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Challenges and solutions

NORDLIGE VERDENER

Northern Worlds – Report from workshop 2 at the National Museum, 1 November 2011

Edited by Hans Christian Gulløv, Peter Andreas Toft and Caroline Polke Hansgaard

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Rødøy in Flatøysund, Alstahaug area,
Helgeland, South Nordland
Photo: Flemming Kaul

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Copenhagen 2012

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Close-up of a string of beads on an amaut, a woman's jacket, combining large worn 18th-century glass beads with unworn seed beads produced in the 19th century. Photo: Peter Andreas Toft.

Pinhoulland seen from the north west down towards Voe of Browland. Photo: D. Mahler.

Challenges and solutions – status of Northern Worlds

Hans Christian Gulløv
Koordinator

On 1 November 2011 the National Museum's cross-disciplinary research initiative 'Northern Worlds' held a workshop with a presentation and discussion of a number of projects which, under the heading 'Challenges and solutions', demonstrated the breadth of this initiative.

At present the initiative consists of 20 separate investigations and PhD projects as well as two associated research programmes, all of which are presented in the following pages of this publication. Some of the investigations have been concluded since the initiative was officially launched on 1 January 2010, but subsequently a few new ones have been added.

The theme of the workshop was 'Challenges and solutions', and it was meant to follow up on the workshop held earlier with the title 'Changes and challenges' (Gulløv et al. 2011). The idea behind this theme was to evaluate the various solution models that the individual projects had to make use of in order to tackle the challenges that had emerged since the formulation of the tasks set.

The theme was thus meant to challenge the individual researcher's choice of method and the theoretical content of the project, which was associated with one of the three overall research subjects that constitute the bearing idea of Northern Worlds: Climate changes and society – Farming on the edge – Networks in the North.

A cross-disciplinary initiative like Northern Worlds, built up on the basis of projects that came in from seven of the museum's ten research-conducting units, is thus not a project in itself. It is rather a concept that can concentrate and challenge thinking as long as one knows what 'the northern' actually is.

However, there seems to be no doubt about this in the following presentations of the projects involved; and yet there is a search for another approach to the concept than geography and climate, both of which are postulated to constitute and determine 'the northern'.

At the previous workshop such a new approach was presented by Professor Kirsten Hastrup of the Department of Anthropology, University of Copenhagen, with her analytical challenges to Northern Worlds. She introduced the concepts 'perspectivization', perceived in terms of similarities and differences, and 'scales', perceived in terms of relations and connections (Hastrup 2011).

The concept of 'the northern' can however also be perceived in terms of an archaeological point of view, as it is in the following by Professor Bjørnar Olsen, Department of Archaeology and Social

Anthropology, University of Tromsø, who as the invited guest speaker turned the focus on 'A sense of snow'. His lecture is featured here in full.

The main point of Bjørnar Olsen's presentation is to underscore the vital difference between 'weather' and 'climate', whose significance as concepts can only be clarified when we begin to form conceptions of mankind's use of the landscape, which in the northern hemisphere lies barren for large parts of the year. "The inclusion of winter and snow adds to our already rich portfolio of experiences and memories achieved through our ordinary summer fieldwork and increases the interpretative and heuristic potential of our discipline [...] Bringing winter and snow to this experiential record may prove decisive for how we activate this difference and make it traceable as manifest deposits in the texts and images we are producing [...] to activate our material experiences of being in the north, activate the tacit knowledge achieved through many encounters with northern places, with northern people and things and the skills they possess about being in the north". With his personal experiences as his point of departure Bjørnar Olsen succeeds in vitalizing the concept of Northern Worlds and shedding clarifying light on the cross-disciplinary research initiative.

As will be evident from this stocktaking of the projects presented, these have come a long way in the extensive work with the collected empirical data, and solutions to the issue of the projects can be outlined. Kirsten Hastrup and Bjørnar Olsen have made it clear to us that Northern Worlds as a concept can be analysed phenomenologically, that the discursive approach (Hastrup) and an intuitive approach (Olsen) to the concept of Northern Worlds are both necessary to our understanding, and that it is in the context of the interaction of human beings, landscapes and histories that we must see the new results of the research initiative.

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A sense of snow? Archaeology, weather and the conception of northernness

Bjørnar Olsen
University of Tromsø

When asked to give this keynote address I was on my summer vacation. I was in a surprisingly good mood (for me), and I immediately and carelessly accepted; the workshop seemed ages ahead anyway.

Autumn came, and in my initial preparations I slowly and with increasing clear-sightedness started to realize how extensive and varied the interdisciplinary Northern Worlds research programme of the Danish National Museum really was. My confidence was not boosted much by discovering that the theme chosen for the workshop was "challenges and solutions". How would it be possible to say something sensible that was relevant to the various projects gathered under such different and broad research headings as "Climatic changes", "Farming on the edge" and "Networks in the North"?

My dreams started to be haunted by images of a bearded, serious, head-shaking audience. In other words, I started – to stick with the vocabulary of my own theme – to get rather cold feet. In an attempt to cure my initial panic, I read the address Kirsten Hastrup had been invited to give to the previous workshop to see how she coped with the task (Hastrup 2011). Needless to say, the depth and quality of her approach, and her elegant inclusion of all the research areas, did nothing to help my feeling of frostbite.

Anyway, it spurred me to work on it and, as you can see, helped me with the always-tricky task of how to introduce a paper.

Among other things in her address, Hastrup examined the concept of 'northernness' – what constitutes the north or the northern and makes it analytically significant? She asserted that the north is not a substance, something that is easy to concretize, and suggested thinking of the northern "as something that affects society in a genuine way without determining it" (Hastrup 2011: 7, my translation). The northern, she says, is manifested in three ways: first, by its matter or "fabric" (Danish: *stof*) (especially the elements of land and water); secondly, by its dynamics and inner motion (seasonal changes, light and darkness), and thirdly, by what she refers to as its constitutive content or "fullness" (Danish: *fylde*), which is defined primarily as a cognitive, identifying conception of what northernness is to the native northerner, involving among other things the awareness of being 'outermost' and peripheral (Hastrup 2011: 7-9). While I have few problems with the first two of these characteristics, I am more hesitant – a point to which I will return – about one particular aspect of the last one.

Hastrup's take on the issue of northernness is analytically acute and thought-provoking; it is also, for better or worse, to some extent a view from a distance. With no illusion that I can escape the effective history of my academic *fylde*, I have chosen to be more concrete and personal, perhaps even outright banal in my comprehension of the northern. Sometimes such banality, or naivete, is worth a try, and may even suit the object of study better than our usual urge to intellectualize it. In my opinion research also involves the necessity – or at least the desirability – of a certain empathy and sympathy with what we are researching. This includes an ethical dimension, in the sense that we are concerned with what northern worlds, northern places, are in themselves, in their own frameworks of reality, involving far more than human concerns and constructs.

For me, northernness is mostly about substance and materiality; and one of the most defining elements of the north is the weather. Not in the abstract sense as climate, but experienced as wind, sunshine, rain, hail, sleet, and not least snow and frost. There is – and has been in the past – much talk about climate in archaeology, but little about weather. And it is to this particular way of concretizing the north that I want to draw your attention.

Being northern

For me northernness is also part of a personal involvement, not primarily because of my professional career as a northern archaeologist, but because I

was born and have lived most of my life far to the north. I thus take the liberty of starting off by sharing some personal thoughts, experiences and reflections on being northern. Apart from the narcissistic pleasures such reminiscences always provide at a certain age, I hope this has some significance for the topic discussed here.

I grew up in a small village on the coast of Finnmark in Arctic Norway. At that time around 100 people lived in the village, and our only regular connection with the outside world was by boat, a local coastal steamer which called at the village three times a week carrying small loads of everyday goods and a few passengers. There I had a fairly uncomplicated childhood with my parents, five older siblings, our cow, chickens and sheep (figure 1). It was in the far north, approximately at the same latitude as Point Barrow and Uummannaq (71°N), and about 400 km as the crow flies north east of Tromsø, where I work at the "northernmost university in the world". Given the location, there was of course plenty of severe weather – though I never thought of it as anything exceptional for us. Without access to national newspapers or TV, we were not reminded very frequently of our climatic otherness and how fantastically warm, bright and pleasant conditions were elsewhere. Bad weather as an attribute of our life-world

Figure 1. Childhood: Author, sheep and sister, winter 1963 (unknown photographer, probably author's mother).

was something that primarily emerged when we joined the media network and were thus 'filled' with a consciousness of being climatically peripheral.

What has this everyday northern experience given me as a scholar? To what extent is it different to be an archaeologist with this background – where the northern is not a place you visit temporarily to do fieldwork, a subject of your thesis or your field of research, but something inextricably bound up with your own personal memories and identity? Needless to say, there is no simple, single answer to this question. However, it may have given me a rather different understanding of things: an empathy clearly not ex-

clusive to those with a similar personal biography, or peculiar to northerners, but perhaps more involuntary and immediate for us? Speaking for myself, this empathy is often manifested as a kind of gut feeling, an intuitive reaction provoked, for example, by a text or a lecture which, without much reflection, describes the northern landscape as sparse, unproductive, barren, peripheral, marginal and inhospitable. Or when a visitor, tourist or scholar, encountering a northern rural area, asks with astonishment what people live on here (though, to be fair, I have sometimes had similar thoughts when visiting Copenhagen, Brussels and other metropolises). And it always triggers rather naïve rhetorical counter-questions. Unproductive and inhospitable for whom? Marginal and peripheral in relation to what?

Although of course we don't know this for sure, I still find it extremely unlikely that those who hunted and camped at Qeqertasusuk, Tupersuai or Niertussannguaq some 4000 years ago were full of a feeling of being marginal and peripheral; of being situated outermost in the networks. Even among my fellow villagers just 50 years ago I don't think this feeling of peripherality very often filled their minds. At all events, such assumptions should be used with caution, and we should increasingly question how far their apparent naturalness is evoked by a certain localized gaze; that is, prompted and normalized by the habitat, roots and location of the scholar? In other words, by the inherent "fullness" of research itself, also as historically and geographically constituted. And to remain in this critical mode for one more sentence, we should perhaps also further scrutinize how research itself, including fieldwork, has contributed to the creation or maintenance of 'centres' and 'peripheries', for example by normalizing the directions and routes that scholars, students and data take – such as the obviousness directionality of 'going out' and 'bringing home' (cf. Olsen 1991).

However, amidst all this trivial critical reflection, let us not lose sight of weather. Visiting my childhood home last summer, I looked as usual through collections of old photographs, most of them from the 1960s and 1970s. Suddenly it struck me that there was something odd about these photos, a difference – even apart from their basic Kodak aesthetic and our captured black-and-white past. And after a while I realized how many of them depicted winter and snow; my parents, siblings, me, friends, and relatives skiing, playing, standing, sitting, posing in snow (see figure 1). Of course, it shouldn't come as any surprise given the fact that the snow came in October and stayed until early June. Thus in sta-

tistical terms winter images should predominate – my childhood was mostly winter. However, these basic photos represented and mediated something more, a northernness different from the one I myself had become accustomed to and cultivated in my academic life, and which made me reflect on the images we are creating of the north.

The archaeological summer

How do we as archaeologists represent northern landscapes and places in our texts and figures? What do our photos depict? Snow-covered land, frozen lakes and rivers which for most of the year were the physical reality for people and animals? Certainly such images exist – at least I recall Morten Meldgaard's photo of a wintry Qeqertasussuk in the early book about the site (Grønnow and Meldgaard 1991: 139). Unfortunately, this is close to the exception that proves the rule. The norm is summer. Only and always summer. In the magnificent, now already-classic book about Greenland's prehistory (Gulløv 2004), we are presented with a large number of photos of stunning Greenlandic sites and landscapes, but winter is completely absent. Not one image of winter can be spotted. Besides, most or all of them seem to be taken at midsummer and in conspicuously calm and pleasant weather.

Unfortunately, I cannot myself boast of any different practice worth imitating. My own background – born in wind and snow, so to speak – has helped little. For me and the others, the result is more or less the same; the images in our books and papers depict summer, sunshine and calm sea. The perpetual summer of archaeology (figure 2). The reasons may seem obvious and legitimate. For workers in the field, only the short summer season without snow will do – at least for excavation. This climatic imperative actually

Figure 2.
The perpetual summer of archaeology. Remains of four-thousand-year-old winter house in Bjørnelva, Finnmark, northern Norway (photo: Bjørnar Olsen).

leads to an ironic paradox: While excavations under more southern skies may be carried out throughout all or most of the year, probably producing a relatively balanced (if not unbiased) seasonal image of the area in question, the archaeological photographic record from the area with most winter ends up depicting nothing but summer! We may talk about and analyse winter settlements in clever and original ways. However, what we show from these winter sites is summer, always summer (cf. Hedman and Olsen 2009).

Whatever the reason, the actual imagery produced has effects. It sediments and gathers in museum and university archives and in personal folders; photos are increasingly circulated in publications and all kinds of visual media. They take on their own reality and cause what Roland Barthes (1986) called a "reality effect", affecting the public, our colleagues, and in the last analysis our own conception of the north. This record perpetuates a peculiar – and perhaps southern – aesthetic, which may also be seen as a mode of appropriation and domestication, making northern places more inviting, picturesque, and even sublime. Moreover, this coherently biased imagery also has the effect of turning winter and snow into an anomaly, or at least rendering it marginal and insignificant, something not worth attention or disclosure.

It is thus an important challenge not just to get a sense of snow, but also to reflect more on the role that weather plays in our conception of the north. In what remains of this paper, I will first have something to say about weather more generally and how it affects our understanding of northern places and landscapes, and then I will proceed to talk more concretely about snow.

Weather and landscapes

In my introduction I briefly hinted at the difference between weather and climate, where the latter may be seen as relating to basic long-term structural conditions, while weather is the actual effect of these conditions. Climate is often described as the average weather pattern shown by studies and measurements of wind, temperature and precipitation in an area over many years, while weather is what we actually encounter of these elements on a daily, 'lived' basis. As stated by Ingold and Kurtilla, "climate is recorded; weather is experienced" (Ingold & Kurtilla 2000: 187). Weather, in short, is concrete; it can be felt, be seen, smelled and heard (figure 3).

Anthropologist Tim Ingold is a scholar concerned with weather as ordinarily perceived and experienced. He has also criticized archaeological and anthropological studies for having neglected this phenomenon, for example in relation to

how weather conditions affect the way we experience a landscape. "Much has been written about how we see landscape," he writes, but "virtually nothing on the relation between visual perception and the weather" (Ingold 2005: 97). Trying to find the reason for this neglect, he makes the following suggestion:

> *because we generally think and write indoors, the world we describe in our writing is one that has been imaginatively remodelled as* if *it were already set up within an enclosed, interior space. In this as* if *world, populated only by people and objects, those fluxes of the medium that we experience as wind and rain, sunshine and mist, frost and snow, and so on, are simply inconceivable. This, I believe, accounts for their absence from practically all discussions concerning the relations between human beings and the material world.*
>
> (Ingold 2007: 32)

According to Ingold, it is our academic habitat – the fact that our analyses and writing take place in safe, weather-free offices – which implicitly and unintentionally blinds us to weather as a component in our research. The places we describe and interpret thus appear as screened and protected as our warm, dry studies, unaffected by the dynamic and often unpredictable elements of wind and rain. The cure he prescribes is equally simple. We have to get out and into the landscapes: "Only by spending time in them, and becoming accustomed to the sights, sounds, odours and feelings they afford, under varying conditions of illumination and weather, can they properly sink in" (Ingold 2005: 122).

Figure 3. Katla and Marta fighting windy weather in Norðurfjörður, NW Iceland (photo: Tryggvi Hallgrímsson).

It inevitably feels a little strange for a northerner to be lectured by Ingold, an anthropologist whose field experience is quite limited (though see Ingold 1976), about weather and outdoor practices: much of his weather observations seems to stem from strolls with his students in hills and on beaches around Aberdeen. Moreover, as archaeologists, zoologists,

biologists, geologists, and others working each year in northern fields, we certainly get acquainted with weather; all kinds of weather – heath, wind, cold, rain and yes, even snow in July. Not only do we stay there to 'collect data', it is hard physical toil, and we travel, camp, live, sleep and cook food in varied, often rough conditions. We even think and interpret while in the field.

Still, Ingold does at least hit some nails on the head. On the way from the field to the published text, there are indeed some peculiar losses. The immediate, embodied experience of northernness, the direct and practical encounters which were such a self-evident part of our life a few months ago soon seem irrelevant; they wither from our reports, and when the scholarly texts are ready to be submitted, they have almost completely vanished. This of course applies not only to weather but to all our direct experience of land and places, things, soil and stones, how to land and launch a boat in rough sea; making fire, setting up camp, etc. All these experiences and skills are overshadowed and displaced by analytical safeguards, that is by models, purified data and the weirdly persistent idea that knowledge can only be obtained through theoretical detours. It is thus no small challenge to have the courage to trust our own senses and experiences, to include things and places, and not always to begin with the search for scholarly support and back-covering, constructing a safety net of theoretical alliances, well-proven methods and the comforting approvals of the said-before.

