 | - | 5 | - | 1 | 1 | - | - | - | - | 1 | - | - | - | - | - | |
| Chenopodium album | - | - | 1 | - | 1 | 6 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Ch. ficifolium | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | |
| Cirsium arvense | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | |
| Echinochloa crus-galli | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 | - | - | - | - | - | - | |
| Elytrigia repens | - | - | - | - | - | - | 20 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Medicago lupulina | - | - | 1 | - | - | - | 1 | 10 | - | - | - | - | - | - | - | - | - | - | - | - | |
| Melandrium spec. | - | - | - | - | - | 1 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | |
| Neslia paniculata | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Odontites verna | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Pastinaca sativa | - | 1 | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Polygonum aviculare | - | - | - | - | - | 3 | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - | |
| P. convolvulus | - | - | - | - | - | 4 | 1 | - | - | - | - | - | - | - | 3 | - | - | - | - | - | |
| P. lapathifolium | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Ranunculus arvensis | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | |
| R. repens | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | 1 | - | - | - | - | |
| Raphanus raphanistrum | - | 2 | 3 | - | - | 1 | 1 | - | - | - | 1 | 2 | - | 1 | - | - | - | - | - | - | |
| Rumex spec. | - | - | - | - | - | 13 | 2 | - | - | - | - | - | - | 2 | - | - | - | - | - | - | |
| Scandix pecten-veneris | - | 2 | 1 | - | - | 3 | 1 | - | - | - | 1 | - | - | 1 | 6 | - | - | - | 1 | - | |
| Setaria glauca | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Sonchus asper | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | |
| Stellaria media | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| VARIA | | | | | | | | | | | | | | | | | | | | | |
| Carex spec. | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Chara spec,globuli | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 1 | - | - | 1 | - | - | |
| Eleocharis palustris | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | |
| Erica tetralix, leaves | - | 1 | 16 | 1 | - | - | 2 | - | - | 1 | 2 | - | - | - | - | 2 | - | 2 | - | - | |
| Calluna vulgaris,flowers | - | - | 1 | - | - | - | - | - | 1 | - | 2 | - | - | - | - | - | - | - | - | - | |
| idem, sprigs | - | - | - | - | - | - | - | - | - | - | 5 | - | - | - | - | - | - | - | - | - | |
| Nicotiana tabacum | - | * | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | tobacco |
| Phippsia algida | - | - | - | - | - | - | 6 | - | - | - | - | - | 29 | 18 | - | - | - | 11 | - | - | |
| Potamogeton spec. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | |
| Scirpus lacustris | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | |
| Leaf buds | - | 18 | 10 | 6 | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | |
| Unidentified | - | 1 | 1 | 3 | - | 3 | 1 | - | - | - | - | - | - | 5 | - | - | 2 | - | - | | |

Table 3

| SMEERENBURG II | 021 | 031 | 032 | 033 | 034 | 035 | 038 | 041 | 042 | 043 | 045 | 050 | 080 | 082 | 094 | 109 | 110 | 119 | 132 | 148 | 149 | 154 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FOOD PLANTS | | | | | | | | | | | | | | | | | | | | | | | |
| Hordeum vulgare | - | - | - | - | - | - | - | - | - | - | - | - | 2 | 2 | - | 1 | - | - | - | - | - | 5 | barley |
| Secale cereale | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - | rye |
| Triticum aestivum | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | wheat |
| Pisum sativum | - | - | - | - | - | - | - | 1 | - | 1 | - | - | - | | 10 | 1 | - | - | - | 10 | - | - | pea |
| Vicia faba | - | - | - | - | - | - | - | 1 | - | - | - | - | - | 5 | 2 | 2 | - | - | - | 7 | - | 1 | bean |
| Ficus carica | - | - | - | - | 8 | 2 | 3 | - | - | 1 | - | - | 3 | - | - | - | - | - | - | - | - | - | fig |
| Prunus insititia | 3 | 1 | 3 | 1 | 1 | - | - | 7 | 8 | 2 | 1 | 1 | - | - | - | - | 1 | - | - | - | - | - | bullace |
| Vitis vinifera | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 | raisin |
| Corylus avellana | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | hazelnut |
| Brassica nigra | - | - | - | - | 2 | 3 | 8 | 1 | - | 3 | - | - | 1 | - | 3 | 2 | - | 5 | 1 | - | 1 | 2 | black mustard |
| Sinapis alba | - | - | - | - | - | - | - | 45 | - | 8 | - | - | 3 | 14 | 5 | 40 | - | 5 | - | 32 | 5 | 10 | white mustard |
| MEDICINAL PLANTS | | | | | | | | | | | | | | | | | | | | | | | |
| Cochlearia officinalis | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | scurvy grass |
| Galium aparine | - | - | - | - | - | - | - | - | - | 2 | - | - | - | 3 | 7 | 3 | - | - | - | 47 | - | 5 | cleavers |
| Humulus lupulus | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | hop |
| WEEDS | | | | | | | | | | | | | | | | | | | | | | | |
| Agrostemma githago | - | - | - | 3 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Alopecurus myosuroides | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 | - | - | - | - | - | - | |
| Atriplex spec. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | 7 | 1 | - | |
| Centaurea cyanus | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | |
| Chenopodium album | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | |
| Cirsium arvense | - | - | - | - | - | - | - | - | - | - | - | - | 6 | - | - | - | - | - | - | - | - | - | |
| Daucus carota | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 1 | - | - | |
| Galeopsis spec. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | |
| Neslia paniculata | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Polygonum aviculare | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | |
| P. convolvulus | - | - | - | - | 1 | - | - | 7 | - | 3 | - | - | - | - | 1 | 2 | - | 1 | - | 6 | 1 | - | |
| P. lapathifolium | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - | 2 | - | - | - | 1 | - | - | |
| Raphanus raphanistrum | - | - | - | - | - | 1 | - | 11 | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | |
| Rumex acetosella | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | |
| Rumex spec. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 3 | - | - | - | 1 | - | - | |
| Stellaria media | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Thlaspi arvense | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Viola arvensis | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| VARIA | | | | | | | | | | | | | | | | | | | | | | | |
| Calluna vulgaris,flowers | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 1 | - | - | - | |
| Menyanthes trifoliata | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Phippsia algida | - | - | - | - | - | 1 | - | 1 | - | - | - | - | 3 | - | - | - | - | 1 | - | - | - | - | |
| Leaf buds | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | 7 | - | - | - | - | 1 | - | |
| Unidentified | - | - | - | - | - | - | - | - | - | 2 | - | - | - | 1 | - | - | - | 3 | - | 1 | - | 1 | |

Table 4

| SMEERENBURG III/3001 | top | middle | bottom | |
|---|---|---|---|---|
| FOOD PLANTS | | | | |
| Avena sativa | 1 | - | 7 | oats |
| Hordeum vulgare | - | - | 11 | barley |
| Panicum miliaceum | 8 | 28 | 2 | broomcorn millet |
| Pisum sativum | - | - | 1 | pea |
| Ficus carica | 1 | - | - | fig |
| Brassica nigra | - | - | 4 | black mustard |
| Sinapis alba | - | 1 | - | white mustard |
| MEDICINAL PLANTS | | | | |
| Galium aparine | 1 | 1 | 8 | cleavers |
| Hyssopus officinalis | - | - | 1 | hyssop |
| WEEDS | | | | |
| Anthemis arvensis | - | 3 | - | |
| Bromus secalinus | - | - | 2 | |
| Centaurea cyanus | - | 1 | - | |
| Chenopodium album | - | 1 | 7 | |
| Daucus carota | - | - | 1 | |
| Galeopsis tetrahit | - | 1 | - | |
| Lapsana communis | - | 1 | - | |
| Malva spec | 1 | - | - | |
| Neslia paniculata | 22 | 27 | - | |
| Polygonum aviculare | - | - | 2 | |
| P. convolvulus | 2 | 3 | 1 | |
| P. lapathifolium | 2 | - | 1 | |
| Raphanus raphanistrum | 1 | 2 | - | |
| Rumex spec. | - | 1 | 2 | |
| Scandix pecten-veneris | 3 | 1 | 1 | |
| Setaria viridis | 1 | 2 | 1 | |
| Solanum nigrum | - | 2 | - | |
| Sonchus asper | - | - | 1 | |
| VARIA | | | | |
| Carex sect. Acutae | - | 1 | - | |
| Calluna vulgaris, leaves | - | - | 2 | |
| Erica tetralix, leaves | - | - | 16 | |
| Ranunculus flammula | - | - | 1 | |
| Scirpus lacustris s.l. | - | - | 1 | |

Table 5. Hand picked large seeds

| | Smb I | | | | | | | | | | Smb III | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1001 | 1024 | 1042 | 1049 | 1068 | 1102 | 1104 | 1106 | 1107 | 1113 | 1123 | 3002 | 3005 | 3014 | 3017 | 3018 | |
| Prunus insititia | 1 | 1 | 1 | 1 | 3 | 12 | 7 | 3 | - | - | 1 | 1 | 2 | - | 1 | 1 | bullace |
| Corylus avellana | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | hazelnut |
| Juglans regia | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | walnut |
| Cocos nucifera | - | - | - | - | - | - | - | - | - | 1 fragm | - | - | - | - | - | - | coconut |
| Mucuna sloanii | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | drifting tropical seed |

In SMB-II, pulses seems to be confined to the central part of the building (samples 2082, 2094 and 2109, with 2148 as an exception outside the building; this is, however, a refuse deposit rich in ashes and pitcoal, and would have been the place where refuse from the regularly cleaned hearth was deposited), whereas fruit remains, especially fig pips, were found along the supposed outer walls.
In SMB-I a number of samples were taken in or near gutters (1004, 1005, 1020, 1051, 1053, 1058 and 1074), in order to elucidate the function of these structures. However, the contents of these samples did not permit any conclusions. There is no connection with latrines or the like.
Samples from building 2 of SMB-I are all sterile, with the exception of 1102; it is therefore improbable that this structure was used for cooking or eating.