Let me offer you with a trivial but hopefully instructive example of northernness and weather. Look at this photo (figure 4); it was taken in Enontekio Municipality, northeastern Finland, in late January 2009. It is the middle of the day, and the sun has just returned from its two months of absence. The temperature has reached its maximum of minus 29 degrees C that day, after slipping to a low of minus 36 degrees during the previous night. There is not that much to see: frost- and snow-covered birch trees, some hare and fox tracks in the snow, otherwise mostly snow, sky, and some glimpses of distant snow-covered mountains. Perhaps you also can sense how quiet it was; almost no sound could be heard, and there was hardly any smell.

Then imagine the same place less than six months later; when the temperature had risen by more than 60 degrees. The forest was green, the ground was covered with plants and herbs, the air was full of smells and the sounds of birds and mosquitoes, wasps, bumblebees and insects of all kinds. This, more than anything else, is what northernness is

Figure 4. Cold winter day near Kilpisjärvi, Enontekio, northern Finland (photo: Bjørnar Olsen).

to me. Just think of the enormous contrasts between a snow- and ice-covered northern landscape during the months of darkness, when temperatures easily slip below minus 30°C, and the very same geographical landscape during summer when the sun never sets. The entire reality of the land is totally transformed: its appearance, substance, sounds and smells, as well as its 'affordances' and risks. This transformation not only affects us mentally, of course; it affects most of the actions of humans and animals, all the everydayness of their being-in-the-north.

Certainly seasonal variations are considerable and effective at other latitudes too, with their monsoons, hurricanes and droughts. Still, I venture to claim that under no other skies where humans have settled is the transformation as radical and – to some extent at least – as predictable as in the Arctic and Sub-Arctic. Archaeologists, anthropologists and others certainly talk about seasons and seasonality; they include them as parameters in models of economy and settlement, but not very much is said about this particular dimension of the radically different life conditions that

were the reality northern people, northern animals, and yes, northern things, had to face for better or worse. This is a kind climatic change that hasn't featured very prominently in our research agendas.

A sense of snow

As superbly grasped by the title of Peter Høeg's novel, northern peoples have a sense of snow expressed, among other ways, in the rich and context-specific vocabulary in Inuit and Sámi languages, for example, for types of snow, snow conditions, tracks in snow, the shape of snow patches, their way of melting, etc. (cf. Jernsletten 1997; Ryd 2001). This vocabulary reveals a concern with snow, with the problems that different snow conditions cause as well as the other challenges and possibilities they offer. In our modern world, however, snow and winter are mostly associated with something negative, something that hinders, makes impossible and marginalizes, that creates chaos on the roads and that generally makes life more dismal and difficult to live. And there are certainly problems and risks associated with frost, snow, and ice – also in the north. For example, early snow followed by rain and frost may create ice crust which prevents the reindeer from reaching lichen and other food plants (Roturier and Roué 2009), and which in turn may cause what the Sámi call nealggedalve – hunger winter. Night frost in late July may ruin the cloudberry season, and snow and slopes have often proved to be a bad combination. As I myself experienced several times in my childhood, avalanches may demolish houses and barns, harming people and animals.

However, snow and winter also provide favourable conditions and offer possibilities, and in our approaches to northern worlds we have been far too ignorant of the possibilities or positive 'affordances' offered by winter, snow and ice. The concept of 'affordance' is derived from James Gibson's "ecological psychology" (1986), and I find it particularly useful in this context. It relates to the qualities or 'competences' of a thing or natural entity which enable (or prevent) certain actions and behaviour by people and animals. The 'affordances' of a landscape are what it offers to people or animals, "what it provides or furnishes, either for good or ill" (Gibson 1986:127). For example, a landscape may afford good reindeer pastures, migration passages and calving places, which in turn may afford hunting or herding. It may also afford trout fishing, egg collecting, sheep pasturage, and even sacred sites and burial grounds. What is important here is that snow and ice adds new affordances to the landscape, transforming it into a different landscape with other competences.

Here we may add a critical remark to Ingold's weather anthropology. He has claimed that weather is a medium of perception, something we conceive the landscape through or in, rather than an object of perception. Thus, according to him, weather has nothing to do with the substance and surface of a landscape, its "matter", to use Hastrup's term: ".. [A]s the weather changes, we do not see different things but we do see the same things differently" (Ingold 2005: 102). This may seem plausible, but at the same time it reveals that snow, ice and frost do not feature very prominently in his weather repertoire, nor is it clear what kind of ontological status he actually ascribes to these phenomena. Which may in turn say something about the location of the 'knower'? Nevertheless, the baseline is still that snow, ice and frost actually do provide landscapes with a new materiality, a new substance, a new surface and thus new possibilities.

Let us briefly recapitulate the immediate and self-evident. Ice and snow make northern travel and transport possible in a very different, and mostly far better and more expedient way, than the landscapes of summer. The northern landscape often contains large areas of crevices, fault blocks and glacial striation which are very difficult to pass through during summer. Snow fills in these gaps and smoothes the surface. Likewise, the huge marsh areas found in the circumpolar region are often untraversable in summer. Thanks to frost and snow they are transformed to a safe, solid surface enabling travel on skis and on sledges pulled by reindeer or dogs. And these affordances are something that northern peoples and travellers have always appreciated. On the basis of his experience of travelling across Arctic America, the Danish explorer Knud Rasmussen described winter as the great provider, one that build bridges across the sea, covers stones and fills in crevices (Rasmussen 1955: 63). Thus, it was hardly accidental that the annual markets in northern Fennoscandia, where traders and tax collectors from Denmark-Norway, Sweden and Russia met the Sámi, were called "winter markets" (Hansen and Olsen 2004). Only at this time of the year was it possible to reach the main Sámi settlement areas efficiently and speedily. Reindeer-drawn sledges and skis were thus used for travel by representatives of state authorities as well as traders and natives.

Snow also affords an inexhaustible source of water. And of course it is an enormous cold storage and freezing facility, enabling long-term storage of food. Even during summer there are snow patches and glaciers that refrigerate fish and meat, even enabling freez-

ing. Snow also provides building materials for snow houses, and as Therkel Mathiassen concluded from his travels with Peter Freuchen along the east coast of the Melville Peninsula, Canada: "One can hardly think of a dwelling more suited to the conditions of this land than the snow house. Outside a snowstorm may rage at minus 50°C, while the inside of the house, when the blubber lamp is lighted, feels warm and pleasant with a temperature around freezing" (Mathiassen 1926: 40-41, my translation). Snow even acts as additional insulation for the snow houses, as Knud Rasmussen was told by the Utkuhiksalingmiut Inuit at the lower Back River, northern Canada. In his conversation with these inland hunters he was curious to know why they didn't have blubber lamps like the coastal people, and he asked if they didn't miss this heating device in an area where the temperature might fluctuate for months between minus 40 and 60°C: "To this they answered that it may feel cold in the unheated snow houses, but only for a short while after they have been built. As soon as the snow houses get packed with thick layers of snow, the many human bodies warm as much as any blubber lamp and they don't feel any cold inside" (Rasmussen 1979: 56, my translation).

Moreover, consider how the snow helps the hunter by showing the tracks of the hunted animals, revealing where they gather and when they have been there. The list of affordances provided by snow and ice for hunters (including animal hunters) is indeed extensive, for example the hunting spots offered by the seals' breathing-holes in the ice. As native vocabulary and knowledge show, different types of snow and ice yielded different affordances. For example, the top layer of crust snow formed during late winter afforded a special type of reindeer hunting among the Sámi. By carrying the skiing hunters but not the hooves of the reindeer, the crusted snow provided a great advantage to the former (Tegengren 1952: 105).

Snow and northernness: Lessons to learn?

At this point most readers will probably agree that snow offers at least some possibilities and advantages for northern living. However, for the archaeological craft it is not very likely that many will list snow as an advantage. Quite the contrary, it is seen as an obstacle. Snow and ice impede our fieldwork, prevent us from digging and conceal the traces we are looking for. Though this too is true, snow can actually be helpful to the surveying archaeologists, offering another view and revealing structures in the landscape. By foregrounding some features and disclosing or obscuring others (including those of the surround-

ings) the way snow drifts, packs and melts can make the outline of a hunting pit, a house ruin or a cache stand out much more clearly than during summer (figure 5). At that time of the year the visibility of these very same structures may be low because they are encased and absorbed by features of the surroundings and the ground vegetation. Moreover, even if snow prevents us from digging and also often conceals the actual surface remains of a settlement or a burial site, visiting a site during winter may prove very helpful as an experiential way of understanding it. Walking in snow, skiing, feeling the cold, and generally experiencing how a place looks and feels during winter brings another dimension to our understanding of it; one that cannot be achieved from indulging ourselves in more theoretical exegeses.

The inclusion of winter and snow adds to the already-rich portfolio of experiences and memories achieved through our ordinary summer fieldwork, and increases the interpretative and heuristic potential of our discipline – a great, but still not satisfactorily activated potential. Without much pretensions to the usefulness of 'reenactment', I am convinced that an archaeological engagement with northern sites also makes us think of their past differently. Being there, undertaking fieldwork, walking the land, digging the soil, being exposed to things, is after all very different from reading about these sites in the comfort of our study. Bringing winter and snow

Figure 5.
Hidden and exposed: Old sheep pen in Krýsuvík, SW Iceland (photo: Bjørnar Olsen).

to this experiential record may prove decisive to the way we activate this difference and make it traceable as manifest deposits in the texts and images we produce. It may not fully compensate for the disadvantage of not being a northerner – but it helps (and gives me another reason to love archaeology).

As already stated, however, the mediation and dissemination of these experiential features of northernness is a great challenge, and here I think we have quite a lot to learn from the old explorers, adventurers and researchers – from the way Fridtjof Nansen, Knud Rasmussen, Peter Freuchen, Helge Ingstad and others mediated their own experiences of the northern in their texts and images. Certainly, you will not find much theory in Ingstad's book about the Nunamiut; but it is full of lived life, experiences, observations and encounters – and no one can deny the knowledge it contains and transmits. Without suggesting that we should copy their style, we should be encouraged by the way they implement what is also a great potential and advantage of the archaeological project, compared for example with the historian's approach: the activation of our material experience of being in the north, of the tacit knowledge achieved through many encounters with northern places, with northern people and things, and the skills they possess by virture of being in the north. In short, we should dare to be richer, more descriptive, and allow our own experiences of northernness to shine through.

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A

Climate changes and society: When climate boundaries move

Installing monitoring equipment at Qajaa, Ilulissat Icefjord, Disko Bay.
Photo: Jesper Stub Johnsen.

A

The following projects constitute the research theme:

- **'Late Glacial Denmark – Humans and the natural environment'**
  Morten Fischer Mortensen, head of project, Danish Prehistory,
  Unit of Environmental Archaeology
  Presented by Catherine Jessen, Danish Prehistory, Unit of Environmental Archaeology

- **'Small trees as climate indicators'**
  Claudia Baittinger, head of project, Danish Prehistory, Unit of Environmental Archaeology

- **'Climate changes and kitchen middens**
  – what happens when the permafrost disappears?'
  Henning Matthiesen, head of project, Research, Analysis & Consulting,
  Conservation Department

- **'Conservation and drying methods in northern regions'**
  Martin Nordvig Mortensen, head of project, Research, Analysis & Consulting,
  Conservation Department

- **'The battle of the weather – weather stations of the German and the Allies in North East Greenland 1941-1944'**
  Jens Fog Jensen, head of project, Ethnographic Collection, in cooperation with Tilo Krause, Ethnographic Collection

- **'Social changes in South Greenland 1900-1950**
  – from hunting to fishing'
  Einar Lund Jensen, head of project, Modern Danish History

- **'The Northern Frisian Captain Houses and their inhabitants'**
  Christina Folke Ax, head of project, Open Air Museum

The landscape and climate of the early Mesolithic hunters of Lundby Mose, southern Zealand

The end of the last glacial period and the Preboreal warming

Catherine Jessen
Danish Prehistory, Unit of Environmental Archaeology

The end of the last glacial period didn't happen as a neat shift from a cold to a warm climate; it stuttered to an end with temperatures swinging within a few hundred years between glacial conditions and conditions as warm as we know today. The final cold snap, the Younger Dryas period, lasted around 1100 years and saw the regrowth of ice sheets in the Northern Hemisphere and the disappearance of woodland vegetation from Denmark. This was followed by rising temperatures and the final retreat of the Scandinavian ice sheet, and the Northern Hemisphere settled into the Holocene period. The very earliest centuries of the Holocene are known as the Preboreal (c. 11,700 – 10,300 years BP) and many records tell us that this was a period of very rapid warming (e.g. Johnsen et al. 1992). But the warming climate was still often punctuated by rapid climatic shifts – not as large as the earlier ones at the end of the last glacial, but affecting summer and winter temperature and precipitation patterns in a fragile fresh landscape. These sudden cool periods (for example, the Preboreal Oscillation/s or the 8.2 event) lasted just decades or a few hundred years and were often caused by the catastrophic drainage of glacial lakes pumping large amounts of fresh water into the North Atlantic and disrupting ocean circulation (Jessen et al. 2008).

The Preboreal saw the immigration of warmth-demanding plants into Denmark in a recognizable sequence of events consisting of appearances and disap-

pearances of various plant taxa (Fritzbøger & Odgaard 2010; Iversen 1967). A generalized model of vegetational immigration was developed over 40 years ago using the percentage of pollen types counted in lake and bog sediments, and although it has now been overtaken by radiocarbon dating, for many years this was the only method of relatively dating different sequences in this geological period. As the temperate vegetation returned, different faunal communities could follow, and along with these, the Late Palaeolithic and Mesolithic human cultures of Northern Europe.

Lundby Mose

The earliest evidence of humans in Denmark after the Younger Dryas is found in a kettle hole in Lundby Mose, southern Zealand, which was excavated in 1999 and 2000 (Hansen & Pedersen 2006: 75). Concentrations of marrow-split bones of elk, red deer, aurochs and wild boar were placed around the lake edge, mostly in tight bundles along with Maglemosian artefacts (fig. 1). The earliest bones from these elk deposits have been radiocarbon dated to 11,796 years ago (cal. BP). One of the deposits looks different, as the bones are spread over a larger area and it contains the bones of at least four individuals, including red deer, and one whole elk torso close to the lake edge. This deposit may relate to butchering waste and is dated to 10,900 years ago (cal. BP). As indicated by both its stratigraphical position and pollen analysis, the wild boar bones are much younger than the other deposits and date to around 10,000 years ago (cal. BP).

Fig. 1. One of the deposits of marrow-split elk bones in Lundby Mose. Photo: Charlie Christensen.

The environmental analysis

As part of the Northern Worlds project Lundby Mose was revisited in 2010 and sediment cores through the peat and gyttja were collected to investigate the environment in which these early Mesolithic hunters lived. At this core position in the centre of the bog, the earliest sediments above the Younger Dryas clays con-

Fig. 2. Photograph of the core analysed for pollen showing the organic-rich and organic-poor sedimentary bands in Lundby Mose. Photo: Charlie Christensen.

Fig. 3. Excavation photograph from Lundby Mose showing the stratigraphic position of the bone deposits. The thick whitish-coloured sediments beneath the bone layer are the Younger Dryas clays. Photo: Charlie Christensen.

sist of bands of dark, relatively organic-rich and pale, relatively organic-poor sediments only 1 or 2 centimetres thick. These shifts in paler and darker gyttja continue upwards but now as thicker (between 7 and 27 cm) bands (fig. 2). The earliest bone deposits were of elk and stratigraphically found in the earliest pale, organic-poor sediments a few centimetres above the Younger Dryas clays (fig. 3).

High-resolution pollen analysis from this core demonstrates the well-known sequence of vegetational immigration into Denmark seen in pollen percentage diagrams, and dominated by birch, pine and grasses with peaks of, for example, juniper, meadowsweet and crowberry. Pollen percentage diagrams indicate the vegetational composition of the landscape, i.e. what proportion of the vegetation is birch and what proportion is pine, or what proportion are wetland plants relative to forest plants. Pollen concentration diagrams can often reflect a very similar pattern, but they give an indication of how much pollen is actually deposited on the bog and give a clue to how productive or how successful the vegetation was. What is noteworthy at Lundby Mose (fig. 4), is that pollen concentrations of all plants except wetland plants show very low values during the early Preboreal period (when the bones were deposited) and do not show an expansion until around 3-400 years after the beginning of the Holocene. The pattern of immigration of vegetation into

Denmark was established many years ago and was based on pollen percentages without the calculation of pollen concentrations. This work from Lundby Mose suggests that the early Mesolithic hunters may not have been living in an environment of birch and pine woodland but may have been hunting in an environment with sparse or patchy tree cover. If our data can be replicated at other sites, this may mean that the traditional picture of pine and birch woodland landscapes from very early in the Holocene should be reconsidered.

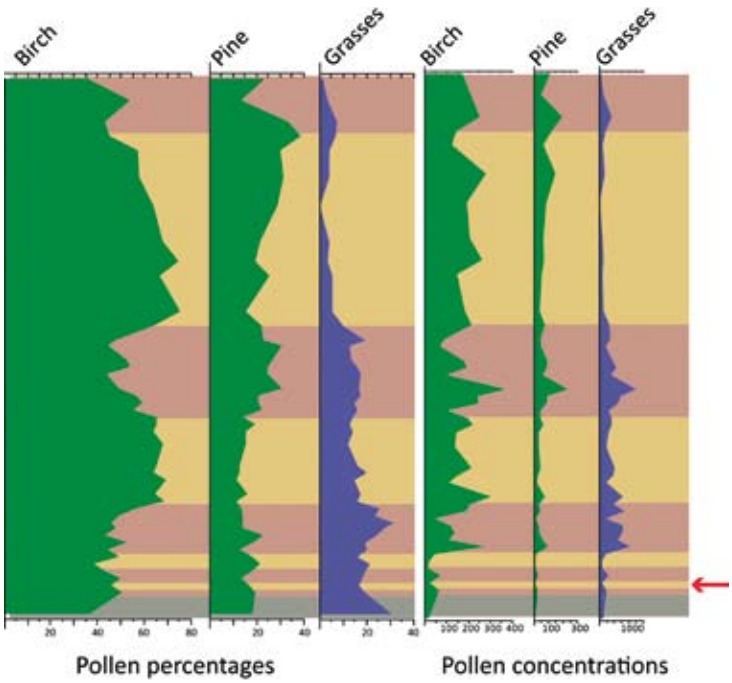

Fig. 4. Pollen percentages (left) and concentrations (right) of birch, pine and grasses showing the low concentrations in the lowest part of the Preboreal sediments in Lundby Mose. The arrow marks the layer within which most of the bone deposits were located and the brown and yellow colours represent the more organic-poor and more organic-rich sediment layers. Drawing: Catherine Jessen.

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‘Small trees’ from North East Greenland

Claudia Baittinger
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Dendroclimatology uses the variation in the width of tree rings to describe changes in the climate of the past and is especially useful in regions where we lack historical records of climate change. One such region is the Arctic, where we know very little about past climate variation but where we expect these variations to have been relatively large and with marked effects on Arctic ecosystems.

Formerly the dwarf shrubs of the Arctic have not been used in dendroclimatology as their growth rings are often difficult to analyse with very low growth rates and missing and discontinuous rings. Recent advances in methodology now allow the analysis of these important climate archives producing time series with annual resolution providing information on the climate of the past.

Fig. 1. Arctic willow (Salix arctica) from Zackenberg Valley. Photo: Claudia Baittinger.

Samples of Arctic willow (Salix arctica Pall.) have been collected since 2001 from an area close to Zackenberg Research Station[1] in North East Greenland. Two hundred individuals of Arctic Willow have now been examined using a method developed for the analysis of the extremely narrow tree rings. These analyses contribute to the understanding of the climate variability effect, snow cover period, habitat type, gender and ontogenesis variations in Arctic regions. The first results have been used to describe changes in the yearly snow cover in the Zackenberg Valley over the past 100 years (Schmidt et al. 2006a).

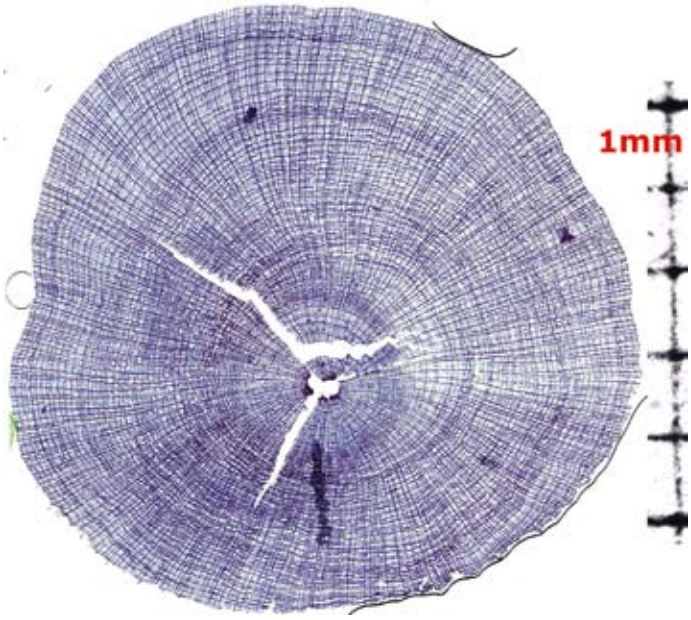
Fig. 2. Arctic willow (Salix arctica) from Zackenberg Valley. A photograph of a female plant with almost mature seeds taken on 20th July 2010. Photo: Claudia Baittinger.

Male and female plants from 3 different habitats – Salix snow bed, Cassiope heath and ablation plateau (Bay 1998; Jones et al. 1999) – were collected in 2003. The analyses showed exciting results in relation to the plants' access to nutrients and water (Schmidt et al. 2006b, 2010) but they also clearly

showed that the tree ring curves of individuals in certain groups didn't agree sufficiently, which means that the cross-dating of the tree rings was not optimal. To improve the analysis basic research into the annual growth of tree rings is necessary to clarify and verify the results. This important work will make it possible to produce proxy data[2] which can be used to reconstruct past climate.

The method is time consuming and involves producing micro-sections of different parts of the plants which are then scanned with a slide scanner with a 4000 dpi optical resolution. Special computer software is then used to measure tree ring width on a large (30"), high-resolution monitor which is also used for the further analysis of tree-ring time series.

Fig. 3. Cross-section/micro-section of a Salix arctica stem, scanned with a slide scanner. Each unit of the scale stands for 1 mm.



New material was collected in July and August 2010 and is expected to aid understanding of local changes in the living conditions of plants and animals in northeastern Greenland using the proxy data. At the same time, this adds to the improvements being made in the use of dendroclimatology on other 'tree-like' plants in the treeless environments of the North Atlantic. With this in mind,

Fig. 4.
Late night volleyball match. Photograph taken by Claudia Baittinger on 29th July 2010 at 11:28 p.m.

the heather plant *Cassiope tetragona* was collected in Zackenberg Valley in the summer of 2010 with the aim of finding this plant's potential in dendroecological and dendroclimatological studies (Callaghan et al. 1989; Rozema et al. 2009). The preliminary work on these plants indicates that some of them are over 100 years old.

Preliminary results indicate that *S. arctica* growth is much more restricted by competition than by any other environmental variables. Thus, the rich and dense populations (*Cassiope* heath and *Salix* snowbed) present a much smaller annual growth than low-cover communities do (Ablation plateau and Fellfield). Individuals from dense populations might therefore be rejected for dendroclimatological studies since they present too many incomplete and missing rings (Boulanger & Baittinger 2011). Results from this project will be analysed and compared with data collected in the Canadian High Arctic and should provide interesting insights into shrubs' response to climate change in the High Arctic[3].

1. Zackenberg Research Station (www.zackenberg.dk) is owned by the Government of Greenland and is operated by the Department of Bioscience, Aarhus University. The objective of the station is to facilitate ecosystem research in the High Arctic.

2. In the study of past climates, known as palaeoclimatology, climate proxies are preserved physical characteristics of the past that stand in for direct measurements (as statistical proxies), to enable scientists to reconstruct the climatic conditions that prevailed during much of the Earth's history.

3. The first Shrub Synthesis Workshop was held in Davos, Switzerland, in September 2011 and included 13 participants from North America and Europe who work at sites around the circumpolar Arctic and at alpine sites. The Shrub Synthesis Workshop (http://shrubhub.biology.ualberta.ca/shrub-synthesis-workshop/) was sponsored by IASC (the International Arctic Science Committee, http://iasc.arcticportal.org/), which is a non-governmental organization that aims to encourage, facilitate and promote cooperation in all aspects of Arctic research in all countries engaged in Arctic research and in all areas of the Arctic region.

Acknowledgement

It has been a pleasure to work with master's student Noémie Boulanger-Lapointe, Trois-Rivières University, Québec, Canada, both during fieldwork and when she was attached to the National Museum's Dendrochronology Laboratory from June through to December 2010. Noémie works with tree rings from the dwarf willow species described above and has collected material relating to her research in the Canadian Arctic and is presently completing her master's thesis.

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Fig. 5. Noémie Boulanger-Lapointe counting Arctic willow seedlings in the Cassiope heath, Zackenberg Valley lowland, Greenland. Photo: Claudia Baittinger.

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Kitchen middens and climate change – what happens if perma-frozen archaeological remains thaw?

Henning Matthiesen, Jørgen Hollesen and Jan Bruun Jensen
Research, Analysis & Consulting, Conservation Department

Permafrost can ensure excellent preservation of organic archaeological materials. Extraordinary examples recovered in recent years include the discovery of the Ôtzi man, as well as the first mapping of the complete genome for a prehistoric man, using hair from a permanently frozen midden (Rasmussen et al. 2010). When organic materials are preserved, it is possible to obtain a much more complete picture of the people that once inhabited a site than from sites with only inorganic materials preserved. However, the global temperature is rising and as a result permafrost is currently retreating. This is a particular threat to arctic sites where preservation of organic material relies on the generally low or freezing temperatures. Thus, it is important to know the consequences for permanently frozen archaeological sites. Will these sites be affected by thawing and how will increasing temperatures influence the decay rate of the archaeological remains?

Here we present a four-year monitoring and research study which takes place at Qajaa, situated 18 km south east of Ilulissat in the western central part of Greenland. The purpose of the study is to investigate current preservation conditions through field and laboratory studies and to evaluate possible threats to future preservation. Qajaa is a unique site where permafrost has preserved organic remains from the prehistory of Greenland. Three different cultures settled here (Saqqaq 4,000-3,000 BP, Dorset 2,400-2,200 BP, and Thule 800-250 BP) and their waste accumulated in an up to 3 m thick kitchen midden. The site was first

described in 1870 by Nordenskiöld, who visited the site in 1879. Excavations were carried out in 1981-1982 by Jørgen Meldgaard, documenting the amazing archaeological potential of the site (Meldgaard 1982). The excavation history and some of the results have recently been described by Jensen (2011). It is considered the best preserved site for Saqqaq and Dorset culture in all of Greenland.

The kitchen midden covers an area of approximately 2900 m^2 and has a maximum thickness of more than 3 m. It contains huge amounts of bones from prey, as well as very well preserved tools and remains made of wood, antler, baleen and stone, all interlaid with natural peat (fig. 1). The midden lies next to Ilulissat Icefjord, and is characterized by vertical erosion fronts facing the fjord.

During the monitoring project, Qajaa has been visited four times up till now (the period 2009-2011). In 2009 cores were drilled through the permafrozen soil layers in order to take samples for soil analysis and to install monitoring equipment (fig.2). The monitoring equipment included sensors for measuring temperature and water content down through the midden, and in 2010 was supplemented by a climate station measuring air temperature, wind speed, precipitation and snow cover. Equipment for monitoring the sea level was installed to evaluate

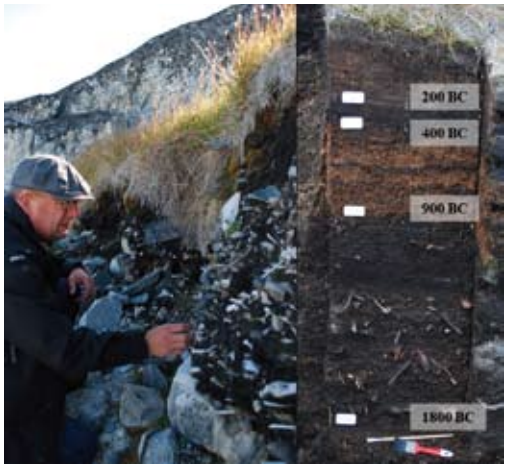

Fig. 1 The Qajaa kitchen midden contains thick layers of refuse that represents 3 individual periods of settlement during the last 4000 years. Photo: Jesper Stub Johnsen.

the risk of coastal erosion. Finally an automatic camera was installed, taking pictures of the site four times per day. Most equipment runs on solar panels, supplemented by batteries for the dark period, and the data are stored in a datalogger until they are downloaded at the next visit. Some of the open erosion fronts were cleaned in 2009 in order to retrieve material for laboratory studies, both to document the state of preservation of the material, and to investigate its vulnerability to changing temperatures. During the visit in 2010 a soil monolith of one of the main profiles was made (fig.1, right) – the profile was thoroughly cleaned, and glued to a supporting textile using a special bonding agent. Then a 2-3 cm thick soil layer of the entire soil profile could be cut and pulled

Fig. 2
Cores were taken down through the permafrozen midden (left), in order to take samples for analysis and install monitoring equipment (right). Photo: Henning Matthiesen and Jesper Stub Johnsen.


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loose giving a complete 1:1 presentation of the different soil layers including bones and artefacts. The soil monolith was transported to the Conservation Department for mounting, and after a short exhibition at the National Museum in Copenhagen it is now on permanent exhibit in Nuuk at the National Museum of Greenland.

Results from the monitoring are under publication in scientific papers and no details will be presented here. Very briefly, the results show that most of the midden is still permafrozen, and only the uppermost 40-50 cm thaw during summer. The mean soil temperature in the deepest soil layer is -2°C, which is slightly higher than expected (Hollesen et al., accepted). The preservation conditions in the midden are controlled by low temperatures as well as a lack of oxygen: As regards the temperature, laboratory studies have documented how the decay rate for organic material from the midden increases with temperature, showing an abrupt change when the material thaws (Matthiesen et al., manuscript). As regards the lack of oxygen, high water/ice content in the midden slows down the transport of oxygen, which again slows down or even halts the decay caused by insects and fungi. Correspondingly, studies of wooden objects from the midden show that artefacts from the permafrozen soil layers are in an excellent state of preservation, whereas some decay is observed for wood that thaws every summer (Matthiesen et al., manuscript).

As for the future preservation conditions, an initial evaluation based on the field data from 2009 indicated that thawing of the midden will probably be a relatively slow process, despite increasing air temperatures (Elberling et al. 2011). However, with the data from the automatic monitoring equipment it will be possible to evaluate the processes in much more detail, and a numerical modelling of future thawing and preservation conditions will be conducted when the latest data have been collected on the next field trip in August 2012.

Besides the scientific publications, the project has been presented to the public through lectures in Ilulissat and at international conferences. Radio interviews have been given on Greenlandic radio, as well as a longer presentation in the DR (Danmarks Radio) programme "Alletiders historie" (available at the project's website). The website also presents various films from the fieldwork, including a time-lapse video showing how the conditions change over a full year at Qajaa, based on pictures from the automatic camera at the site. Finally, a temporary exhibition about Qajaa was shown at the National Museum in Den-

mark in February 2011. Overall, there has been great interest in the project and its results, and it is the ambition of the authors to continue the work and use the results from Qajaa to evaluate current and future preservation conditions at other sites in Greenland.

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Project website
http://nordligeverdener.natmus.dk/forskningsinitiativer/samlet_projektoversigt/klimaaendringer_og_koekkenmoeddinger_naar_permafrosten_forsvinder/

Conservation and drying methods for archaeological materials modified for use in northern areas

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Researchers

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Conservation and drying methods for archaeological materials modified for use in northern areas is a project under *Northern Worlds*, which aims to develop simplified, but efficient methods for conservation of waterlogged organic materials. The most common method today is vacuum freeze-drying. This requires sophisticated equipment and experience. For this reason methods that use household freezers at atmospheric pressure are investigated. The project consists of research on equipment for conservation; qualities of archaeological objects, impregnation agents and packing materials; models for freeze-drying and degradation patterns for archaeological wood. The status of the individual projects is described below.

Drying rates for waterlogged materials at atmospheric pressure

The project has so far confirmed that waterlogged materials can be freeze-dried at acceptable rates as long as the temperature is just below 0°C and the relative humidity (RH) is low. Figure 1 shows the drying rates for three archaeological wooden spear shafts of different sizes. Diffusion coefficients, surface emission coefficients and heat transfer coefficients were determined. Further

research on diffusion coefficients will be carried out in 2012.

Equipment for conservation at atmospheric pressure

Standard household freezing cabinets and chest freezers have been tested with and without moisture sorption agents. Freezing cabinets with shelves consisting of the cooling coils can be used without moisture sorption materials, as the cooling coils work as an ice condenser. Besides the freezers, thermostats for regulating temperatures in freezers and data-loggers for temperature and RH have been tested. The research will continue in 2012.

Selected moisture sorption agents

The capacity of selected moisture sorption agents was established. The sorption agents were used for freeze-drying experiments on waterlogged Oasis at -5°C. Drying rates in relation to sorption materials, temperature and RH were measured. It was found that molecular sieve, silica gel and chrome-tanned leather had the best moisture sorption qualities. The research will continue in 2012.

Determination of moisture sorption isotherms

The moisture sorption isotherms for molecular sieve, silica gel and cat gravel has been established at 20°C for RH between 0 and 95%. The research will be continued in 2012 with determination of moisture sorption isotherms at -5 and -20°C at RH between 0 and 95%. Climate cabinets and moisture meters will be used.