## The vegetable component in the diet

According to the documentary evidence (Martens 1710, l'Honoré Naber 1930) the staple food of the whalers during the voyage to and the stay at Smeerenburg consisted of cereals (barley, buckwheat, rye flour and groats) and pulses (peas and beans). Apart from the animal food (van Wijngaarden-Bakker, this volume) the following items were taken along: butter, cheese, hard and soft bread, white biscuit, lemon juice, raisins, plums, figs, black and white mustard (a mustard mill was an integral part of the ship's inventory!), pepper, ginger, nutmeg, cinnamon, cloves and mace.
The results of the seed analysis show that the species expected to be preserved were in fact found. Condiments such as pepper and nutmeg are grated or finely ground and thus have a minimal chance to be preserved in recognizeable form; their absence is therefore not surprising. In the material from Amsterdam they are also lacking (Paap 1983, 1984).
A comparison of the information from archaeological and historical sources is given in table 6. It appears that the list of the whaler Jacob Seghersz van der Brugge (l'Honoré Naber 1930), who wintered on Amsterdam Island and the one published together with the logbook of Friedrich Martens almost eighty years later are almost identical. The vegetable basis of the diet was apparently very consistent.
The botanical analysis has supplemented the historical information: the assortment of cereals was greater than the one suggested by the documentary evidence, and the use of some medical plants not mentioned in the historical record was established. These plants were probably used as domestic remedies, without being prescribed by a ship's doctor, if such a man was at all present. The food- and industrial plants found in Smeerenburg are briefly discussed in the next section.

## Food plants

-Groats are not recognizeable as such in the archaeological context, and the documentary evidence does not specify which cereal species were processed to make groats. Most probably this were barley and buckwheat.
-Oats: one carbonized grain in SMB-III, in SMB-I a few uncarbonized grains and in sample 1013 a cache of unthreshed grains, possibly interpretable as chicken feed. Chicken bones have been found (Van

Table 6. Comparison of historical and archaeological information.

| | Mentioned by Martens | Seghers | found in Smeerenburg |
|---|---|---|---|
| groats | * | * | ? |
| oats | - | - | * |
| barley | * | * | * |
| rye | *(flour) | *(flour) | * |
| wheat | - | - | * |
| millet | - | - | * |
| buckwheat | * | * | * |
| peas | * | * | * |
| beans | * | * | * |
| linseed | - | - | * |
| plums | * | * | * |
| raisins | * | * | * |
| figs | * | - | * |
| ginger | * | * | - |
| pepper | * | * | - |
| nutmeg | * | * | - |
| cinnamon | * | * | - |
| cloves | * | * | - |
| mace | * | * | - |
| mustard seed | * | * | * |
| hazelnut | ?('nooten') | - | * |
| walnut | ?('nooten') | - | * |
| coconut | - | - | * |
| scurvy grass | - | * | * |
| Oxyria | - | *('sueringh') | - |
| hop | - | - | * |
| cleavers | - | - | * |
| hyssop | - | - | * |
| tobacco | - | * | * |

Wijngaarden-Bakker 1984) and in the logbook of the winterers (l'Honore Naber 1930) 'hens' are mentioned.
-Barley: abundant in SMB-I and II, often uncarbonized.
-Rye was very scarce, but this is to be expected if this cereal was taken along as flour.
-Millet was found occasionally in SMB-I and in greater numbers in SMB-III. Remarkably, this 'poor men's food' is never mentioned as part of the ship's supplies, which were always purchased as cheap as possible (Bruijn 1967).
-Wheat: one carbonized grain in SMB-II and an uncarbonized rachis fragment in SMB-I.
-Buckwheat: although the documentary evidence is positive concerning the use of buckwheat, no grains of this species were found. Only the husks were abundant in SMB-I. Buckwheat chaff was commonly used as padding in the transport of pipes, glasswork and other fragile equipment. Furthermore it was used as bedding in two coffins at the Zeeuwse Uitkijk (Maat 1981, van Wijngaarden-Bakker & Pals 1981).

-Peas and beans occurred regularly, both carbonized and uncarbonized. Although even the uncarbonized specimens were well preserved, it was impossible to distinguish between green and yellow peas. The beans belong to Vicia faba var. minor, celtic bean. Infestation of the pulses by bean beetles (Acanthoscelides obtectus) could be established (van Wijngaarden-Bakker & Pals 1981). Differences in price between the various pulses (van Brakel 1910) were not reflected in the find material.
-Linseed was sporadically found in SMB-I. It was possibly part of the gruel used for breakfast, in which also various cereals and buckwheat were incorporated.
-Fruits could only be taken along in dried form. The dried fruits mentioned in the historical record, plums, figs and raisins, are all present in Smeerenburg. The term 'plum' was used for both Prunus domestica with all its varities and for the various races of bullace (Prunus insititia). The fruit stones found in Smeerenburg belong to P.insititia var. intermedia.
-Nuts: remains of this easily preservable food were scarce, probably due to the relatively high price. Shell fragments of walnut, hazelnut and coconut were occasionally found. Coconuts could have been taken along, but the possibility of occasional drifting ashore could not be entirely ruled out: the proof that seeds from the tropics were transported to Spitsbergen by the Gulfstream was furnished by the find of a seed of the Southamerican Papilionaceous species Mucuna sloanii in a culture layer in SMB-I.
-Mustard was commonly used to flavour the daily ration of salted and possibly partly taint meat. It was also used as a cure for scurvy (van Wijngaarden-Bakker & Pals 1981). The seeds of both white and black mustard were very common, especially in SMB-I and II.

Medicinal plants

One of the most serious problems the ship's crew had to cope with was the deficiency of vitamin C, better known as scurvy. This disease struck first and hardest on the ships which, like the whalers', sailed in spring (van Andel 1927). The crew of these ships had not been able to eat fresh fruits or meat for several months and the monotyonous food at sea (Bruijn 1967) only worsened the vitamin deficiency built up during the previous winter.
At Spitsbergen, the scurvy-grass ("salaet", Cochlearia officinalis) was a very welcome source of vitamin C. It may be stated without exaggeration that this plant was of vital importance to the whalers (just like the meat of reindeer and polar fox, which also contains vitamin C). Although a number of findspots of this herb were carefully mapped and special expeditions were organized to collect it, many people suffered from scurvy. Maat (1981) found traces of the disease in 78% of the investigated skeletons from Amsterdam Island and the Zeeuwse Uitkijk.
Seeds of scurvy-grass were not found regularly, but this is not surprising: the medicinal effect is optimal in plants in an early stage of development.
The reasons to interpret cleavers (Galium aparine) as a medical plant are the following: although this species is scarce or absent in the Netherlands in Medieval or Post-Medieval context (N.A.Paap, IPP, pers.

comm.), it is one of the commonest wild plants in the Smeerenburg material, and furthermore the only wild plant of which carbonized and uncarbonized fruits occur together (with one exception, a carbonized fragment of a Raphanus pod in SMB-III, all seeds of wild plants were uncarbonized). The find of 47 partly carbonized cleaver fruits in a refuse deposit at SMB-II suggests intentional roasting, possibly to make an extract. Even today, roasted cleaver fruits are a well known substitute for coffee. The medicinal effects of such an extract, especially the styptic qualities (see for instance Gerard 1597), would have been appreciated by scurvy patients suffering from bleeding gums.
Hop, found once in both SMB-I and II, may be used for various purposes; a well-known effect is that of a mild sedative.
Hyssop, found once in SMB-III, may also be applied in different ways, both as a condiment (flavouring of meat) and a medicine (against affections of throat and bronchial tubes).

Weeds

About 15 weed species were established in the pollen record from the culture layers at Smeerenburg, 4 of which were even present in the core from Søre Salatberget more than 3 km away (van der Knaap 1985). Dispersion of these pollen and that of Secale (rye) is possibly caused by the beating of straw mattresses. The weed flora recorded by the seed analysis contains more than 30 species and is characterized by a number of submediterranean and continental elements:
Scandix pecten-veneris
Neslia paniculata
Ranunculus arvensis
Alopecurus myosuroides
Echinochloa crus-galli
Setaria viridis and S. glauca
The first four are characteristic for the Caucalidion lappulae Tx.1950, an alliance of submediterraenean, thermophilous weed associations. In the Netherlands this alliance is represented by weed associations in wheat and barley fields on lime-rich soils in Limburg and along the great rivers, with an outpost on the young, lime-rich clay in Groningen, where two of the species mentioned (Scandix and Alopecurus) show an optimum in their distribution in the Netherlands. In view of this, the northern part of Groningen was suggested as one of the regions of origin of the cereals (van Wijngaarden-Bakker & Pals 1981); alternatively, the grain could have been imported from the Baltic countries and, in view of the occurrence of the continental Setaria spp., Echinochloa and especially Neslia this is much more probable (cf. also Paap 1984). Especially rye was imported on a large scale from Poland and Prussia in Late Medieval and Early Modern times (Heijder 1979).
In two cases it seems to be possible to establish an association of a cereal species with certain weed species: in SMB-III, where Panicum miliaceum (broomcorn millet) outnumbered the other cereals, Neslia paniculata was by far the most common weed. However, the weeds normally associated with millet (cf. Hilbig & Lange 1981) were not found.
Much more reliable is the combination of Atriplex, Medicago and Avena (oats) in sample 1013, because here the weed seeds were mixed with the cereal grains.