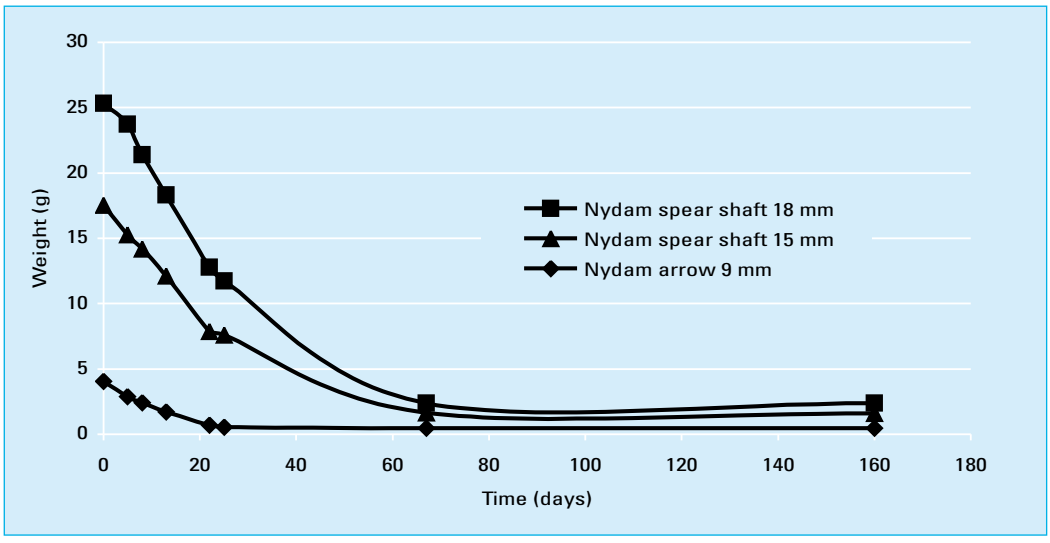
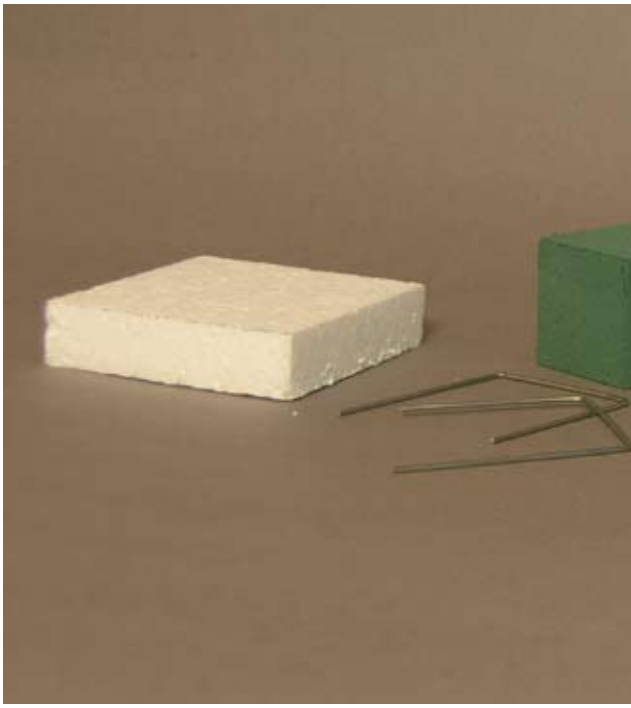


Figure 1. Drying time for wooden objects freeze-dried at atmospheric pressure. Drawing: Poul Jensen.

Packing materials

The influence of packing materials on drying rates and the quality of surface details of freeze-dried objects were examined. A range of different modern packing materials were examined by testing the drying rate of 4 cm cubes of waterlogged Oasis covered by the packing material (figure 2).

In 2012 another series of packing materials will be tested. This time the emphasis will be on natural materials and fabrics. Selected packing materials from both series will also be tested on 4 cm cubical samples of waterlogged oak wood. All tests will be carried out at -5°C and RH below 50%.



Mathematical models

Mathematical and numerical models for freeze-drying at atmospheric pressure are under development. The mathematical model will be finished in 2012 and the numerical model in 2013. Data for diffusion coefficients, surface emission coefficients and heat transfer coefficients from other parts of the research programme will be incorporated.

Impregnation agents

Phase diagrams, collapse temperatures and moisture sorption isotherms for impregnation agents (mannitol, sorbitol and polyethylene glycols) are examined in order to find methods for freeze-drying at temperatures just below 0°C. The research will be finished in 2012.

Degradation of waterlogged wood by fungus and bacteria

A research scheme where 2.5 cm cubes of oak, pine and beech wood are degraded by soft rot, brown rot and white rot was started in 2011 and will continue in 2012. The degraded wooden samples will be examined in order to see how the degradation influences the porosity and diffusion coefficients for water-soluble agents and water vapour during freeze-drying. Light microscopy, scanning electron microscopy and elec-

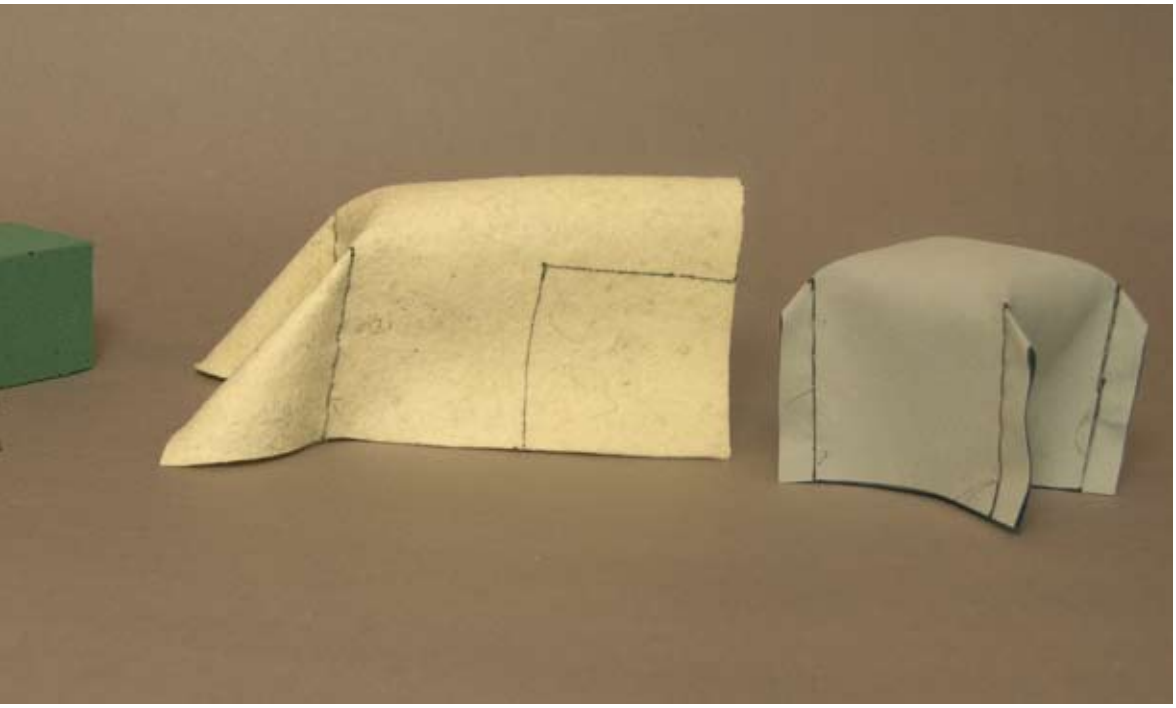


Figure 2. Picture showing a stand, an Oasis cube and two covers made of different materials. Photo: Natasa Pokubcic.

trical conductance are used for evaluating the samples. If time permits, research on degradation of waterlogged wood by erosion bacteria will be conducted in 2012.

Cellulose-producing bacteria

In 2012 it will be tested whether cellulose-producing bacteria are able to produce cellulose inside already-degraded waterlogged wood in order to stabilize the wood before drying.

Climate inside large freezing chambers

The climate (RH and temp.) inside large commercial freezing rooms will be investigated during 2012 in order to examine whether such facilities can be used for freeze-drying voluminous archaeological finds.

Implementation of research results

The results will be published in peer-reviewed articles and at the WOAM-2013 conference in Istanbul. If conservation workshops in Greenland or elsewhere are interested, the knowledge of conserving waterlogged archaeological materials by freeze-drying at atmospheric pressure can be passed on and implemented during 2013.

The Weather War: The German operation 'Bassgeiger' on Shannon Island 1943/44

Tilo Krause and Jens Fog Jensen
Ethnographic Collection

"In the faint evening twilight, we reach the coast, entering solid ground at approximately 4 p.m. Proceeding through the short Wolf's Glen, we arrive at the large snowdrift. Scarcely visible from the outside, two narrow tunnels lead into its interior (Nos. 1 and 2, fig. 1). The whole complex appears romantic. The tunnel to the left is comparatively short, opening into a cave, where [a] tent [. . .] is erected. This is the humble abode of Schmidt, Müller and Muschalek. There is light inside and a Primus is buzzing; we're warming up together with two comrades from the ship, who have arrived shortly after us. The key surprise, though, is the other tunnel to the right. This is the main tunnel, approximately 15 metres in length, with a number of side tunnels and caves on both sides. Right at the entrance to the left we find the privy cave, followed by a storage cave further inside. On the opposite side, to the right, a short side tunnel leads to a larger cave with an empty tent. This will be our new home from now on. The main tunnel then leads further upwards over some steps, where we finally find our radio operators' tent in a cave to the left." (Schatz 1944: 129-130)

These words were written, originally in German, on 4th January 1944, at an isolated spot called Cape Sussi, situated on the High Arctic coast of Shannon Island, North East Greenland. The author, Heinrich Schatz, in civil life a professor of mathematics at the University of Innsbruck in Austria, had arrived at this inhospitable coast by ship some months earlier, in October 1943; and as the text suggests, he had brought with him a considerable number of comrades: Schatz, then aged 42, was the senior officer and leader of a secret weather expedition code-named BASSGEIGER, comprising

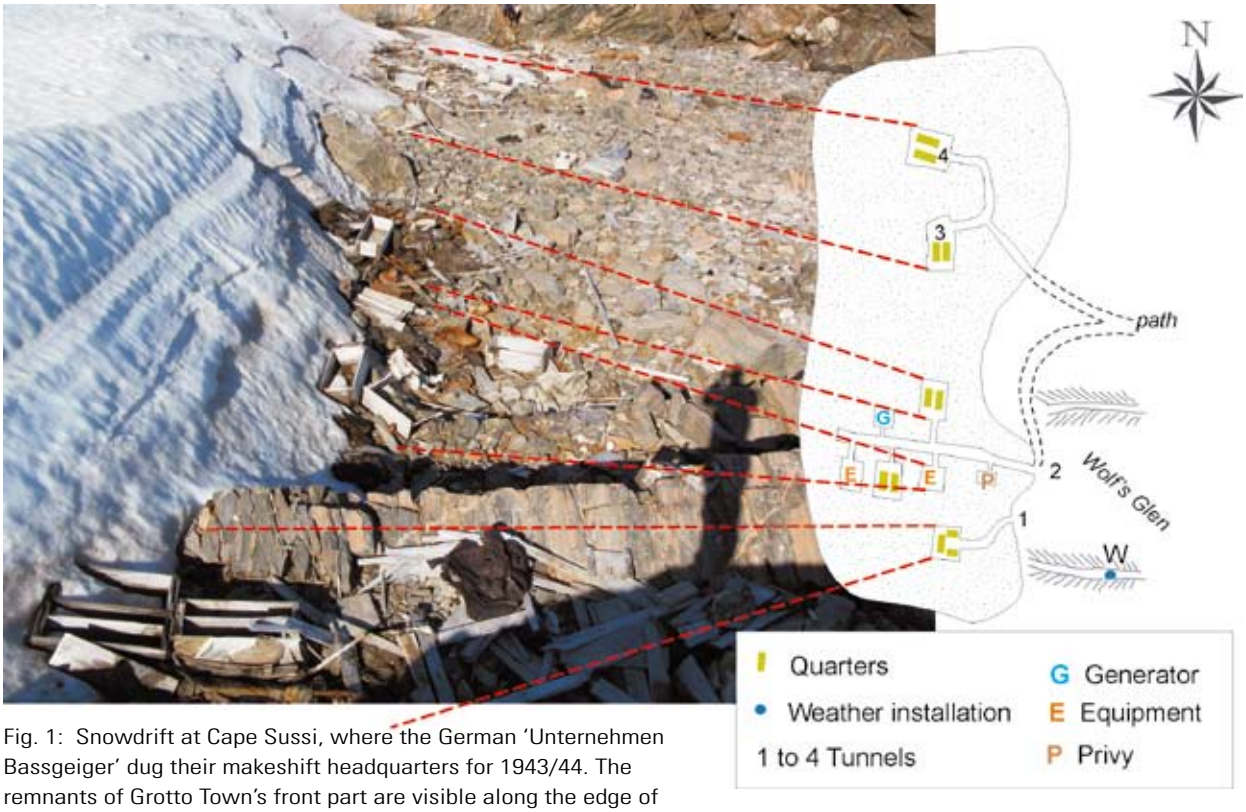


Fig. 1: Snowdrift at Cape Sussi, where the German 'Unternehmen Bassgeiger' dug their makeshift headquarters for 1943/44. The remnants of Grotto Town's front part are visible along the edge of the snowdrift (left). The expedition leader's hand-drawn map of the cave quarters from January 1944 (right) corresponds well to the remains seen today. Photo: Morten Hjorth 2010. Archive: Arctic Institute, Copenhagen.

27 men, sent out to Greenland by the German Navy, the Kriegsmarine.

With our Northern Worlds research project "The Weather War" (Kampen om vejret), we are focusing on the relics, both physical and written, of this particular German weather expedition to North East Greenland during World War II. As part of our interdisciplinary, archaeological-historical approach, in the summer of 2010 we have carried out a complete registration of the physical relics at the site at Cape Sussi. Research in German, Danish and American archives has provided a considerable stock of original written sources about the weather expedition in 1943/44, thus permitting a qualified interpretation of the physical relics registered on site. In the longer perspective, we hope that our results can contribute to future efforts to pre-

serve and protect these exceptional recent-time archaeological remains in the High Arctic.

The Weather War and the story of BASSGEIGER

Weather data from the High Arctic regions were equally crucial to the Axis and the Allied powers during World War II. Their importance can be illustrated by the simple meteorological fact that the general path of low-pressure areas over the North Atlantic – west to east – is more or less dictated by the position and movement of cold Arctic air masses. Regular weather data from the High Arctic thus enabled reliable forecasts for the battlefields in both continental Europe and in the North Atlantic itself, where German submarines were operating against Allied convoys. Since the Allied forces, soon after the outbreak of World War II, had started coding the transmissions from existing Arctic weather stations under their control, Germany soon had to establish her own network of weather stations in the High Arctic, in order to fill in the gap.

In Greenland, a total of six German attempts to establish manned weather stations are recorded for the period of World War II, all taking place on the uninhabited northeastern coast of the enormous island. Yet only two of them managed to become operative and actually wintered on these distant shores: HOLZAUGE in 1942/43 and the aforementioned BASSGEIGER under the command of Heinrich Schatz in 1943/44.

BASSGEIGER was sent out in the summer of 1943 to become the direct successor to HOLZAUGE, thereby securing the crucial Greenlandic weather data for Germany for yet another season. As the previous expedition had run into a series of hostilities with the Allied coastal defence force, the "Northeast Greenland Sledge Patrol", the BASSGEIGER team was instructed to establish its weather station as far north on the North East Greenland coast as possible, in order to avoid another encounter with the Patrol.

Like their predecessors, the BASSGEIGER party travelled to Greenland by ship from occupied Norway. The expeditionary vessel *Coburg* left Narvik on 28th August 1943, with her own crew of 18 on board, plus the actual BASSGEIGER weather party of nine men. After only a few days, however, the Coburg was caught in the drifting ice off the North East Greenland coast – the vessel never reached the shore: On 16 October 1943, after several weeks of struggling through the ice belt, she was finally stuck in landfast ice some eight km off the closest landmark within reach, which was Cape Sussi, situated at 75°20' N on the flat, stony island of Shannon. Here the

BASSGEIGER party had to disembark, and consequently spent most of their time during the following dark polar autumn months carrying the entire wintering equipment of the coming weather station across the eight km of bumpy sea ice to the shore at Cape Sussi, as the station naturally had to be established there on solid ground. For the 18-man crew of the *Coburg*, though, the original plan to return home after landing the BASSGEIGER party could not be implemented either because of the lateness of the season. As a result they had to winter on the spot together with Schatz's weather party, which meant that BASSGEIGER ended up as a wintering expedition of 27 men.

Having used up nearly all their timber in a wooden hut ("Eislager") on the ice halfway between the Coburg and the shore, however, the weather party had no materials left to erect any wooden facilities on shore. The solution to this problem, suggested and carried out by the two Viennese radio operators Robert Riedl and Johann Zima, was to put up tents inside one of the permanent snowdrifts on land. On 23 November 1943, these two young men formed the first group to move ashore, where they immediately started digging the first tunnels and caves into a large snowdrift close to the Cape. Over the next six months this snowdrift, about three metres high and 40 metres wide, would turn into the BASSGEIGER party's "Grotto Town", housing the complete radio equipment plus quarters for the weather party and parts of the *Coburg* crew.