## Conclusions

In the absence of botanically rich features such as latrines, the information provided by the macroscopic plant remains is rather scanty. Nevertheless a considerable number of species could be added to the 'historical' list of food- and industrial plants. The exploitation of Cochlearia as a local resource is shown by the paleobotanical analysis. There are indications for spatial differences in the distribution of plant species within SMB-I en SMB-II. Positive evidence for specific activities within the sites was not found.
The weed flora indicates import of cereals from the Baltic area.

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# WORKMAN'S CLOTHING OR BURIAL GARMENTS? SEVENTEENTH AND EIGHTEENTH CENTURY CLOTHING REMAINS FROM SPITSBERGEN

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## Introduction

In a series of campaigns spanning the years 1979 to 1981, the excavation team of the Artic Centre, under the direction of Dr. L. Hacquebord (University of Groningen) investigated the material remains left by the 17th and 18th century whalers on Spitsbergen. Amongst the sites excavated was the Dutch whaling settlement Smeerenburg on Amsterdam Island in the N.W. of Spitsbergen, where, during the summer months of 1614 to 1660 A.D. the harpooned whales were processed (Hacquebord 1984 and this volume). Also investigated was a cemetery on Zeeuwse Uitkijk or Ytre Norskøya, where, from about 1640 onwards many whalers found their last resting place (see also Maat this volume).
One of the purposes of the excavations was to establish the degree of correspondence between the historical sources concerning the Dutch whaling fleet and the archaeological evidence. This was also an opportunity to find out what sort of clothing was used (Vons-Comis 1984a & b).
Considerable quantities of textiles were recovered from the settlement Smeerenburg as well as from a large number of graves on Zeeuwse Uitkijk. The damp textiles were placed in plastic bags which were then sealed. Following their transport to Holland, the larger pieces of clothing were washed in soft tap water and de-ionized water by Miss E. van Dienst and Mr. O.Goubitz, both of the State Service for Archaeological Investigations in the Netherlands at Amersfoort, to whom I am indebted for this work.
The smaller finds were cleaned at the Albert Egges van Giffen Institute of Prae- and Protohistory (University of Amsterdam) where the study was also carried out. This research was undertaken between 1981 and 1984 and was supported by the Netherlands Organisation for the Advancement of Pure Research.
The two themes central to the entire study of the textile finds were:
a. the materials and techniques used (cf Vons-Comis 1982)
b. the function of the textiles, and whether there is any evidence for specialized or modified working dress.

## Textiles from Smeerenburg (c. 1614-1660 A.D.)

The remains of several furnaces and buildings were excavated in the whaling settlement Smeerenburg. A considerable number of textile fragments was recovered from the domestic refuse in and behind the houses. The total of well over 1000 scraps and large rags ultimately proved to belong to about 600 different textiles, predominantly work clothing and bedding remains. Room furnishings at a site like this can never have formed an important category.

Before describing the remains of clothing I will first deal briefly with the textile scraps found in the settlement. Over 95% of the 600 surviving excavated textiles were woollens. Almost all the rest was made of vegetable fibres such as flax, hemp or cotton. These vegetable fibres were, however, so degraded by the prevalent soil conditions that positive identification of the fibre concerned was impossible.
Only four silk weaves and some silken sewing-threads occurred amongst the Smeerenburg textiles. This is in marked contrast to the picture obtained from seventeenth and eighteenth century cess pits in the Netherlands where silks tend to predominate (Vons-Comis 1985).
The type of fibres preserved in the ground depends very much on the degree of water saturation as well as the pH of the soil. In the Netherlands it is chiefly the animal fibres such as wool and silk which survive burial. On Spitsbergen, however, textiles of both animal and vegetable origin have been preserved. It is probably the cold climate which has assisted in the preservation of the plant fibres.
The techniques used in the production of the excavated textiles are: felting, knitting and weaving. Other techniques familiar in the first half of the seventeenth century, such as plaiting and lace, are entirely absent from this group.
Felt accounts for 8% of the textiles and consists mainly of narrow slivers though there are some larger pieces and even two complete felt hats (Fig. 1a). On closer inspection it became clear that many of the felt hats had been secondarily cut up to make inlay-soles. Five of these, which had been cut out of the broad rims, were also recovered.

Fig. 1a

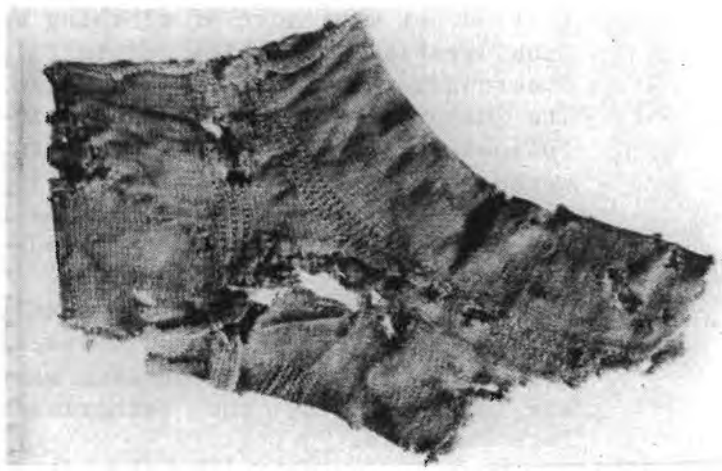

Fig. 1b

Fig. 1, a: Complete felt hat; b: Fragment of knitted sock with relief designs (both from Smeerenburg, first half 17th century)

Knitting, which formed 8% of the total material usually employs plain or stocking stitch (49 fragments). Purl stitch was only used to form the stripes, lozenges and blocks of relief decoration (Fig. 1b). Most of the knitting belongs to worn-out stockings, with heel and ankle parts often still recognizable (26 fragments). Several fragments of stocking tops were also found, sometimes with coloured design knitted in. Small fragments of knitting could belong to a cap. There is no evidence at all for jumpers.
The majority of the textiles is woven (84%). The fabrics were, for the

most part woven on a treadle loom, usually in tabby (62%) but also in 2/2 twill (25%) and 2/1 twill (10%). There are also several fabrics in deratives of tabby or twill weaves.
In contrast, the two fabrics in satin weave and one damask were manufactured on a drawloom. In a completely different category is the fragment of tapestry work, in which the various colours are particularly well preserved. Unfortunately, the design is no longer recognizable. Another unusual piece is a double weave with stylized French lillies.
A few narrow textiles were woven on a ribbon loom (a silk ribbon, for example), on a small frame (for garters etc., Kristensen 1969) or with tablets. Two pieces of tablet weaving were identified: one was of silk and the other incorporated vegetable fibres as well as silk. Such narrow tablet-woven ribbons were used to trim garments, perhaps under influence of Spanish fashions (Streiter & Weiland, 1985).
Colours such as blue, red, green and black remained well preserved in the Spitsbergen textiles, providing yet another contrast to the situation in the Netherlands where the vegetable dyes have usually been leached out, leaving the textiles with the brownish stain of the surrounding soil.
Numerous seams and button-holes suggest that the textiles for the most part belong to clothing, quite large fragments of which have sometimes survived.