Together with his mate and colleague Ernst Günter Triloff, who was the party's chief meteorologist, Heinrich Schatz eventually joined his comrades in "Grotto Town" on 4 January 1944; his first and immediate impressions of the snowdrift facilities on this day were presented at the beginning of this article. From this date, the BASSGEIGER weather and radio service was operated entirely from the shore station at Cape Sussi. Apart from the "Grotto Town", the station at Cape Sussi comprised only one further building, erected no earlier than March 1944. The first spring foehn storm in February had led to the immediate abandonment of the hut at Eislager, which was demolished shortly afterwards. From the materials saved, Riedl and Zima erected a radio hut ("Funkhütte") on shore, which provided quarters for five persons.

The German presence on Shannon Island, however, had not remained undetected this time either. Already back in November 1943, one member of the North East Greenland Sledge Patrol, Peter Nielsen, had discovered fresh footprints on the sea ice off Cape Sussi. Still, the subsequent scouting of the sta-

tion's exact position, followed by lengthy and fruitless negotiations with the American Allies regarding reinforcements, had delayed the Patrol's operation on Cape Sussi, which was finally mounted as late as 22 April 1944. A meagre force of six men was all the patrol could muster for the attack. Completely outnumbered by the alarmed residents of "Grotto Town", which counted 13 at this time, the patrol had to flee the spot after some 30 minutes of gunfighting. There was one human casualty, though, this time on the German side: The military leader of the BASSGEIGER party, Lieutenant Gerhard Zacher, had by an odd coincidence walked into the chief scout of the patrol, Niels Ove Jensen, only minutes before the attack. Their meeting had resulted in a gun duel, instantly fatal to Zacher, but nevertheless alarming his comrades in "Grotto Town" just in time to save them from being taken by surprise.

In the remaining weeks after the attack and up to the BASSGEIGER party's return home in June, four stone-built gun posts were erected around the station; one in each cardinal direction. Lieutenant Zacher was buried on the beach at Cape Sussi; his grave has since become the unofficial landmark of the site. The wrecked *Coburg* out on the sea ice was finally abandoned and blown up on 6 May 1944, after which all 26 men were assembled at the station for the first time. The "Grotto Town" in the snowdrift was more crowded than ever before in these last weeks, housing no fewer than 21 men in its now-five tunnels with a total of seven accommodation caves. The radio operators Riedl and Zima had by then moved into Funkhütte, together with their three younger assistants Schmidt, Muschalek and Müller.

On 3 June 1944, the whole party was picked up by a Ju-290 plane, which was landed on the plain sea ice of Nordenskiöld Bay approximately five kilometres south of Cape Sussi, and flown home to the occupied Norway. Before departure, the tents inside "Grotto Town" were incinerated, and the middle tunnel was blown up. Funkhütte on the other hand remained intact. Two months after the German party's departure, on 31 July 1944, the abandoned station facilities were inspected by an American landing force put ashore from the Coast Guard Cutter *Northland*. The remains of "Grotto Town" as well as the still intact Funkhütte, were identified as German installations, and after securing considerable amounts of German equipment, the American forces incinerated the installations, including Funkhütte.

Fieldwork on Cape Sussi 2010

Our three-man expedition visited the former German station BASSGEIGER on

Fig. 2: Two hydrogen cylinders found several hundred metres north of the main station at Cape Sussi (left). A close reading of Heinrich Schatz's diary has identified the spot as the station's balloon launching area, a fact that is further emphasized by Johann Zima's photograph from 1944 (right). It shows the two meteorologists Heinrich Schatz and Ernst Günter Triloff on the same spot, preparing a weather balloon for launching. Photo: Morten Hjorth 2010. Archive: Johann Zima, private.

Cape Sussi in August 2010 with the following three purposes: a) the localization of all installations on site; b) precision measurement of the site's natural topography and all localized installations; c) description and photo documentation of all localized structures as well as selected objects. During ten intensive days in the field, all three tasks were completed with the following results. In addition to the three distinctive structures 1) Lieutenant Zacher's grave, 2) the ruin of the Funkhütte and 3) the snowdrift with the remains of "Grotto Town", we localized 21 features on site, including the aforementioned stone-built defence structures, several hidden depots and waste heaps. The total number of registered objects is well above 900.

The written accounts and the physical remains

Having secured no fewer than three diaries and two extensive accounts by the principal BASSGEIGER participants from German archives, we were able to make a comparatively precise reconstruction of the expedition's history as outlined above. And we were also able to connect the written sources with the physical remains on site. These interconnections can be made with quite a number of structures and objects at Cape Sussi, thus demonstrating the potential of the historical-archaeological approach to such recent-time debris.

The most conspicuous example is of course the snowdrift itself, where the distribution of the remains in the eastern half of the former "Grotto Town", exposed

Fig. 3: A soaked cigarette packet, trademark "Gold-Dollar", found in the remains of "Grotto Town" at Cape Sussi. The second officer of the Coburg, Kurt Koos, mentions the very same trademark in his account of the expedition. Photo: Morten Hjorth 2010.

by the now-shrinking snowdrift, quite accurately matches the hand-drawn map of "Grotto Town" in Heinrich Schatz's diary (fig. 1). As a result, we are able to assign virtually every heap of objects in front of the snowdrift to a former ice cave as described in the diary – and as a corollary, by reading the diary we can locate the exact spot where the described events must have taken place. Two hydrogen cylinders, each so heavy that it takes at least two men to transport it, have been located several hundred metres north of the centre of the station. They were apparently placed there on purpose. Close reading of Heinrich Schatz's diary reveals that these cylinders were transported there to fill the weather balloons, and that the locality thus must be identical to the station's balloon-launching area (fig. 2). Finally, even the smaller objects can be identified in the sources: A soaked cigarette packet, 60 years old, was found in the remains of one of the accommodation caves of "Grotto Town". Its trademark "Gold-Dollar" can still be deciphered with no great difficulty, and this particular cigarette is in fact mentioned in the account of the *Coburg*'s second officer Kurt Koos (fig. 3)!

Fig. 4: Tilo Krause visiting 88-year-old Johann Zima in Austria, October 2010 (top). When he participated in the BASSGEIGER expedition as a radio operator in 1943/44, Johann Zima was in his early twenties (right). Photo: Tilo Krause 2010. Archive: Johann Zima, private.

Last but not least, we were fortunate in being able to meet and interview one surviving participant of the BASSGEIGER expedition, the former radio operator Johann Zima. As he happened to be the person who originally came up with the idea of digging tunnels and caves into a snowdrift for the headquarters of the station back in 1943, it was especially fascinating and stimulating to meet him in person and ask him questions concerning everyday life on the BASSGEIGER expedition. We visited the then 88-year-old Johann Zima at his home in Austria in October 2010 (fig. 4).

Preservation and perspectives

As indicated above, the site at Cape Sussi offers favourable conditions for the preservation even of organic materials, since the majority of objects have been buried in the collapsed snowdrift, the former "Grotto Town". However, since the 1940s the snowdrift has melted and shrunk considerably (fig. 1). The front parts of the "Grotto Town", where most of the well-preserved objects were recorded, have thus become the object of archaeological inquiry, but also of looting and degradation by wind, precipitation and sunlight. As a result, the well-preserved books and clothing registered in 2010 after 60 years of 'waiting' under the snow will probably soon decompose and vanish.

The conservation aspect is also relevant when one considers the increased accessibility of the North East Greenland shores caused by the depleting drift ice, which has already resulted in increased cruise-ship traffic in the area. Souvenir-hunting activity and trampling may on the whole soon spoil the hitherto 'untouched' character of historical monuments in North East Greenland. Historical photographs clearly indicate for instance that Lieutenant Zacher's grave at Cape Sussi already shows signs of having been disturbed. Finally, it should be mentioned that not all objects at the site are equally harmless to the interested visitor: At least 15 unexploded hand grenades and an even greater number of rifle grenades have been registered adjacent to the structures.

To sum up, it has to be noted that in the course of climate changes, the formerly remote and generally inaccessible Arctic regions are currently becoming more and more accessible, while at the same time the natural conditions, such as the annual snow and ice cover, that have hitherto ensured the preservation of the objects are in obvious retreat. Our detailed mapping of the World War II stations at Eskimonæs and Hansa Bugt in 2008 (Jensen & Krause 2009a, b) as well as the registration of Cape Sussi in 2010, have recorded the status of the objects in this process, thus providing a professional basis for future efforts to preserve these exceptional relics from the weather war in the Arctic. We therefore hope that this initial historical-archaeological project will be helpful in future assessments of Greenland's historical remnants and their rate of deterioration, thus enabling specific measures to be taken to protect them and to interpret heritage, similar to some of the measures already taken with historical monuments in Svalbard (Bjerck & Johannesen 1999) and Antarctica (Roura 2009).

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Poster

2010. *Frozen WWII battlefields in High Arctic Greenland*. Poster presented at the conference 'Frozen Pasts', Trondhjem.

Depopulation of the Cape Farewell region

Einar Lund Jensen
Modern Danish History

In the Cape Farewell region in the southernmost part of Greenland, the first half of the 20th century was characterized by great transformations in the settlement structure and the number of inhabitants. Mobility was high, many people moved to other settlements, some even out of the region, and the number of inhabitants decreased. The situation culminated in 1944 when the inhabitants of Sammisoq and Itilleq and in 1951 when the inhabitants of Nuuk were forced to leave their settlements. During a period of 50 years, the number of inhabited localities in the Cape Farewell region had fallen from ten settlements to the two settlements that still exist.

The events involved three parties: the local population, Greenlandic politicians and Danish colonial authorities. The purpose of the investigation is to shed light on the motives behind the changing positions and decisions of the Greenlandic politicians and the Danish authorities on this matter during the period in question. In addition the project will focus on the attitudes of the population concerned to moving and being moved.

The direct sources for answering these questions are the minutes of the meetings of the Council of South Greenland, where the social and commercial conditions in the Cape Farewell region were discussed through the 1930s and 1940s (Beretninger & Kundgørelser 1923-1927). The Council agreed that conditions were very poor and put forward several proposals to improve the situation. However, this had no immediate effect, and the members of the Council came to the conclusion that the only solution was to move at least a part of the population to other areas with better commercial conditions, especially areas with a burgeoning fishing and fishing-related industry.

However, the Council only had a consultative role, while the Danish colonial authorities had the last word. They countered any proposal to move people or close down settlements with a demand that the people concerned should be

asked. And only if all inhabitants at a settlement agreed to move would the authorities defray and reimburse the expenses of moving, building new houses etc. The majority of people who were asked did not want to be moved, and the Danish authorities therefore turned down the proposals from the Council. However, in 1944 the attitude of the authorities changed, and in accordance with a so-called "administrative relocation of the population" all the inhabitants of the southernmost settlements Sammisoq and Itilleq were moved. This was the first step in the implementation of a new Danish policy, and over the next few years the authorities actively worked on concentrating the population in Greenland at fewer settlements. In the Cape Farewell region, this development had consequences for the inhabitants of the settlement Nuuk, who were moved in 1951, some of them even out of the region.

The inhabitants of the three settlements mentioned moved reluctantly, but the source material has little information on the population and their reactions. The project therefore includes directive interviews in order to collect information that can contribute knowledge of people's own understanding and opinion of the events (cf. *http://nordligeverdener.natmus.dk/uploads/media/Affolkningen_af_Kap_Farvel_omraadet.pdf*). From this it is evident that many people, at the time as well as in posterity, viewed the events as forcible relocation against the wishes of the population. Many people seem to have lived with a trauma and a feeling that injustice had been committed against them and their relatives.

The investigation of the relocation of people viewed from different perspectives thus not only demonstrates a variety of demands and wishes, but also changes in these over time. At the present time, what remains is an analysis of the different positions outlined, including the issues of population relocation and settlement closure viewed in a wider perspective. In that connection the following questions will be asked. How can one explain the discrepancy between the population in the Cape Farewell region and the representatives in the Council of South Greenland? Why was there a conflict between the Council of South Greenland and the Danish colonial authorities regarding the question of relocating people and closing settlements? And why did the Danish authorities change their attitude to this question at the end of the 1940s?

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For a time, Itilleq was the southernmost trade station in Greenland. In 1909 the trade moved to nearby Sammisoq, and in 1944 both settlements were closed down and the inhabitants were relocated. In the landscape, though, one still can see traces of former human presence and activities, in this case the foundations of what probably used to be the combined school and chapel building. Photo, Einar Lund Jensen.

The whaler and the ostrich egg – Introduction to a project on life on the North Frisian Islands and whaling in the Arctic Ocean

Christina Folke Ax
Open-Air Museum

There is an ostrich egg hanging from the ceiling in the farm from the island of *Rømø* at the Danish Open-Air Museum. It seems oddly out of context in the home of people who had a substantial part of their income from catching whales and seals in the Arctic Ocean. The fact is, however, that the whole interior of the farm seems out of place. From the outside the farm looks small and ordinary, as one would expect on an isolated island where farming can at best be described as marginal and under constant threat from sand and sea. Although the brick walls indicate that the inhabitants had considerable resources, it is only when you enter the building that the sense of displacement sets in. Under the low ceiling, the walls are covered with blue and manganese-coloured tiles, while other rooms have panels painted in bright red or blue patterns and ceilings decorated with Rococo ornaments (Michelsen 1973: 185-190). One walks through the rooms with an increasing sense of confusion and amazement. Who were these people?

The island of Rømø is situated in the Wadden Sea off the west coast of Jutland. It is the third northernmost of the Frisian Islands that lie like a string of beads along the Danish, German and Dutch North Sea coastline. Today, the island is often perceived as a peripheral area in Denmark. During the period 1650 to 1850, the islands may very well have been part of a periphery, but it was the periphery of some of the major cities and harbours of the colonial trade: Amsterdam and Hamburg. These ports, along with British and other port cities in the area, dominated the Arctic whaling in-

Fig. 1: One of the painted rooms at the farm from Rømø at the Open-Air museum.

dustry, and although the Danish Government attempted to engage in the commerce and keep other nations at bay, it did so without much success (Jónsson 2009: 17-27; Kappelgaard 1970: 6-7). Nevertheless, Danish subjects had a stake in the whaling industry not only through ships sailing from Danish ports, but also because people on the Frisian Islands played a major role as captains and crews on the Dutch, German and British whaling and sealing vessels. This reached a peak in the late 18th century when almost 80% of all men on Rømø above the age of six earned their living at sea – most of them in the whaling and especially sealing industry in the Arctic Ocean (Guldberg 2011: 76-87; Kelm 2005: 107). It is in this context that the sumptuously decorated rooms on the farms on Rømø and the other Frisian Islands are to be understood.

Fig. 2:
The northern living-room museum with Dutch tiles, an octant and what may be the jaw of a whale.

The local community and the wider world

The aim of this project is to analyse in what ways and through which routes the inhabitants on the North Frisian Islands were connected to the Northern world, and how life on the islands was shaped by the participation in the whaling and sealing industry. It is equally important to examine whether there were aspects of life and culture on the islands that made the inhabitants sought after as captains and crew on the whaling ships. This reciprocity is often described

as an intertwining of the local and the global. As Frederick Cooper has pointed out, however, the terms 'local' and 'global' are vague and do not hold much analytical or methodological water (Cooper 2005: 36). It can be difficult to determine exactly what can be described as 'local' in this context. Is it the island of Rømø or does the local world include the other Frisian Islands or parts of the mainland? And although life on the North Frisian Islands was connected to life in the wider world, and the products and capital generated in the whaling industry were tied in with broader flows of commerce, this particular study can hardly claim global scope. Nevertheless, in spite of the many problems with the use of concepts such as global and local, the overall understanding that the two levels are entangled in actual life is highly relevant; life on the North Frisian Islands cannot be studied as a separate entity, but people on the islands were interwoven and actively participated in processes and networks that went beyond the local community as well as the Danish nation. (For an introduction to "entangled history" or "histoire croisée", see for instance Kaelble 2005: 1-10; Gould 2007: 1415-1422).

Likewise, the idea of reciprocity is central to this study. The world did not just come to the people of Rømø – they were involved in shaping it through their actions. Thus the influence of the whaling and sealing industry on the local community and practices should not be studied as a one-way transfer of ideas and goods from an outside centre incorporated unaltered by the local community. It is more constructive to examine not only how ideas and objects were incor-

porated and perhaps altered as they became part of local life and practices, but also whether the practices and structures of the local community influenced the whaling and sealing industry and its centres in some ways. For instance, the networks forming the backbone for the recruitment of crews on the whaling and sealing ships may have originated in the local community. And in view of the number of Dutch tiles that decorated the walls in the homes on the North Frisian Islands, the taste of the local communities may be said to have supported that particular Dutch industry. Of course the idea of reciprocity may be taken too far. The actions of the whalers and their families were restricted by government policies, unequal power structures, financial fluctuations, the environment and many other phenomena over which they had little or no influence.