## Seventeenth century workmen's clothing from Smeerenburg

Examples of seventeenth century clothing are relatively rare in the Netherlands and those garments which are contained in costume collections have usually only been preserved on account of their great costliness.
The clothing of the working man is entirely absent from collections in both the Netherlands and the neighbouring countries. The reasons are obvious: these garments were worn out, they were often repaired or were remade into other articles of dress.
Later, the fabrics might be sold to the ragman or the pieces could be used as cleaning rags or swabs for cleaning or tarring ships (Vons-Comis 1981, two of these swabs were also found in Smeerenburg). Finally, the smallest scraps - the original function of which can hardly be guessed at - land in refuse deposits or cess pits, where they are preserved for the future archaeologist.
On Spitsbergen, however, the men could only do simple repairs, like darning their stockings and caps or patching their garments. Larger holes in the garments were patched with smaller pieces of fabrics. Only when the patch was also worn right through the entire garment was thrown away.
As there was not the time or opportunity to remake garments or to sell them to the ragman, many recognizable fragments of clothing and accessories were preserved. Sometimes it is only a loose sleeve, but there are also fragments of a jacket (Fig. 2a).
Under the jacket the whaler wore in a linen shirt. Although no fragments of these shirts were found, we know something about their shape from a woollen example, which has short sleeves and a T-shaped neck opening (Fig. 2b).
In addition to a jacket and a shirt, the labourers also wore breeches. Two pairs of breeches were recoverd in Smeerenburg. One of them had been

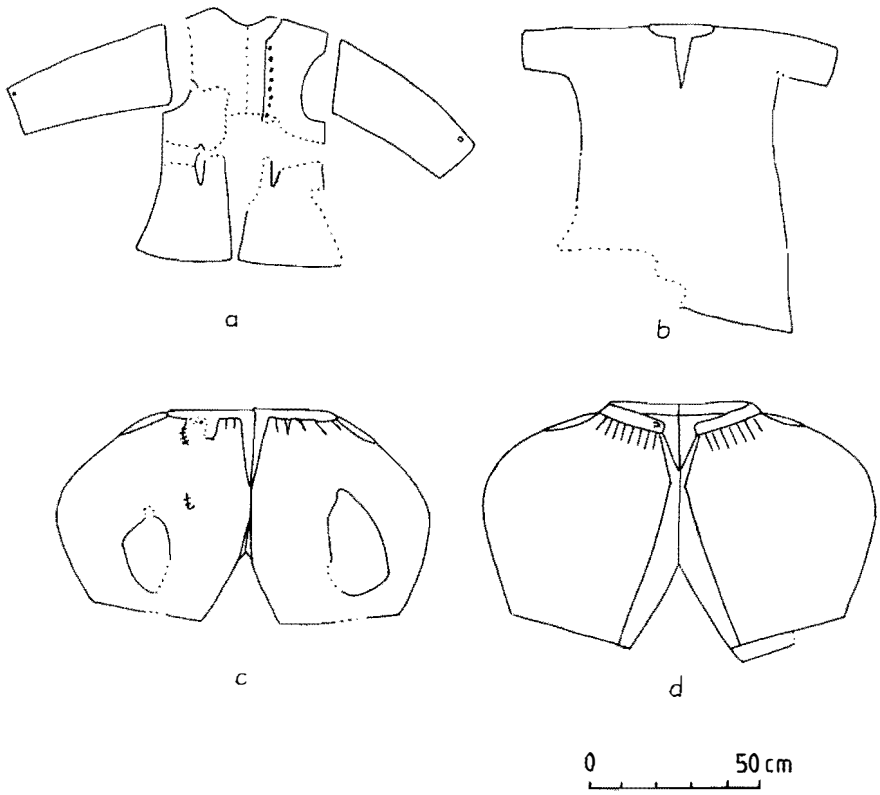


Fig. 2. Woollen clothing from Smeerenburg:
a. brown jacket in 2/1 twill
b. brown shirt in 2/1 twill
c. & d. dark brown breeches in tabby

secondarily cut up and only a number of fragments was left (Fig. 2c). The rows of stitch-holes which are still visible show that at some point of time there were two holes in the breeches which had been patched. The patches themselves are lost because the linen sewing-thread has decayed. It is likely that these patches also wore through in time and the owner decided to throw his breeches away, but not before cutting away the pieces which were still useful for patching other garments.
The other pair of breeches, which is of roughly the same size, was probably too filthy to touch (Fig. 2d). The entire garment was discarded, and even now, after innumerable rinses, it is still very stiff. The original width of the trouser-legs is not reconstructable as the kneeband is missing. The absence of buttons and of button-holes suggests that the trouser-legs were very wide indeed.
Both pairs of breeches must have had pockets in the seams. These pockets, and also the lining of the breeches would have been made of linen which has decayed.
The knee-breeches and the low shoes (Goubitz & Hacquebord 1984) made it essential to cover the legs with long knitted stockings. There are particularly fine ones with designs (Fig. 1b) but there are also coarse plain examples. It is known that the coarse stockings were put on over the fine ones, not only in order to preserve the finer ones, but also as additional protection against the cold.
The felt hats with their broad rims which could be up to 14 cm wide, were probably not very useful. The exposed position of the flat promen-

tory on which Smeerenburg is situated will have been the reason why so many hats - after they had been blown off into the blubber - were cut up to make inlay-soles.
The whalers undoubtedly wore knitted caps, but as yet only one fragment of knitting from the settlement can be identified as belonging to one of them.
In addition to the garments there are also five mittens. They are very simple to make: just take a rectangular piece of cloth, fold it and stitch it along two sides. The thumb is sewn into a nick cut in the fold. These mittens were patched very frequently before finally being thrown away.
But not all labourer's clothing was simply discarded. The results of the excavations showed that men were sometimes buried in their everyday working clothes!

## Seventeenth and eighteenth century clothing from Zeeuwse Uitkijk

In 1980 there was also an excavation in the cemetery Zeeuwse Uitkijk. Fifty seventeenth and eighteenth century graves were opened for skeletal analysis.
To everyone's surprise, many graves contained clothed bodies. In total, there were 31 knitted caps, one leather cap trimmed with fur, 6 jackets, 3 breeches, 5 pairs of stockings and a beautiful embroidered piece of cloth. No shoes were found.
All the garments were woollens, sometimes with silken sewing-thread. The absence of clothing from the other graves does not mean that these men were buried naked. At this period it was more usual to dress a corpse in a burial shirt of linen. But here the linen has not survived so the excavators were sometimes confronted by the strange sight of a skeleton wearing only a knitted cap.
After cleaning the caps preliminary examination revealed that at least 5 types were present (and not 3 as in IJzereef 1983). Sometimes it is just a single cap with a turned up rim, but there are also double caps: an outer and an inner cap forming one piece or a fine cap covering a coarse inner cap. Further variation appears in the rims which may or may not have ear-flaps. The colours are beautifully preserved.
Some of the knitting yarns were tie-dyed (Fig.3). If the dyer did his job well, the knitter - either a man or a woman - could knit special effects such as blocks (Fig. 3b). But for coloured designs he could also use yarns of different colours (Fig. 3b).
Only two of the six woollen jackets are still in good condition. Three of the jackets are blue and one is brown, all are woven in twill and are cut to the same pattern. Even the best preserved jacket of this group is very patched (Fig. 4). At least 12 patches are visible on this jacket, which was found in grave 579. The jacket is lined with a woollen fabric woven in tabby.
The dead man also wore a knitted cap and a pair of stockings. The missing breeches were probably made of linen. These linen breeches are still worn in the summer by the fishermen on the Isle of Marken in the Netherlands.

There were only two persons buried in a complete set of woollen clothes. The man in grave 550 was about 65 years when he died. He wore a fine knitted cap with stripes, covering a coarse cap which had not the same shape, so the top of the cap drooped down like a night cap.
His woollen jacket, in satin weave with green and yellow stripes, was in very poor condition. This kind of striped jacket is also familiar from

Fig. 3a

Fig. 3b

Fig. 3 Woollen knitted caps from Zeeuwse Uitkijk (dating 17th/18th century); a. coarse cap made of one multicoloured (white, red and blue) yarn; b. fine cap with tie-dyed yarns for the blocks, and stripes made of different yarns.

Fig. 4. Front of a blue jacket in 2/2 twill (Zeeuwse Uitkijk, grave 579; dating c. 1700)

costume collections, and it must date to the middle of the eighteenth century.
On the other hand, his narrow breeches were, excellently preserved. The man wore two pairs of stockings which were fastened on above the knee by woven garters.
Another eighteenth century woollen jacket in damask weave, now yellow coloured with green stripes in which flower motives are woven, was found together with breeches and a fine woollen cap, in grave 417.
The dating of the two striped jackets is less of a problem than the dating of the blue and brown jackets. There are parallels for these garments in the folk costume on the island of Marken. Some of the old jackets from this island which are now in the Open Air Museum in Arnhem closely resemble them, but unfortunately their exact date is unknown. A preliminary study of the buttons from the excavated jackets suggest a date around 1700.
This brings us to the dating of the caps, which at this moment is impossible. Only coarse caps were found with the blue jackets from about 1700 A.D., but the combination of a fine striped cap over a coarse one which was recovered in an eighteenth century grave, only indicates that coarse caps were still being knitted in the eighteenth century.
So long as the dating remains uncertain nothing can be said about the origin of the caps. There are a few early nineteenth century parallels in Denmark for the cap with tie-and-dye designs (pers. communication mrs. T. Willigenburg-Søndergaard, Copenhagen). But caps were knitted everywhere in Britain (Turnau 1985), the Northern Isles of Scotland and on the West coast of Norway. Three knitted hats originally belonging to tsar Peter I are supposed to have been knitted in the Netherlands (Turnau 1973).
The dress of the whalers is in fact extremely similar to the garments worn at this time in the whole of NW Europe. Under the influence of the Spanish fashion men in the first half of the seventeenth century wore breeches, jackets, broad rimmed felt hats, long stocking and low shoes. All these are familiar from the Dutch paintings of ice-skating scenes (Van Straaten 1977). They also correspond exactly to the finds from Smeerenburg which were described by the first part of this article.
This suggests that when they left Holland the whalers were dressed in their winter clothing. They kept these garments on during their entire stay on or near Spitsbergen. No specific 'whalers costume', specially modified for either the cold climate or the dirty conditions of blubber preparation was found. When it became too cold they simply put on an extra set of clothing.
Paintings from the later seventeenth century show that fishermen and whalers continued to wear these practical garments. This fits in with the simple blue and brown jackets excavated in the cemetery. It would seem that the men wearing the striped jackets were a little better off since these were not typical of everyday clothing. Alternatively these jackets could have been bought second-hand.
Another question which remains unanswered is why some of the men were buried in their clothing. One would think that the surviving whalers could have used the clothing of their dead comrades. In one case, however (grave 550), the fully dressed man had a number of broken bones. Perhaps it was impossible to undress him before burial.

The presence of so many knitted caps - 31 in 50 graves - suggests that these caps were very personal belongings. Nobody would wish to wear the cap of his dead collegue.
After all these vague datings and uncertain origins of individual items of clothing, I wish to close this article with reference to a piece of textile from grave 416, which is certainly of Dutch origin and which must date to mid seventeenth century. It is a piece of embroidered cloth with applied designs in the form of stripes, a sun and small, swan-like birds. The embroidery consists of rows of dots and a vase with flowers. Other almost identical cloths are known from the Netherlands. They were probably made in the province of North-Holland. Eight of them - but of much better quality - have survived in museums and in private collections (Schipper-van Lottum 1979). The function of these embroideries was unknown but now, with this find from Spitsbergen, we know that they sometimes ended up as a shroud.

## Epilogue

The discovery of such a collection of workmen's clothing from the seventeenth and eighteenth century gives an excellent impression of the materials and techniques utilized. It is particularly striking that the majority of finds from Smeerenburg is comparable to late medieval textiles from western Europe. There is rather less correspondence to the seventeenth century textiles from urban sites in the Netherlands, where silk fabrics dominate and fine woollens also occur.
The presence of a woollen damask, a piece of tapestry and a double weave in Smeerenburg suggests not only a certain degree of luxury but also identify types of textiles which are lacking in the Dutch archaeological contexts.
The seventeenth and eighteenth century remains of clothing from the graves on Zeeuwse Uitkijk show that the dead men were not only laid to rest in linen shirts but that they were also buried in their everyday clothing.

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# TEXTILES FROM DANSKØYA

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## Place and time.

All Danskøya-textiles come from graves situated at lake Jensenvatnet on the northern coast of Danskøya facing the narrow sound of Danskegattet. The sound separates Danskøya from the neighbouring island Amsterdamøya, and the islets are positioned between 79 and 80° north - just off the northwesternmost point of Spitsbergen. Spitsbergen is the main island in the Svalbard archipelago (Norway). In the 17th century Dutch and Danish whalers used Danskeøya and Amsterdamøya as abodes and the graves at Jensenvatnet date back to that time. The excavations on Danskøya took place during the summer of 1984 and were carried out by a joint Danish-Norwegian expedition headed by curator Svend E. Albrethsen of the Danish National Museum, Copenhagen. The expedition itself came off as a result of a teamwork including the Curator for Svalbard and Jan Mayen, the Museum of Tromsø, Norway, and the Danish Maritime Museum at Elsinore, Denmark.

## Historical backgrounds.

The taking of whale and walrus along the shores of Spitsbergen was initiated in 1608 by England and Holland; 2 mighty trade nations of the time. Spitsbergen was then believed a part of Greenland and consequently the Danish Monarch, Christian IV automatically became involved, being king of Denmark and Norway, to which also the Faroe Islands, Iceland, and Greenland belonged. During the wholeperiod, the king tried to maintain his sovereignty over the area, though with varying success. One thing these efforts did trigger off, however; Danish-Norwegian whaling at Spitsbergen was initiated in the year 1617.

Until 1660 when most of the catch along the shores had been taken and the whalers were forced onto the high seas, the whaling took place from permanent bases ashore at which whaleries, maintenance facilities etc. had been built. Every such base had its own burial grounds placed in the immediate vicinity wherever conditions were favorable. These cemeteries have probably been used periodically even after the whaleries closed down, as the custom of committing the dead to the deep did not enjoy widespread acceptance at the time. Economic reasons had not yet overridden religious concerns, and one often went to considerable lengths in order to give the dead a proper grave. Preferably one sought out the old places destined for this purpose - otherwise the nearest shore would have to do. For this reason and because of the high-arctic

climate the graves at Spitsbergen offer a unique opportunity to meet the common man of the day.

That the Danish-Norwegian expedition chose to concentrate its efforts at the graves at Jensenvatnet of course has its explanations.

1) The results of a wool analysis done by Tove Hatting of the Zoological Museum of Copenhagen. The material for this analysis derived from small fragments of garments I had found in 1978 in some ravaged graves at Jensenvatnet. The analysis seemed to hint that the wool came from a Nordic breed of sheep. The result was interesting, as Denmark/Norway was not selfsufficient in wool and indeed had to import considerable quantities thereof, from, among others, England and Holland.

2) A few years ago the remnants of a whalery was found on a plateau west of Jensenvatnet. This hitherto unknown whalery, the appurtenance of which remains in darkness, lies close to the burial grounds and so there is little doubt that the graves belong there. Earlier guesses have allocated the graves either to Smeerenburg (Spækbyen or "Blubbertown") on Amsterdamøya or to the Harlingen whalery that was built at Virgohamna near the northeastern corner of Danskøya in 1636. Both these settlements, however, had their own and more readily accessible burial grounds.

3) If anything should be done, it was about time, as the area was severely threatened by the sea, and both the newly-found whalery and many of the graves were in fact disappearing. Much has already been lost.

Types of finds.

Of the 22 graves excavated at lake Jensenvatnet, 16 contained garments or other kinds of textile material. A first-sorting will divide the finds into roughly 3 groups: Woven textiles, knitwear and miscellaneous. This last group includes rope, felt, plume, buttons etc.

The woven textiles are from trousers, jackets, shirts, and pillow slips. In one case a coffin was decorated with an approx. 7cm wide strip of canvas along its entire length; hanging a few cm´s below the edge of the lid. The strip was tacked down with close-set, large-headed nails (approx. 11mm´s in diameter). There were small fragments of black tar or paint at the corner joinings - both on the wood and on the fabric. This, including the presence of metal that has a preserving effect on vegetable material, is probably the reason why the textiles were so well preserved. Other vegetable textiles, e.g. from shirts are very fragmentary, but nevertheless clearly reveal that people had a fondness for small-chequered and striped shirts.

By far the greater part of the textiles found are wool as they resist the high-arctic climate much better than vegetable material - of which most was flax.

Almost all the textiles are plain-woven or twill-woven. This also goes for the various ribbons of which most are garters. There are, however,

small satin-woven fragments and a beautiful little checkwoven silken ribbon. Today the textiles appear in various shades of brown, but even to the naked eye it is often very easy to see traces of indigo and red.

The knitwear comprise stockings, caps and a solitary knitted hat plus various fragments - beyond doubt deriving from the same kind of commodity. Several stockings are knitted with a rifled garter edge at the top, a fake seam down the back of the leg, and an arrow-pattern at the ankles. The fake seam and the arrow-pattern have been made using purl stitches on a plainly-knitted base. 2 pairs of stockings have no garter edge - apparently the leg has just been folded down a couple of times - and also they had no pattern at the ankles. One pair, however, did have the fake seam. This pair, in fact nothing but a large fragment, distinguishes itself in having been used inside out - that this is no mistake can be seen from the fact that the fastening-off has been made on the plainknitted side of the toe. All stockings are circular-knitted and handmade. The heel is knitted right down and then gathered under the foot; then the circular knitting has been resumed, allowing for decreasing for the toes.

The knitted caps can be divided into 3 sub-groups:

1) The ear-flap model. The cap is hand-knitted from the top down, and the increasings have been evenly placed. It is circular knitted in the plain mode with the turn-up done in purl, thus showing its plain side when turned up. The ear-flap effect is caused by increasings in the turn-up at the ears - furthermore these are placed so they form a decorative line.

2) A double-knitted cap consisting of 2 pieces sewn together on both sides and at the top. The caps have probably been made on a flat-knitting machine. On these 1st-generation and very simple machines that were used in the beginning of the 17th century, it was neither possible to increase nor to decrease the item concerned - only shaping it along its edges was possible. The pieces are striped on the parts of the cloth that constitute the outside part of the cap, and by beginning the stripes approx. 8cm below the median one automatically gets stripes at the turn-up.

3) A double-knitted cap consisting of a machine-knitted outer cap and a hand-knitted inner cap. The outer cap, that is similar to the outer cap of the above-mentioned model, is both striped and sporting a "cloud-pattern", deriving from a partial binding of the yarn during dyeing.

Pattern stripes are found not only on the machine-made types, but often e.g. on the turn-up of the ear-flap model. Of the specimens of this type found at Jensenvatnet, one, however, was embroidered.

Also the knitted hat has been made from the top down and the brim is double knitted. Along the outer edge of the brim, the hat has been decorated with a twill-woven woollen ribbon. When new, this hat has been hardly distinguishable from a felt hat, as it appears to have been both fulled and raised, making the structure of the knitting almost invisible.