When one is working with complex matters, one methodological solution may be to study how these play out within a well-defined area (see for instance Christiansen 2000). Thus the island of Rømø is the starting point for the analysis of the interplay between the European whaling industry and the North Frisian Islands; bearing in mind, as stated above, that the community on the island was in no way cut off from the rest of the world. After all, the aim of the project is to trace such connections, and places and people outside the island itself will be included in the analysis to the extent relevant to the study. The project will focus on a selection of related topics that seem relevant in revealing the connections with the wider world and the influence of the Arctic whaling: that is, *material culture, networks* and practices with regard to *social organization* and *risk management*. Furthermore, issues relating to gender, knowledge and cultural horizons will be part of the analysis because these variables may nuance the understanding of the topics and tie them together.

Material culture

As one walks through the rooms of the farm at the Open-Air Museum, it is obvious that the inhabitants were sailors. A compass hangs from one of the beams in one of the living-rooms, and other sailing instruments are placed around the building, for instance an octant used for determining position at sea. There are sea chests and models of ships. Closer attention reveals traces of the connections with the whaling industry, but they are there in the shape of whalers' knives hanging on the wall inside the front door. The fence-posts are made of whalebone. In addition, as mentioned above, the richly decorated rooms, the Dutch tiles and the earthenware, and what is assumed to be part of a swordfish skeleton, but looks more like the jaw

Fig. 3:
The entrance to the farm with the fence-posts of whale-bone.

of a toothed whale – and of course the ostrich egg – all indirectly point to the fact that the inhabitants had contacts with the Dutch and German ports through their participation in the North Atlantic whaling and sealing.

The project aims to reconstruct the belongings of the people of Rømø, relying on the archives found at the National Museum, but also on inventories made after deaths or auctions. Such documents have been used by Martin Rheinheimer, who has analysed investment strategies on the island of Amrum and in the parish of St. Laurentii on Föhr (Rheinheimer 2005: 141-165). He found that captains invested their money in houses and land, but since land was a scarce resource they would go on to invest any further surplus in loans. There are suggestions that the same practice can be found on Rømø (Kappelgaard 1970: 8), but this needs further investigation. Looking at the beautiful rooms, however, it seems unlikely that the interiors can be explained purely in financial terms, and this project focuses on the other explanations.

The same kind of objects and decorations can be found, however, in many of the other maritime communities in the area, for instance the neighbouring island of Fanø (Michelsen 1992: 94-105). A direct connection between the interiors and the whaling industry is thus probably hard to establish, but the farm indicates the residents' financial and social standing and can also shed light on the connections and inspirations that the sailors brought back home with them. Besides tracing these connections and what they can reveal about the cultural horizon of the residents, it may be worth investigating whether the objects were used differently in a new context, and whether the whalers were role models for other families in the island that did not participate in the North Atlantic whaling. Accordingly, it is not so much the objects themselves or the artistic style that is of interest, but the cultural aspects and what they can reveal about the residents and their way of living.

Networks

The houses of the whalers are often referred to as 'Commanders' farms' *(kommandørgårde)*, although 'skipper' or 'captain' may be a more correct translation of the actual occupation of the residents. However, the Danish word *kommandør* is a translation of the Dutch word *commandeur (www.ordnet.dk)*, so the word itself places the residents in a network with strong connections with the Netherlands.

Even before embarking on the whaling business, the inhabitants of the North Frisian Islands had made their main income from the sea. In the 16th and 17th centuries people from Rømø owned a considerable fleet of vessels and used them for shipping and trade along the coast to the Netherlands, as well as to England, Norway and Sweden. For example, when the Swedes burned 14 of the 21 ships during the war between Denmark and Sweden in 1643-45 (Kappelgaard 1970: 6), the contacts with the Netherlands and Germany were already established, and it may not have been a major step to become captain of a Dutch or German ship. Nevertheless, networks must have been of the utmost importance to the people who sailed as captains and crews on foreign ships. Preliminary reading suggests that the captain was responsible for hiring at least part of his crew. In order to understand how the North Frisian Islands were connected with the whaling and sealing industry it is therefore essential to understand how the networks functioned and how people became part of them.

This project relies on information and names found in a variety of sources, from crew lists to information found in censuses, church records and accounts.

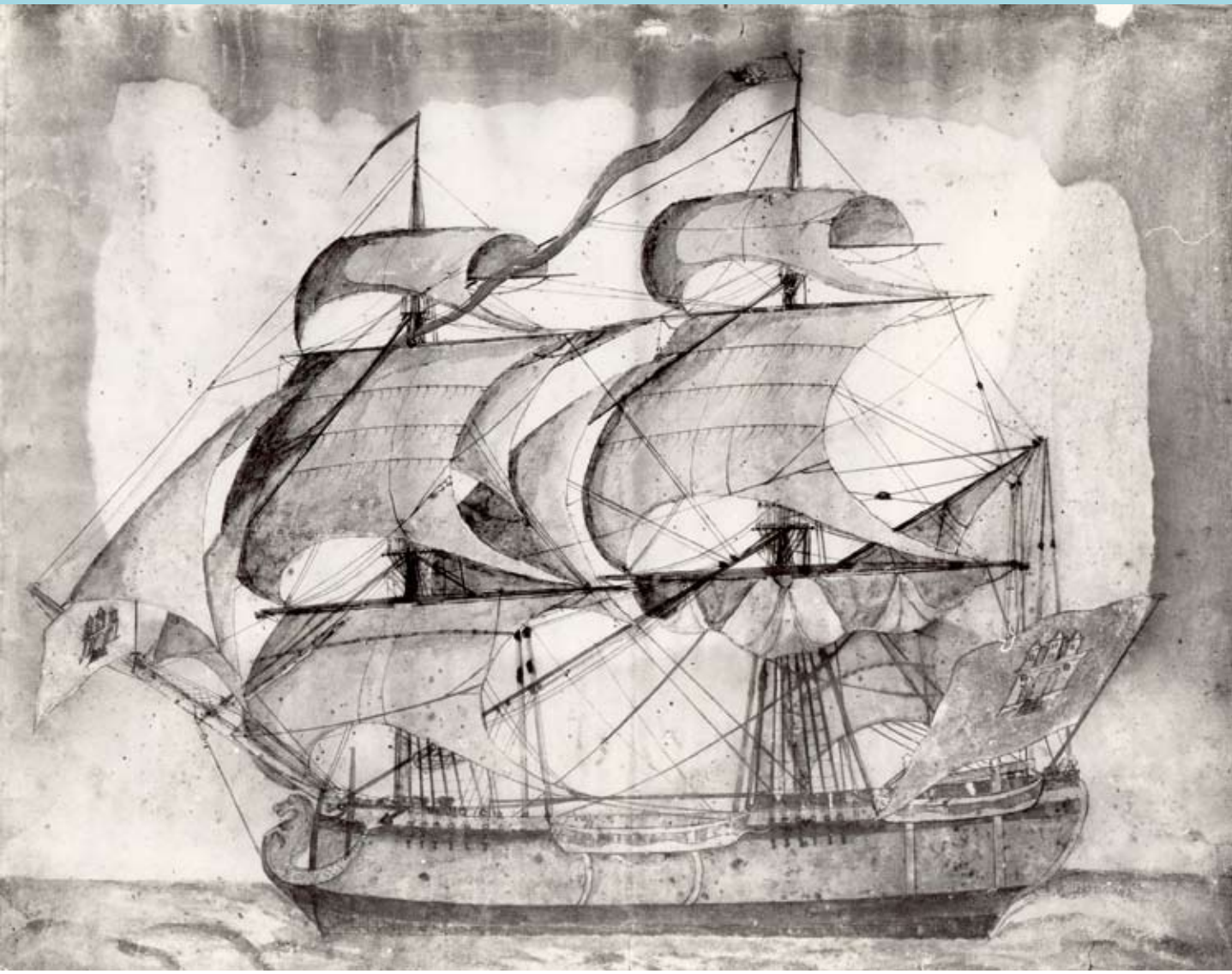

Fig. 4: De twee jonge Hermans out of Hamburg.
Copy from Handels- og Søfartsmuseet.
The original belongs to Skærbæk Museum.

Combining the information found in these documents will make it possible to trace at least some of the contacts of the inhabitants. The networks of the whalers were not the only networks in the community. Not everyone on the islands was a sailor, and the question is whether the networks of the sailors were connected to the others in any way. The same question is relevant in the case of the women. Did they have separate networks, and if so, what was the nature of these networks, and how far into the region did they extend?

Fig. 5: Jochem de Vries, De Groenlandvaarder Zaandam. Original at Rijksmuseum Amsterdam.

It is very likely that ideas of reciprocity and obligation were important to the working of the networks. This may be seen from an episode in 1777 when ten ships were caught in the ice and were wrecked along the east coast of Greenland, so the crew had to walk across the sea ice to the shore in the hope of being rescued. Engelbrecht Jensen from Rømø was captain of the ship *De twee jonge Hermans* out of Hamburg. When he had the option of walking ahead with the strongest members of the crew, he stayed behind to be with a 12-year-old boy, Anders Mickelsen List, whom he had brought with him from home. They both survived (Hanssen 1977: 30). Many of the people who survived did so be-

cause the Inuit took them in and fed them during the winter or helped them get to the colonies. Accounts of the accidents preserved among the Inuit show that the hierarchical structure from the ships was maintained in this time of crisis. The Inuit could not tell who the commander was because the Europeans all looked equally dreadful after the long walk, but they worked it out when they noticed that one man among the sailors was able to order the others around (Bistrup 1931: 216). And Marcus Voss, a German commander, made his crew say prayers instead of heading for the safety of the shore (Hanssen 1977: 50-51).

It is of equal interest to know why the Dutch and Germans ship owners hired people from the North Frisian Islands in the first place. Was there a shortage of skilled sailors and captains in the vicinity of the big port cities, or was it because within the whalers' networks there was reliable knowledge of the Arctic waters and how to manoeuvre the ships in a treacherous environment? The establishment of navigation schools on Føhr and Rømø in the late 17th century suggests that training was of importance in maintaining a place among the captains and crews on board the ships.

Practices

In a society where the men were absent for long periods of time and some never returned, women had a special position. People had to find practical solutions, so women could act independently and take on responsibilities they did not have in farming societies. The commanders' farms may for example have been named after the occupation of the husbands, but it was the women who lived in them all year round and the women who did the farming along with old men and hired help. It is, however, highly unlikely that such practices can be ascribed solely to the influence of the whaling industry, since the same situation is found in many other maritime societies.

What is called for is not only a mapping of the world of the women separate from that of the men, but also an integration of the two in order to understand where and how they interacted and supplemented each other. Curiously, the role of the women in the whaling communities is often only mentioned in passing, and in some cases the neatness of the homes of sailor families is ascribed to the fact that the men were used to clean, orderly, cramped conditions on board the ships (Michelsen 1992: 102). One cannot help but wonder at this explanation, since housekeeping was traditionally the women's domain. In fact, there seems to be a scarcity of studies that combine the world of the men with the world of the women. With few exceptions, most studies of the whaling industry focus on men.

Granted, there were no women on the ships; nevertheless an analysis of the role of the women in the communities may prove to be another way of investigating how the whaling industry and the local communities influenced each other. To what extent and in what ways were the women invested in the whaling industry? And what happened when the men settled at home after a career at sea?

Some of the practices were related to the management of the risk involved in both whaling and farming. Whaling may have presented an opportunity to make large profits, but these involved facing danger from ice, the hunt and diseases such as scurvy. Likewise, Rømø was exposed to wind and weather, and farming can hardly be said to have provided much security. The study by Martin Rheinheimer, mentioned above, shows that even if the surplus gained at sea was invested, the strategies were conservative, with a strong emphasis on minimizing the risk of losing money. It may therefore be of interest to examine what strategies the population on Rømø employed to handle the insecurities they faced? And what happened as whaling and sealing became less lucrative? How did this influence the local practices and the relations between men and women?

What happened to networks that had connected the inhabitants with the whaling and sealing industry? Did the families lose their social standing or was it perpetuated in other forms and against a different background?

The ostrich egg, the whaler and the world

The people from the commanders' farms are long gone, and all that is left is the objects, buildings and names in documents. And we must try to make sense of these sources, however difficult that may be when we stumble across puzzling objects such as ostrich eggs in what seems an unfamiliar setting. As it turns out, the ostrich egg in the whaler's house can actually be said to be out of context. According to the records at the Open-Air Museum, the egg was bought in the 1930s from an antique dealer in the town of Sønderborg on the Island of Als off the east coast of Jutland. The egg was probably put in the house by a museum curator because – along with the tiles, compass and other objects with which people surrounded themselves – it points to the fact that seafaring communities were connected to a wider world, and that local life on the islands was not isolated from that world. As such, the ostrich egg is in its proper place.

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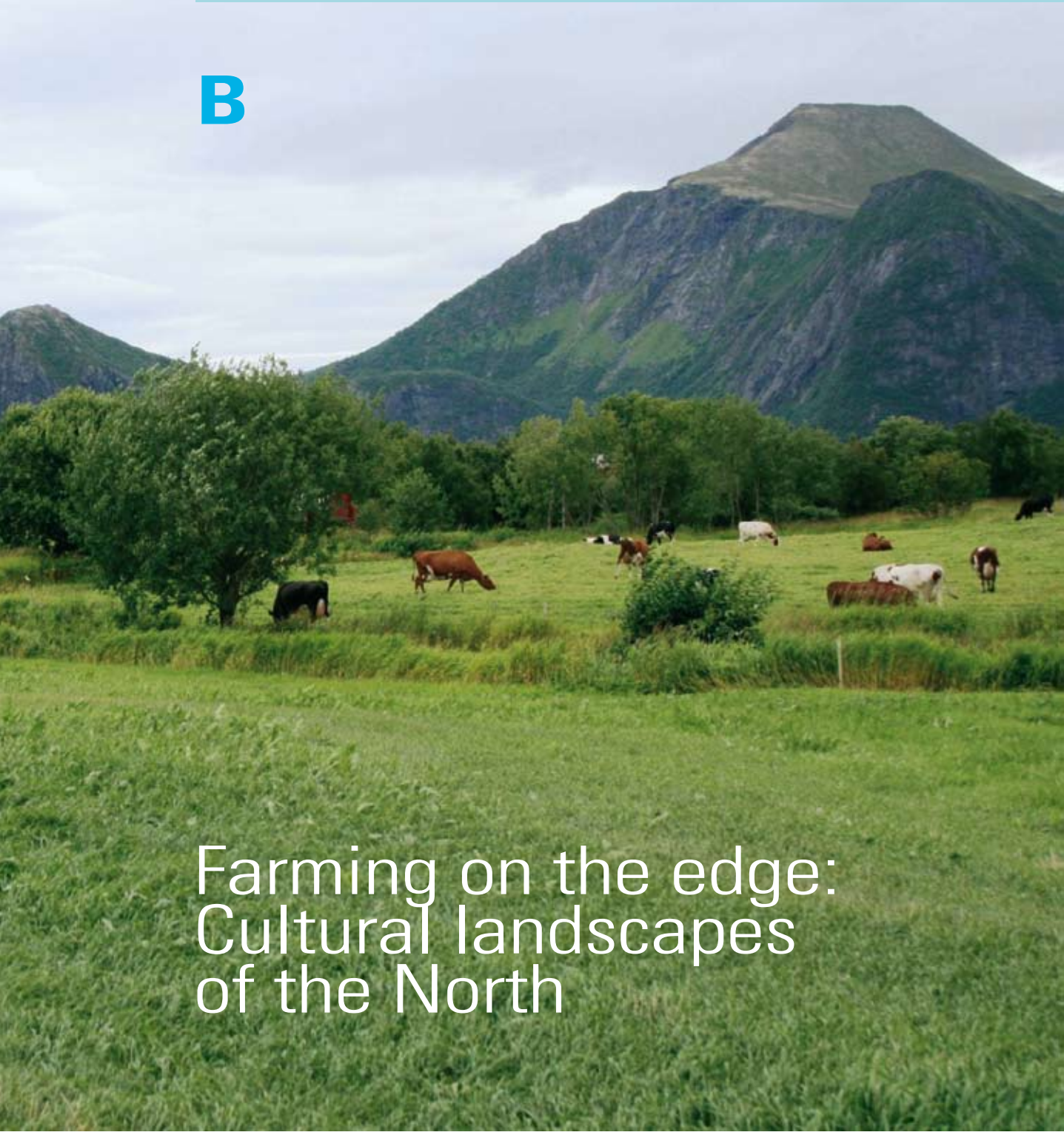
B

Farming on the edge: Cultural landscapes of the North



Agrarian landscape at Bø, just downward of the Grådusan cairn, Engeløya, Steigen, North Nordland. Photo: Flemming Kaul.