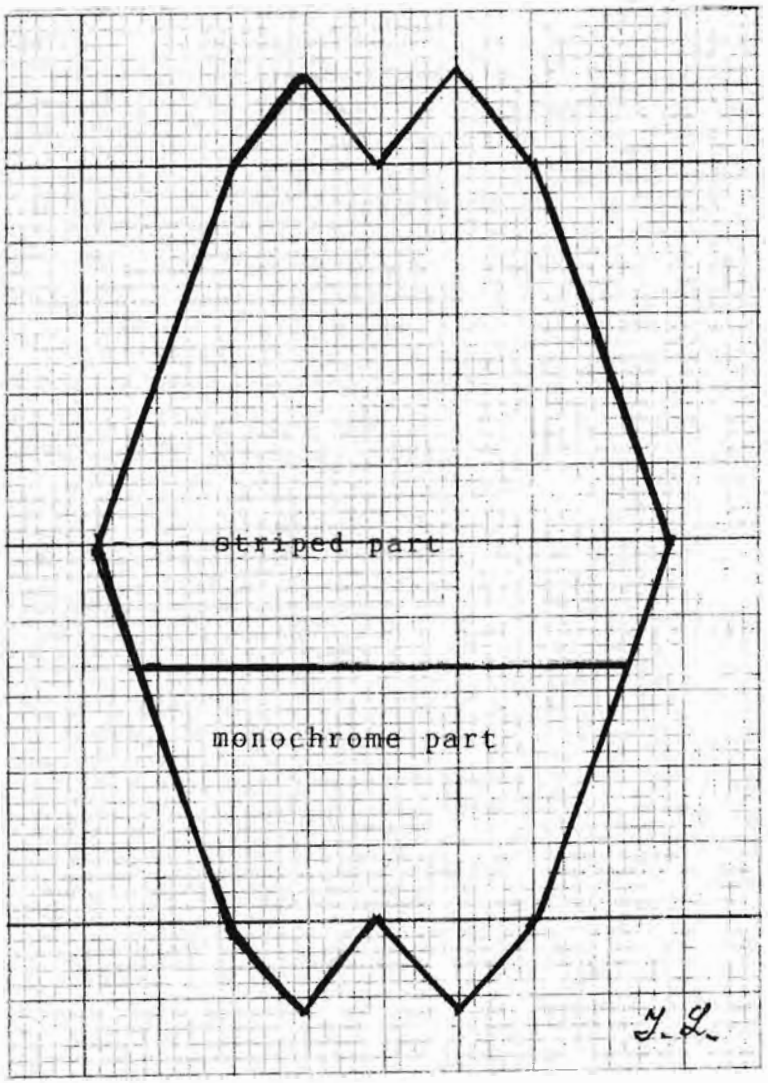
Double-knitted cap. Height approx. 31cm.
Diameter approx. 38cm.
Photo: Niels Erik Jehrbo.

| Number found | Stitches x needles pr. 5cm | Thread | Material | Colour | Finish |
|---|---|---|---|---|---|
| 1 | 15 S x 24 N | 1-threaded Z-spun | wool | light & dark green and/or blue, plus 2 unidentifiable colours | slightly fulled |

# DOUBLE-KNITTED CAP

Outline of the knitted pieces.

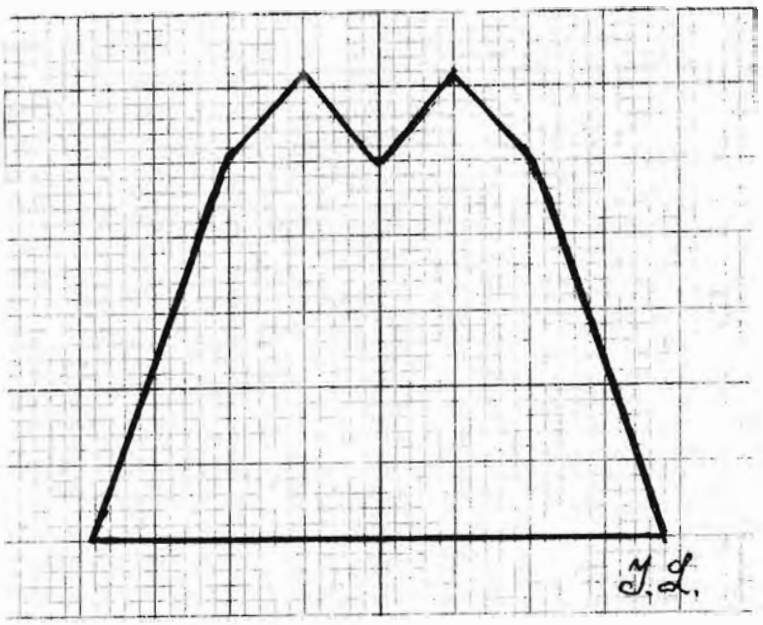
1 square equals 1 cm.




Folding line

The pieces are folded and the triangles at the top are sewn together for rounding the top.

The cap is made of 2 such pieces sewn together at the sides.



Textile field-work.

Working with textiles at an excavation taking place under such extreme conditions as the high-arctic climate offers, naturally exposes you to a host of very special problems. Ideal demands, for one thing, is something you learn to dispense with, as the brisk reality confronts you. Despite ardent efforts to the contrary, the dream of having our own expeditionary ship with cooling facilities for the finds and adequate working facilities for the members of the expedition, proved economically unrealistic. As no people live permanently at these latitudes, no supply ships call there, by which we might have shipped a cold-storage cargo home. Though you plan everything in advance to the best of your knowledge and confers with the experts at the preservation institutes, and though you make use of almost every piece of available arctic experience, situations are bound to turn up where you will have to trust your own judgement.

One problem people working with textiles face, is the fact that the work necessarily is dependent upon that of the archeologists - making you the last one in the group to finish. In the openening phases this does not mean much; towards the end you can only hope that they will not find too many things of interest - which, of course, they'll do - throwing you hopelessly behind schedule. This poses certain problems concerning packing of the finds. All textiles will be soaking wet because of melting snow, and the transport from Danskøya to Denmark may very well last several months. As the main part of the finds are made of wool and as wool is strongest in dry condition, I tried to let them dry in the air (handdrying would have damaged them needlessly). But time is short and when sitting on a desert island you will have finished your doings when the ship appears. There just isn't any next departure. This means that some of the items had to be packed when still wet - fortunately only a few, as the unpacking in Denmark showed. Though everyting had been sprayed with a 1% Rodalon-solution to deter mould growth, all wet textiles were in a very bad condition. All others looked as they did when packed.

Another problem you can come across is that of finding adequate working light - this might sound weird when you are working in the land of the midnight sun. But the weather will not always permit open-air work - the slightest winds will blow the smaller fragments away and rain is not too nice to them either. In other words you will have to withdraw to your tent from time to time. At the excavation sites we had 2 work tents, one splendid, modern tunnel-tent and a big old tent of a kind used by geologists in Greenland. The last was big enough to accomodate all members of the expedition during meals and house a number of big crates containing tools and appliances for the daily work. E.g. a number of oil-hardened masonite-plates, lots of cheesecloth, adhesive tape and rubber foam. When removed from the graves, the textiles were placed on a frame with tightly-streched mosquito-netting and then carefully dabbed with a sable brush so all loose dirt would come off. Hereby they also got air from both sides. Having then reached a reasonable degree of dryness, they were sprayed with Rodalon and placed on a conveniently-sized cheesecloth-covered masonite plate. Finally the whole thing was covered with yet another layer of cheesecloth to keep everything in place, and then packed down in crates with rubber foam in between. The caps were placed on heads made of rubber foam and cheesecloth and then

put into the position in which they had been found.

A greater part of this work had to be done in a tent, and this is where the problem of adequate light turns up. The tunnel-tent intended for the textile-work had a yellow inner-tent and a green fly sheet. So even with round-the-clock daylight, the tent was definitely not suited to textile-scrutinizing. The anatomy of that same tent created yet another problem: strenuous working positions. In a tunnel-tent you are forced to stay on your knees, and this in fact is a hopeless position that quickly wears you out.

Luckily we had the geologists´ tent. That was made of white canvas and gave a fine light. It was also big enough to accomodate a working table, but as the tent was originally intended as a messroom, this disposition was not entirely popular. Very few people enjoy having lunch at at mortuary, so I had to move everything to the other tent before meals. This sounds enervating, but was in fact a welcome break, for no matter how warmly you dress, you get cold when not moving. And so in fact these little trips between the tents turned out to be excellent excercise.

The first time you are given a head complete with remains of skin, beard, eyebrows, hair and hat - and even if it is not on a silver charger but just on a simple shovel - and your job then is to do the man up so he can have his first picture taken - then you are feeling like a mixture of a make-up-woman at a theatre and biblical Salome with the severed head of John the Baptist. Later on you´ll catch yourself chatting to these heads while removing the most obtrusive dirt with a little brush. Heads retain their individuality and people with whom you have been "working" take on separate and unique identities. - Then it is in fact quite more difficult with legs, but even legs can be beautiful!

When working with textiles it is a great advantage to have been present at the excavations. For one it is the special relations you develop to your material; secondly it saves you a lot of time later on when you get home and resume work because of the first-hand information it provides you. That saves you from asking questions and leaves you free to concentrate on the aspects and questions that often struck you already during the excavations or the packing of the material.

A head on a charger.... Photo: Ingrid Lütken

Legs with stockings and garters.

Photo: Ingrid Lütken

Analysis results.

Step one is purely technical textile analyses in which you investigate how the textile is made, how closely it is woven or knitted, how the yarn has been spun, of which material it is made, etc. - and you draw patterns of the garments in question if this is possible. Then you take samples for further analysis - for instance of the wool and the colour. The buttons require expertise as well and that in so diversified areas as wood, metal or bone.

As the collected analyses total more than a hundred pages, I am forced to restrict myself here to giving only a few examples representing various aspects of the material.

Almost all the woven textiles are, as mentioned, plain- or twillweaved. Among the twills one piece is a 2/1 twill, the rest are 2/2 twills except for the ribbon from the knitted hat which is point-twill-weaved and if we concentrate on those made of wool, we see a clear tendency to employ an evenly spun thread in both warp and weft. The plain-weaved textiles include 13 different types; by types I mean that the textiles show so great variety, e.g. in the density of the texture, that they cannot possibly have come from the same original piece of cloth. Nine of these pieces are woven of an even yarn in both warp and weft. Seven are S x S spun; two are Z x Z spun yarns. The same tendency is found among the twill-weaved textiles (9 types); two of which are woven of S x Z spun yarns, while the rest are predominantly Z x Z spun.

The knitted caps and stockings are identical to the types hitherto known from the heyday of whaling at Spitsbergen. In the large Dutch collection of caps from Zeuwse Uitkijk on Ytre Norskøya you will find ample evidence of the three types of caps mentioned here: The ear-flap model, the machine-knitted cap, and the partly machine-, partly handmade model.

The finds from Zeuwse Uitkijk are probably from a slightly later period than those from Smeerenburg and Jensenvatnet (this is clearly seen on the trousers found here). The combination model was used in Denmark even as late as the beginning of the 19th century - a fairly long time by any standard for a garment to be in vogue.

Also the special ways the stockings are made have been preserved throughout the following ages; this goes both for the special heel-cut, the ankle pattern and the fake seam.

(Off the record, does anybody know anything about the headgear of present-day Scottish fishermen? I caught a glimpse of some of their kind on TV recently, and their caps struck me as having a striking resemblance to the old ear-flap model. Could it be that it is still in use?)

Among the knitwear the knitted hat enjoys a special status. It is, to my knowledge, the only one of its kind found in Spitsbergen, and you are forgiven should you find this odd - I myself do, as this is really the epitome of a hat; a crown ringed by a fairly stiff brim - the kind of hat you would expect to find anywhere. The model is known from Danish medieval frescos and from the art of Pieter Brueghel, but neither sources offer any testament as to how the hat is made. What we do know

is, partly from excavations in the City of Copenhagen, that the knitted hat has been worn at any rate since early 17th century. However, the main part of the hats found here are high-crowned like one of those czar Peter the Great in 1698 brought back to Russia from the Netherlands, where it enjoyed widespread popularity among the common people. The Danskøya specimen is low-crowned and is as such more in line with the depictions we know, though it is knitted in the same way as its high-crowned relatives. If we are dealing with whims of fashion or if both types have co-existed but have had different purposes - this I do not know. Regarding the knitting-mode and type of wool, the textile scientist Lise Warburg who works with the Copenhagen hats, has told me there is a large resemblance between these and the hat from Danskøya.

Man with a knitted cap. Photo: Ingrid Lütken

The same hat after preservation.

Photo:
Niels Erik Jehrbo

Samples from some of the Danskøya-textiles were analysed by Penelope Walton in York and the following results are the fruit of her work.

The colours of the Danskøya-textiles were relatively well preserved, whereas the wool was in a considerable state of decay. Nevertheless it was possible to analyse twelve samples of wool and four different types were established: longwool, shortwool, hairy medium and hairy, the latter two being in greatest abundance.

Thus five of the samples, all knitwear, were made of hairy or hairy medium wool. Several of them had the natural pigmentation that characterizes primitive breeds of sheep e.g. the Scandinavian Shorttail. As far as is known, this breed was common in the whole of Scandinavia until about 1840. Nowadays the sheep roam the hills of Iceland, Greenland and the Faroe Islands. The Norwegian "spelsau" and the Swedish Gotland-sheep and others are descendants of the breed as well. The wool-types of the breed show a great variety; most common is the hairy medium and the hairy, but also a primitive longwool type exists.

Penelope Walton, commenting on the wool employed for Danskøya-knitwear, states its similarities to the hitherto known postmedieval Danish and Norwegian wool-types. The shortwool is hardly from Scandinavia, whereas there is a possibility that the longwool-textiles come from within the region. As a treat she tells us about analyses of wool recovered from the Swedish man-of-war "Wasa" that sank on its maiden voyage, not one nautical mile from its building berth. Of six types of wool recovered from the ship, four are identical to the ones found on Danskøya.

The colours on the Danskøya-textiles range from rose over red, brown, purple, blue and green to black. Especially the rose, the green and the red colours are interesting, as they differ from the colours normally found on 17th century textiles. The red colour is madder-red, but the pigment is not Rubia Tinctorum (Dyers madder) as was commonly used at the time, but Galium boreale or odoratum. The use of these vegetable dyes for red-dyeing have been known in Denmark since the iron age and are still used among dyers here.

The rose and the green are found on a small garter-fragment that has a dull-green central stripe on a pinkish fawn background. The mode of dyeing applied here is rather special. The ribbon has been woven in white wool with a yellow stripe and then dyed with orchil; a lichen. This way of making green is totally unique, though orchil has been known since medieval times. It was a commodity then purchased in the Levant, but in the 14th century also Norway had an export of its own kind of orchil, known there by the name of Lacmus. In Scotland they had their "cork" which was used for pink dyes.

The brown colour was found on the knitted hat only; possibly mixed with yellow. It seems strange that dyeing has been spent on a cheap hat like this that is made of hairy wool, which gives it its stiffness and makes it suitable for fulling. This type of wool is easy to find in a natural brown pigmentation, so the expense of dyeing could in fact relatively easily have been avoided.

The subject of the textiles would be unfinished without mentioning the buttons. The metal ones are made of brass, though earlier finds from the

same burial grounds include some very nice buttons made of pewter. Besides the brass buttons some brass needles were found. These items are made of a fairly soft alloy with a relatively low zinc/copper ratio. (Zinc averages 23-24%).

The wood and the bone buttons have all been turned and several of them have traces of polish. The bone buttons have been made from relatively large pieces of bone. Even the largest of the buttons show no signs of a surface structure.

The wood buttons are made of various kinds of wood. Because of decay not all would be identified, but all are definitely hard-wood. One is oaken and a whole row, all from the same jacket, are turned of sea buckthorn (Hippophaë rhamnoids) - a bush growing by shores. The wood employed for these buttons has been taken relatively far away from the medulla, and the buttons have been turned so that the flat side is rectangular to the longitudinal direction of the wood. In a little protrusion on the back of the buttons there is a drilled hole for the thread. This has been made rectangularly to the medulla ray, which means that the hole follows a tangent to the annual rings. By doing so the risk of splitting the button during drilling is rendered very small. It is surely the work of a professional craftsman.

A certain kind of wood button was found in relatively large numbers. One side is curved to a greater or lesser degree; the other is flat and chamfered a few mm´s at the edge and it has a centered hole. On the curved side I often found traces of polish, but this never occured on the flat side. This monstrosity of a button was in fact a bit of a pain, for how was it fastened? One of the graves gave us the answer. A fairly thick brass wire had been bent into the shape of an eyelet, and the ends of the wire had then been put through the hole and twisted in opposite directions on the flat side of the button, which was then covered by a thin sheet of metal. In this case the remains of the thin cover-plate (with traces of a floral decoration) seems to be copper, but this could be due to the considerable decay. (Almost 40% chloride). As zinc decays faster than copper, there is a possibility that the plate has once been brass. The eyelets are brass, and a harder alloy than we had normally come to expect. The perentage of zinc here was 32.

When categorizing the finds, the buttons were classified under "miscellaneous". This group that comprises not only garments but takes parts of the internal environment of the coffin into consideration as well, turned out to be a rich source of information.

Here was a hazelnut with 2 triangular holes at the pointed end. On one side of the shrunken kernel there are tiny remnants of textile material, probably the remains of a now decayed string used for wearing the nut around the neck. Both the kernel and textile appear metallic, which in fact turned out to be iron oxide, probably deposited there by water percolation. On the surface of the kernel there was a tiny bit of a threaded, asbestoslike mineral $8CaO - 27Al_2O_3 - 65SiO_2$; does such a mineral exist on Danskøya?

The use of the nut-amulets was well-known in Denmark in the 17th century (Cf. Simon Paulli: "Flora Danica", vol.1 p.5 (Copenhagen 1648)). The custom is mentioned herein as a protection against the plague. In order

to be properly effective, though, the nut should contain a drop of mercury, but at the time the metal was rather valuable and we found no trace of it in the nut. Maybe somebody has cheated or maybe the mercury has simply been left out of this indeed "poor man´s nut".

The two pillows found are filled with small feathers and down from ducks. In "Daily Life in 16th Century Scandinavia", Troels-Lund states that the use of poultry or wildfowl plume was at best avoided, as it could destroy your sleep or even rob you of a peaceful death. The custom was originally European, but survived in Scandinavia long after it had disappeared elsewhere. The analyses of these seemingly odd bits and pieces thus seemed to tell us about the superstition of the time.