B

The following projects constitute the research theme:

- **'Expansion of agrarian societies into the North'**
  Flemming Kaul, head of project, Danish Prehistory

- **'Expansion of the agrarian society in the Neolithic Age'**
  Lasse Sørensen, PhD student, Danish Prehistory

- **'The Shetlands – agriculture on the edge 4000-3000 BC'**
  Ditlev Mahler, head of project, Danish Prehistory

- **'Resources, mobility and identity in Norse Greenland'**
  Jette Arneborg, head of project, Danish Middle Ages and Renaissance

- **'Farmers in Norse Greenland'**
  Christian Koch Madsen, PhD student, Danish Middle Ages and Renaissance

- **'Agriculture of the Greenland Norse'**
  Peter Steen Henriksen, head of project, Danish Prehistory,
  Unit of Environmental Archaeology

Agricultural landscapes of Arctic Norway

Flemming Kaul
Danish Prehistory

Introduction

Around 4000 BC Neolithization took place in southern Scandinavia. Within a short span of time most parts of southern Scandinavia were encompassed by the Neolithic Funnel Beaker Culture. In southwestern Scandinavia the Neolithic expansion halted close to what is now the Swedish-Norwegian border at Svinesund. For centuries the border zone remained stable, though a limited agricultural impact can be seen in certain areas of southern, southwestern and western Norway. During the Late Neolithic period and the Bronze Age a new expansion of agriculture took place, and there are finds related to Nordic Bronze Age Culture almost as far north one can get, far north of the Arctic Circle.

North Trøndelag is rich in Bronze Age finds of all categories. Here we find the full agricultural package of the Nordic agricultural Bronze Age Culture: houses, farmsteads, burial cairns, votive offerings, and iconography on rock carvings and on portable objects. However, farther north there are still areas with this broad spectrum of find categories, burial cairns, votive offerings, settlements and rock carvings. Even though the finds are scarce up in the far north, they are not randomly scattered. The finds all appear concentrated in areas which today represent the best possible farming land. The farming connections of the Bronze Age finds are supported by pollen and macrofossil evidence (Binns 1985; Arntzen & Sommerseth 2010).

The Harstad-Kvæfjord area, South Troms

Where Bronze Age objects have been found, one always finds the best arable land – places with a mild local climate and rich soils. This is the case for Helgeland in southern Nordland (Binns 1985; Kaul 2011; Kaul & Rønne 2008, 2011), but certainly also for areas much farther north: Let us go to the area around Harstad and Kvæfjord in southern Troms, east and north east of Lofoten, not far from Narvik. There, in the summer of 2011, I went on a research journey with

Fig. 1:
A row of farms at Borkenes, Kvæfjord, South Troms, seen from the Bronze Age Hundstad settlement site on Kveøy. Photo: F. Kaul.

our Norwegian research partner, Preben Rønne, Vitenskapsmuseet, the University of Trondheim (NTNU), analysing the landscapes around the Bronze Age finds. In the present project, part of the 'Northern Worlds' research initiative, Preben Rønne is working on a full publication of all Bronze Age metal finds from northern central Norway and northern Norway.

In Kvæfjord, at the farm Hundstad on the island of Kveøy, recent excavations have revealed the northernmost Bronze Age farm. Postholes give evidence of a three-aisled longhouse, which according to C^{14} dates was in use around 800 BC. Late Bronze Age fossil soils and finds of charred barley grains (and pollen) are evidence of cereal cultivation. The dating evidence from the fossil soils seems to show the existence of agrarian fields earlier, in the Early Bronze Age (Arntzen & Sommerseth 2010). The excavations demonstrate continuity of the Hundstad farm into the Pre-Roman Iron Age and onwards. When I visited the site (with Johan Arntzen) it was quite obvious that this ranks among the richest farming areas of Arctic Norway. On the island of Kveøy itself there are a number of farms today, and at the time of our visit the site of the northernmost Bronze Age farm was an oat field. When one looks from the Hundstad site across Kvæfjord towards Borkenes, a long row of farms in their agricultural setting is clearly visible (fig. 1). This kind of landscape view recurs every time Bronze Age finds come to light.

Let us go to the area around Harstad (about 40 km from Kveøy) with a small concentration of Late Bronze Age finds. On the island of Grytøy, at Grøtavær, a steatite mould for casting bronze celts (socketed axes) has been found (Rønne

Fig. 2: Agrarian landscape at Grøtevær on the island of Grytøy, South Troms. A steatite mould for casting bronze celts has been found at Grøtavær. Photo: F. Kaul.

2011: 66-67). It can be dated to period V of the Nordic Bronze Age (900-700 BC). Once again, one sees an open, coastal agricultural landscape (fig. 2).

Close to Trondenes Church, at Predikestolen, Altevågen, Trondenes, a bronze collar and a celt were found under a ledge in a marked vertical cliff (Arntzen & Sommerseth 2010: 122-123). Behind the cliff there is evidence of another rich agricultural landscape, and at the rectory farm of Trondenes a farm mound has produced finds from the Pre-Roman Iron Age. In the same area, at the edge of a farm mound, a Late Bronze Age cooking pit has been excavated (pers. communication from Johan Arntzen). Trondenes Church is a magnificent Romanesque church, almost of cathedral size, itself

At Tennevik two bronze neck collars have been found in a crevice in a low cliff overlooking a rich agricultural landscape (Munch 1966; Rønne 2011: 68) (fig. 4). These two collars can be dated to period V of the Nordic Bronze Age (900-700 BC). They are very similar to the necklace found at Predikestolen.

Fig. 3: The Romanesque Trondenes Church at Harstad, South Troms, late 12th century. Photo: F. Kaul.

testifying to the agricultural potential of the area (fig. 3). Trondenes Church is the northernmost of all Romanesque stone-built churches (Eide 2005). It is worth noting that in the other areas of Bronze Age finds in northern Norway (Steigen and Helgeland) a similar relationship between the Bronze Age finds and the few Romanesque churches can be observed.

Engeløya, Steigen

Around 150 km south of Harstad, in northern Nordland, we find another rich agricultural area. The present-day possibility of growing gardening perennials and the presence of oak and chestnut are indicative of the remarkably mild local climate at Steigen. The island of Engeløya, the agricultural centre of the Steigen municipality, is dotted with prehis-

toric monuments, mostly from the Iron Age and Viking Age (Pedersen 2008). Steigen Church on Engeløya is one of the few Romanesque churches of Nordland. On the way from Harstad to Steigen it is possible to take the ferry from Lødingen to Boknes. The ferry brings you through a dramatic fjord 'seascape', and from the ferry it is possible to observe some landscapes quite different from those visited at Harstad and Steigen (fig. 5): rugged rocks descend directly into the sea with no fertile coastal zone well suited to agriculture. There are (consequently) no Bronze Age finds. Once again it should be noted how the

Fig. 4: Agrarian landscape at Tennevik, South Troms. In the foreground a barley field, in the background a grass field with sheep sorrel (Rumex acetosella). Two late Bronze Age bronze collars have been found in at Tennevik. Photo: F. Kaul.

Fig. 5:
Rough landscapes not suitable for agriculture, between the fertile areas of Harstad and Steigen. Photo: F. Kaul.

Fig. 6:
Prehistoric burial cairn at Grådusan, Engeløya, Steigen, North Nordland. Photo: F. Kaul.

Fig. 7:
Rich agrarian landscape at Bø, just downward of the Grådusan cairn, Engeløya, Steigen, North Nordland. Photo: F. Kaul.

landscape types that can be observed today relate to the finds – of both the Bronze Age and subsequent periods.

On the western side of Engeløya, facing Lofoten, the burial cairn at Grådusan is situated, with a spectacular view of the mountains of Lofoten, and in a commanding position in the local landscape. From the Grådusan cairn different types of landscape can be observed. In one direction there is a coast where the rocks drop almost directly into the sea (fig. 6), but in other directions the cairn 'over-

looks' the most fertile land of Engeløya with many farms, fields and pastures (fig. 7). Close to the largest farms and the finest fields there is a sandy beach, Bøsanden, which – together with a couple of smaller beaches – should be regarded as excellent landing places. Unfortunately, the central part of the cairn at Grådusan was destroyed during the Second World War; the cairn became integrated into the huge fortification systems built by the German occupation forces, Batterie Dietl. In the middle of the cairn a machine gun position was placed, using the 'strategic' position of the cairn. There is no record of finds from the cairn, though it has been claimed to be of a Bronze Age date (Pedersen 2008: 118-119). A Bronze Age date cannot be excluded, especially with reference to its landscape setting, but it must be underlined that there is no solid evidence of its date, and it could as well belong to the Iron Age. However, it is tempting to consider the cairn from Grådusan as a 'mother cairn', a cairn that can be seen from most of the more low-lying cairns of the area.

In a lower position in the landscape, though on a plateau overlooking the Bøsanden beach, situated close to the farms at Bø, some cairns and a large mound remain (one mound dated to the Iron Age). One of the cairns is dated to the Bronze Age (Rygh 1906; Rønne 2011: 64-65). It contained a pair of tweezers and a double button with long rod. The top plate of the button is decorated with a star (solar) motif. This button can be dated to period IV of the Nordic Bronze Age (1100-900 BC), probably an early part of the period. Both artifacts were

Fig. 8: Bronze Age cairn at Bø, Engeløya, Steigen, North Nordland. The cairn is seen to the right of the farmyard. Photo: F. Kaul.

Fig. 9: Small cairn at Bø, Engeløya, Steigen, North Nordland. Photo: F. Kaul.

found when the owner opened and partly cleared the cairn in order to build a potato cellar in it. When visiting Bø in the summer 2011, Preben Rønne and I (with the help of the local historian Jarl Arne Pedersen) managed to identify the remains of the cairn at one of the largest farms of Bø. The potato cellar has now been removed, and the cairn remodelled (fig. 8). Other cairns too may be of Bronze Age date (fig. 9).

At Sandvågmoen, Engeløya, one of the northernmost rock carvings belonging to the Bronze Age tradition can be seen. A large flat stone block is dotted with cup-marks, some of these connected by

Fig. 10: Stone with cup marks, Sandvågmoen, Engeløya, Steigen, North Nordland. Photo: F. Kaul.

pecked lines (Pedersen 2008: 32-33). This stone is situated in an open agricultural landscape, mainly consisting of grass fields (fig. 10).

Arctic agriculture in North Norway

The landscape of different Bronze Age find categories from Arctic Norway has been illustrated. As mentioned above, all the Bronze Age sites are related to the best agricultural land, not just when one looks at the area generally, but also in the quite local perspective. All the finds belong to the coastal zone blessed with a mild local climate (due to the Gulf Stream that runs along the Norwegian coast), the fields often lying in a sheltered position with hills or low mountains close by. But a relatively mild climate is not enough. You need to have arable soils for agriculture and cattle breeding, and exactly these areas could provide the soils needed as well as sheltered beaches for landing places (transport and communication).

Today, the main crop of North Norway is grass for hay harvest. With almost no darkness at night two hay harvests can be produced each summer. The hay is used for winter provisions for dairy cattle. Some of the grass fields are used as pasture for the cattle, but a certain system can be observed where during the summer the cattle graze on higher lands of poorer quality. Then in the autumn, after one or two hay harvests proper, the cattle may return to these infields, grazing and supplying manure. Today, large farms with byres for cattle can be seen in the landscapes surrounded by grass fields. At the byres there are silos for silage (of grass, when not dried as hay). Mixed crops are also seen in the fields,

Fig. 11: Yellow seaweed at Rødøy in Flatøysund, Alstahaug area, Helgeland, South Nordland. Photo: F. Kaul.

for instance a crop consisting of barley, peas and vetch, excellent for silage cattle fodder. Unripe barley alone is also used for silage. The Steigen area and the Harstad/Kvæfjord area are rich milk-producing regions. A network of regular ferries connecting the many islands permits daily truck transport of milk to larger central dairies.

Today – as must have been the case in the Bronze Age – fishing is of some importance, especially as an extra resource during the winter. However, another marine resource should be considered. In 2010 the rock carvings on the islands of Tro and Flatøy in Helgeland were revisited (Kaul & Rønne 2008; 2011). Our local guide Kjell Flatøy informed us that characteristic yellow seaweed had been used until recently as cattle fodder. The seaweed is exposed at low tide along the shoreline (fig. 11). According to Kjell Flatøy it was collected, dried, and stored as winter provisions for dairy cattle. The dried seaweed was given to the cows together with the hay, not necessarily to prevent starvation, but as an extra nutrient with salt and minerals. In this case the use of marine resources does not run counter in any way to the agrarian

Fig. 12: Rich agrarian landscape on the island of Flatøy, close to Bronze Age rock carvings, Alstahaug area, Helgeland, South Nordland. Photo: F. Kaul.

Fig. 13: Two horizontal mills, Borkenes Bygdetun, Kvæfjord, South Troms. Photo: F. Kaul.

economy. On the contrary, this seaweed was used and harvested as an integral element in agricultural production. We are (probably) dealing with the species *Chondrus Crispus*. In Ireland the bright yellow seaweed, *dúlamán* in Irish Gaelic, was part of the human diet (soup), especially in times of famine.

On Flatøy itself, close to the rock carvings (both Early and Late Bronze Age), a rich farming landscape can be seen, though the farm has now been abandoned, and the main building serves as a summer cottage (fig. 12). When it was in use there were 15-20 cows in the byre. The mild local climate makes it possible to grow barley in Arctic Norway. Today barley is often harvested before the grains have ripened. But in earlier times of dependence on self-sufficiency barley was of much greater importance. Barley was used for beer, but the grains were also milled, and the flour was used for porridge and flat-bread. The significance of barley is shown by the many small horizontal mills (Danish: *skvatmølle*; Norwegian: *bekkekvern*) that once existed, for instance in the Steigen area (Fygle 1985: 216-218) or in Kvæfjord (fig. 13).

Almost as far north as one can get, at some places along the Alta Fjord, Finnmark, a particularly mild local climate enables barley to ripen in good summers (Magnus & Myhre 1986: 196-198). The Alta Fjord is free of ice during winter. At Hjemmeluft, Alta, the northernmost rock-carving ships belonging to the Bronze Age tradition have been found (Helskog 1998, 2000; Kaul 2011) (fig. 14). They belong probably to period V or VI of the Bronze Age (900-500 BC), but some of the ships should be dated to the Early Pre-Roman Iron Age. At Alta potatoes, turnips and carrots are also grown now. In sheltered inland areas a few kilometres from Hjemmeluft, farms with byres for cattle can be seen today, surrounded by large grass fields (fig. 15). At one of the largest farms a horizontal mill is preserved, testifying to the milling of ripened barley grains (fig. 16). It is

Fig. 14: Rock-carving ship, left foreground, Late Bronze Age, period V or period VI (900-500 BC), Hjemmeluft, Alta, Finnmark. Photo: F. Kaul.

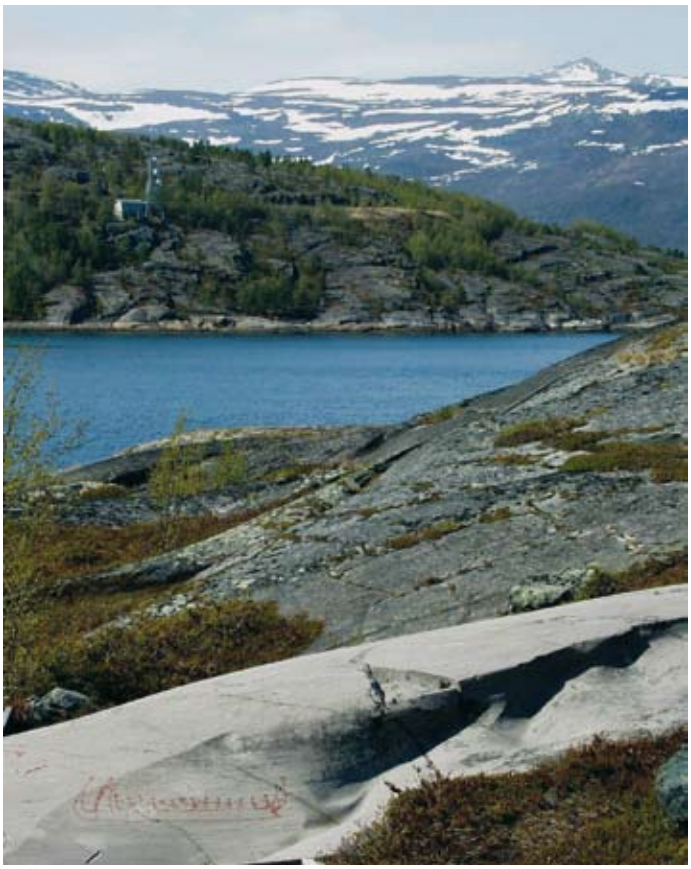


Fig. 16: Horizontal mill at the same farm as fig. 15, at Alta, Finmark. Photo: F. Kaul.

Fig. 15: Large farm surrounded by grass fields, Tangen at Alta, Finmark. Photo: F. Kaul.

possible to speak of Arctic agriculture, even hundreds of miles north of the Arctic Circle, at 70 degrees north. It is fascinating to follow the 70 degrees latitude line, realizing that we are on the same parallel as Disko Island in West Greenland or the northernmost parts of Alaska, where agriculture is certainly no option. On the other hand, it should be admitted that here at Alta we are dealing with farming on the (utmost) edge, and the degree to which an agrarian economy could have been sustained over extended periods in prehistoric times is uncertain.