Another part of the "coffin environment" was the moss. One man had his legs wrapped in something that looked like the remnant of a blanket. In another coffin I found a lining of the same material and later I found similar bits that came from other coffins. Except from the man with "the blanket", the rest of the material seemed to come from the inner sides of the coffins and thus be part of a lining. In this case, as with the wood, bone, metal, plume, etc, I would have been lost without the helpfulness and understanding I was met with by engineers, botanists, zoologists, etc. The problem with this coarse, vegetable material, the species of which I could not determine, was solved by various experts.

A tiny part of the moss found belonged to a local species, but the bulk of the vegetable material turned out to be sphagnum (Sph. cuspidatum Hoffman and sph. magellanicum Brid.). The latter is red when fresh. These peat mosses belong to a boreal-sub-arctic species that does not grow in an arctic climate. Consequently, they must have been brought there from home, and it could be a hint to their place of origin that the mosses belong to a species formerly very common in Denmark, especially in Jutland and Northern Sealand.

The use of sphagnum as dressing material for wounds and scaldings has been known by many people for hundreds of years. This goes for its insulating effects too - it really is a most remarkable material - it neither rots, moulds, nor attracts vermin. This makes it perfect for the packing of food and fragile goods, and furthermore it has this antiseptic effect because of the sphagnol it contains. Our man with the wrapped-up legs may very well have been the victim of a scalding. Hardly an unlikely accident at a whalery.

A man with sphagnum wrapped around his legs.

Photo: Ingrid Lütken

To insulate a dead man´s coffin with sphagnum shipped several thousand miles to the end of the world does in fact seem a bit odd at first, but great pains have been taken to secure the dead a proper interment. The dead have all been placed on a bed of sawdust and/or woodshavings. The bedhead has then been built to form a pillow, if the dead himself was not in possession of a such. Then the moss or sphagnum was placed around him so as to keep him warm and comfortable - if local moss has been used it must have looked beautiful, but even the dried peat moss could have had a decoration effect. It depends upon whether dug-up sphagnum or fresh-picked and dried ditto has been used. If the last has been done, it will have appeared yellowish-white and pale green - sporting a few spots of brownish-red and old rose from the Sph. magellanicum Brid.

17th century man cared a great deal for their dead. Of course we know most about the kings and the nobility for they were buried within the church walls (in coffins filled with aromatic flowers - probably not only for their own sake). However, we do know that the customs of the higher classes had a downtrickling effect, and that people often went out of their way to care properly for their dead. In Scandinavia, at any rate, that was the case.

In the diaries of Jens Bircherod we find the following from December 1659: "On the 13th day of December the body of my grandfather´s poor wife was placed in her coffin in his house - with all proper meticulousness. The Dutch officers, whose nation have no custom of ceremonies concerning their dead, from time to time appeared in the mortuary chamber and took a great pleasure in viewing the "apparatum funebrem" that in noble houses of our nation it is good manners to apply".

At this time several decrees had already been issued, requesting the public to restrict the ridiculously overgrown arrangements concerning death and burial.

Preliminary conclusion.

The information provided us by excavations of the 17th century whaleries at the shores of Spitsbergen tells us about the economy, the trade, and the common man of the era. The initiators of an economic enterprise like this, however, will not be found in these forgotten, godforsaken graves of the wilderness. They lie interred under dry church floors thousands of miles away, and their story is well enough documented. However, trade and economy played a paramount part in the settlement of these islands and those factors have to be taken into account when attempting to interpret and understand the finds.

One of the reasons for excavations at lake Jensenvatnet on Danskøya was, as mentioned, that wool-analyses of jacket-fragments from the place seemed to indicate a nordic connection. Penelope Walton´s wool- and colour-analyses point in the same direction and she ends her report tentatively by saying: "Nevertheless, the Svalbard knitting wools (stockings and hat) and more especially the red dye (trousers and jackets) suggest that an origin within Scandinavia is more than likely." The name Svalbard is here applied to the Danskøya-textiles.

The 18th century Jutlandic production of stockings is well known, but it seems to have started considerably earlier. In J. Kinch´s: "The History and Description of the Town of Ribe", p. 821, you find this trade documented as early as 1630. Handknitted stockings have probably been an everyday commodity, but it is funny that the hat seems to be of Scandinavian origin. The model is almost international, but as it is both fast, easy, and cheap to make, the idea is probably not so far fetched.

The man who owned the hat also wore a wig made of lambskin. He did not wear it to be fashionable, though, for that kind of whimsy did not become modern until much later. He wore it because he was half-bald.

If you compare the knitted caps to those found on Spitsbergen in general, you´ll find a striking resemblance. They have probably been an ordinary commodity; manufactured and distributed from one or more "knitting-centres". A few differences in the way the increasings have been made suggest more than one place of origin, but the pattern as such is uniform.

The machine-made types cannot have been made in Scandinavia as early as the first half of the 17th century. One of the handmade ear-flap caps looks Scandinavian-made, but though it has the "right" form, it is not a typical example as it is embroidered and without the usual stripe-pattern.

Well, this could be the odd "private model", but considering the model´s large area of distribution and the striking similarities of the caps found, my guess is that we are here dealing with a mass-produced item.

In the 17th century Denmark-Norway was roughly what you today would call a developing country. I.e. the country had large import - partly of raw material, but primarily of manufactured goods - while the export consisted solely of raw articles, primarily cattle. That is why you will always find e.g. British or Dutch produced goods at the whaleries, even though the people working there were Danish and Norwegian. There is in fact good reason to keep one´s eyes open, lest you should come across anything that stands out from the bulk of goods produced by the great trade nations of the era.

Of all the finds at Danskøya it is a part of the wool and the nature of the red dyes that most strongly suggest a Danish-Norwegian connection to the settlements here. Another minor detail that might point in that direction is the use of S x S or Z x Z spun yarns in most of the woven textiles. As far as I know, the Smeerenburg textiles, with which the Danskøya-textiles are immediately comparable, are made of S x Z or adversely spun yarns to a much larger degree. I don´t know if this is significant, I mere draw your attention to an obvious tendency.

Turning to the little relics of superstition - the hazel-nut and the duck´s feathers, we know they might very well be Scandinavian. We also know that the use of duck´s down for magical purposes was very common in the 16th century, but I can´t say whether the hazel-nut has been worn as an amulet in countries outside Scandinavia - where hazel has been attributed magical powers ever since time immemorial. To my knowledge, anyway, no other similar have been found in graves at Spitsbergen.

Leaving magic, more or less, and turning to the idea of lining the coffins with moss, we also find a custom not encountered anywhere else yet, and remembering the quotations of Jens Bircherod, we might get a hint as to where these people have come from. The coffin with the strip of tackled-down canvas that I describe in the paragraph concerning types of finds, also has its parallels in contemporary Danish culture. In 1624 Christian IV issued a royal decree concerning death and burial, in which it was clearly stated what was allowed and what was not. Even high ecclesiastics were allowed only a simple coffin, at the most "tinged with lamp-black". By filing a petition and paying the extra expense of 10 daler, they were allowed to "overcome this their poor-man´s coffin

with buckram". The coffin in question has not been "over-covered", but nevertheless it has been decorated, and once upon a time it has been black, too. Its insides have been lined with sphagnum. Could this be the last resting place of the chaplain?

Finding and trying to identify the Northerners among the many graves of the whaling-era, is like trying to find a needle in a haystack. Danish-Norwegian sailors were in great demand and often went into the service of other nations - similarly you´ll find foreign ships and sailors in Danish service. The Basque was everywhere, for in the beginning he was the only one to know the whale, and he earned a great profit off that knowledge, as all other nations with whaling ambitions had to hire Basque whaling teams. In spite of this tangled state-of-affairs I hold that so many bits and pieces from the graves at lake Jensenvatnet indicate a Scandinvian appurtenance, that it will be a relatively safe assumption to say that at least a major part of the people we find here were of Danish og Norwegian origin.

Material analyses.

The bone buttons were analysed by Lecturer Tove Hatting; the Zoological Museum of Copenhagen.

The wood buttons were analysed by Lecturer Peter Wagner, the Botanic Library, Copenhagen.

The metal buttons were analysed by Lecturer Poul Andersen at the Laboratory for Thermic Material Processing at the Technical University of Denmark.

The metal analyses were made by Prof. E.W. Langer using a Scanning Electron Microscope at the Laboratory for Metalanalysis at the Technical University of Denmark.

The plume-analysis was made by Lecturer Jan Dyck, the Zoological Museum of Copenhagen.

Various materials, especially vegetable, have been analysed by Lecturers Anne Marie Rørdam and Bente Lorentzen at the Pharmacognostic laboratory at the Danish College of Pharmacy.

Specific determination of leaf-moss was made by Lecturer Jette Lewinsky, Botanic Museum of Copenhagen.

Specific determination of peat moss was made by Lecturer Bodil Lange at the Institute for Systematical Botany.

Wool and colour analyses were made by Textile Consultant and Dye Analyst Penelope Walton, York, England.

Cleaning and preserving of the textiles were made by Curator Else Østergård, Dep. of Recent Finds, 2nd Preservation Institute, the Danish National Museum in Brede, Copenhagen.

Textile-tecnical analysis etc. made by Ingrid Lütken.

Translated from Danish by Mads Havemann.

Litterature.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