All the way from Trøndelag and Helgeland, along the coast as far north as Alta in Finnmark, we find evidence of the Nordic Bronze Age Culture, and in each case the sites are situated where there are patches of land well suited to agriculture. Today these places favoured by a mild climate yield possibilities for farming types such as cattle breeding and milk production.

We may envisage these patches – where agriculture was practised at the periphery – as islands of arable land surrounded by mountains and the sea (many of the sites are actually on islands), where the only possible vehicle for transport and contacts was the ship.

Acknowledgements

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Pioneering farmers cultivating new lands in the North

The expansion of agrarian societies during the Neolithic and Bronze Age in Scandinavia

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Danish Prehistory

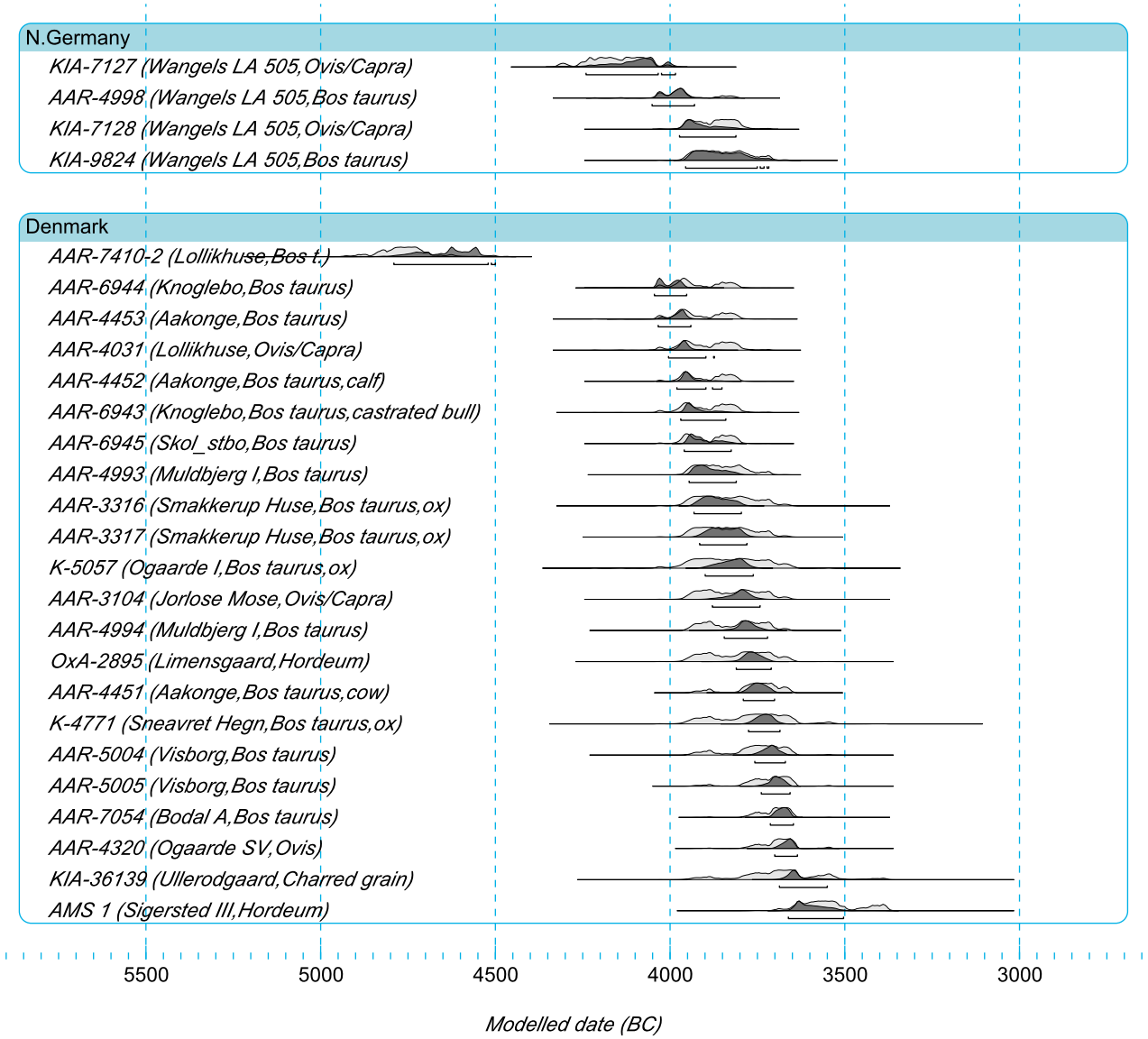
Expansions of agrarian societies during the Neolithic and the Bronze Age in Scandinavia can be studied in a long-term perspective lasting from 4000 to 500 BC. Through a series of ^{14}C datings of primary evidence of agriculture it is possible to document the speed of the agrarian advance with its shifts between expansion, stagnation and decline through the Neolithic and the Bronze Age. The reasons for these shifts are discussed, and it is concluded that diversified climatic zones together with environmental and ideological factors play a central role in the understanding of the expansion of agrarian societies. In geographical terms the length of the Scandinavian Peninsula is equivalent to the distance from Denmark to the southern parts of Italy. The expansion in southern Scandinavia (Denmark and southern Sweden) during the Early Neolithic was rapid, lasting a few centuries (4000-3700 BC), followed by a consolidation of the agrarian way of life. The southeastern part of Norway may be a part of this Early Neolithic (4000-3500 BC) advance. The next advance, to the central parts of Scandinavia, is observed in the western part of Norway during the Middle Neolithic (2800-2400 BC), and the Late Neolithic (2400-1800 BC). The last advance towards northern Scandinavia and beyond the Arctic Circle is observable in the Middle and Late Bronze Age (1400-500 BC). The transition towards an agrarian way of life was probably different from region to region and occurred in a complex and continuous process of migration with gradual assimilation of pioneering farmers and local hunter-gatherers.

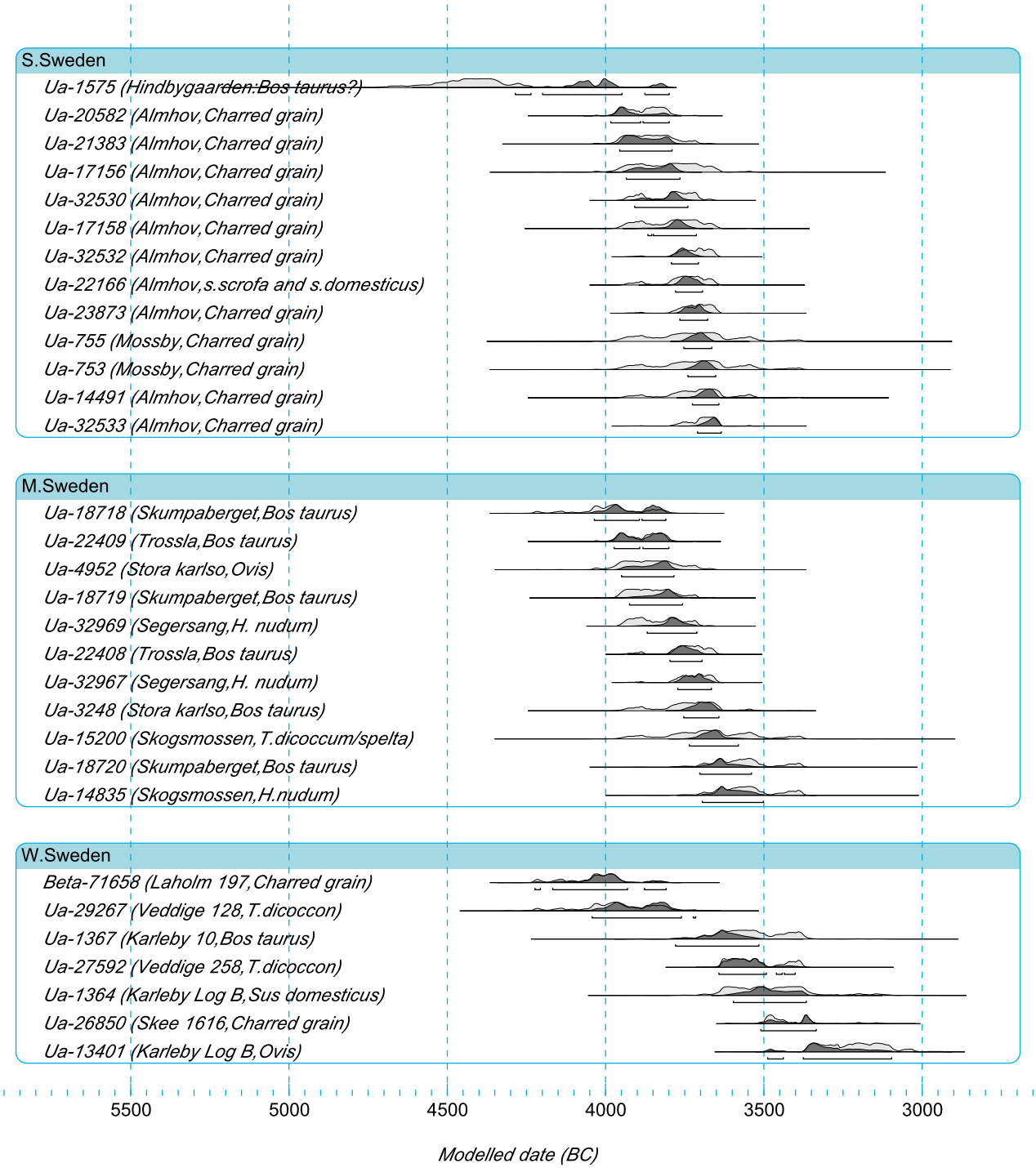
Introduction

The object of this paper is to investigate the speed of the expansion of agrarian societies in Scandinavia (Denmark, Sweden and Norway) in a long-term per-

Fig. 1. ^{14}C dates showing the expansion of agrarian societies during the Early Neolithic.

All radiocarbon dates have been calibrated using the OxCal v4.1.7 program.




S.Sweden
Ua-1575 (Hindbygaarden:Bos taurus?)
Ua-20582 (Almhov,Charred grain)
Ua-21383 (Almhov,Charred grain)
Ua-17156 (Almhov,Charred grain)
Ua-32530 (Almhov,Charred grain)
Ua-17158 (Almhov,Charred grain)
Ua-32532 (Almhov,Charred grain)
Ua-22166 (Almhov,s.scrofa and s.domesticus)
Ua-23873 (Almhov,Charred grain)
Ua-755 (Mossby,Charred grain)
Ua-753 (Mossby,Charred grain)
Ua-14491 (Almhov,Charred grain)
Ua-32533 (Almhov,Charred grain)
M.Sweden
Ua-18718 (Skumpaberget,Bos taurus)
Ua-22409 (Trossla,Bos taurus)
Ua-4952 (Stora karlso,Ovis)
Ua-18719 (Skumpaberget,Bos taurus)
Ua-32969 (Segersang,H. nudum)
Ua-22408 (Trossla,Bos taurus)
Ua-32967 (Segersang,H. nudum)
Ua-3248 (Stora karlso,Bos taurus)
Ua-15200 (Skogsmossen,T.dicoccum/spelta)
Ua-18720 (Skumpaberget,Bos taurus)
Ua-14835 (Skogsmossen,H.nudum)
W.Sweden
Beta-71658 (Laholm 197,Charred grain)
Ua-29267 (Veddige 128,T.dicoccon)
Ua-1367 (Karleby 10,Bos taurus)
Ua-27592 (Veddige 258,T.dicoccon)
Ua-1364 (Karleby Log B,Sus domesticus)
Ua-26850 (Skee 1616,Charred grain)
Ua-13401 (Karleby Log B,Ovis)
5500
5000
4500
4000
3500
3000
Modelled date (BC)

spective from 4000 to 500 BC (note 1). Such an investigation could modulate the hitherto entrenched positions in the discussion of whether agriculture was introduced by migrating agrarian societies or by local populations into a combination of the two hypotheses. But first it is necessary to explain what distinguishes a farmer from a hunter-gatherer. Hunting, fishing and gathering could be practised anywhere these activities were possible, independently of whether you were a hunter-gatherer or a farmer. What distinguishes farmers from hunter-gatherers in a Neolithic or Bronze Age context is cultivation and husbandry all year round. In the first place, cultivation requires a whole new set of technologies, including slash-and-burn activities for clearing the landscape, the preparation of fields, the sowing and growing of crops, the processing of grain and the storage of seeds. Secondly, keeping domesticated animals all year round requires storage of food for the winter. I therefore see no problem with the fact that Late Mesolithic or Neolithic hunter-gatherers could have kept a few domesticated animals for meat reserves. This does not make them farmers. Let us now take a look at the primary evidence of agriculture that documents the advance of agrarian societies in Scandinavia.

Cereal grains

Direct ^{14}C datings of charred cereal grains of Emmer *(Triticum dicoccoides)*, Einkorn *(Triticum monococcum)* and Naked barley *(Hordeum vulgare convar nudum)* have been established for Early Neolithic sites in southern Scandinavia. These are from the period 4000-3800 BC, which is contemporary with the period in which pollen samples from the same area show a higher degree of *Plantago lanceolata*. This could indicate clearances of the forest with the slash-and-burn method (Andersen 1993: 161ff; Odgaard 1994: 1ff; Rasmussen 2005: 1116ff; Sjögren 2006) (figs. 1 & 2). At the same time a few grain impressions have been identified in some Late Ertebølle potsherds from the coastal sites Löddesborg and Vik in Scania (Jennbert 1984). However, both sites have intermixed layers with Late Ertebølle and Early Funnel Beaker ceramics. Thus we cannot preclude the possibility that these sherds could originate from funnel beakers, since they have the same coarse tempering and thickness as the Ertebølle ceramics (Koch 1987: 107ff). Currently, there is no other archaeological evidence supporting any kind of cultivation during the Late Mesolithic in southern Scandinavia.

There are still no direct ^{14}C datings of cereal grains from the southeastern part of Norway (Østfold and Vestfold), but the region is probably connected with the Early Neolithic agrarian expansion, because cereal pollen from Napperød-

C-14 dates showing the expansion of Early Neolithic agrarian societies

Region	Site	Material	Lab. Nr.	BP	±	References
Northern Germany	Wangels LA 505	Ovis/Capra	KIA-7127	5325	45	Hartz & Lübke 2005, 119ff
Northern Germany	Wangels LA 505	Bos taurus	AAR-4998	5165	45	Hartz & Lübke 2005, 119ff
Northern Germany	Wangels LA 505	Ovis/Capra	KIA-7128	5085	45	Hartz & Lübke 2005, 119ff
Northern Germany	Wangels LA 505	Bos taurus	KIA-9824	5047	53	Hartz & Lübke 2005, 119ff
Denmark, Zealand	Lollikhuse	Bos taurus	AAR-7410-2	5890	55	Sørensen 2005, 304f
Denmark, Zealand	Knoglebo	Bos taurus	AAR-6944	5135	45	Heinemeier 2002, 273f
Denmark, Zealand	Åkonge	Bos taurus	AAR-4453	5135	50	Heinemeier & Rud 1999, 340
Denmark, Zealand	Lollikhuse	Ovis/Capra	AAR-4031	5120	55	Heinemeier & Rud 1999, 340
Denmark, Zealand	Åkonge	Bos taurus, calf	AAR-4452	5120	40	Heinemeier & Rud 1999, 340
Denmark, Zealand	Knoglebo	Castrated bull?	AAR-6943	5115	50	Heinemeier 2002, 273f
Denmark, Zealand	Skolæstbo	Bos taurus	AAR-6945	5110	40	Heinemeier 2002, 273f
Denmark, Zealand	Muldbjerg I	Bos taurus	AAR-4993	5050	45	Heinemeier & Rud 2000, 302
Denmark, Zealand	Smakkerup Huse	Bos taurus, ox	AAR-3316	5040	65	Price & Gebauer 2006, 123
Denmark, Zealand	Smakkerup Huse	Bos taurus, ox	AAR-3317	5040	60	Price & Gebauer 2006, 123
Denmark, Zealand	Øgårde I	Bos taurus, ox	K-5057	5030	90	Koch 1998, 253
Denmark, Zealand	Jorløse Mose	Ovis/Capra	AAR-3104	5020	60	Heinemeier & Rud 1998, 303
Denmark, Zealand	Muldbjerg I	Bos taurus	AAR-4994	5010	50	Heinemeier & Rud 2000, 302
Denmark, Bornholm	Limensgård	Hordeum	OxA-2895	5000	70	Fischer 2002
Denmark, Zealand	Åkonge	Bos taurus, cow	AAR-4451	4965	45	Heinemeier & Rud 1999, 340
Denmark, Zealand	Snævret Hegn	Bos taurus, ox	K-4771	4960	90	Koch 1998, 252
Denmark, Jutland	Visborg	Bos taurus	AAR-5004	4955	60	Heinemeier & Rud 2000, 302
Denmark, Jutland	Visborg	Bos taurus	AAR-5005	4925	55	Heinemeier & Rud 2000, 302
Denmark, Zealand	Bodal A	Bos taurus	AAR-7054	4920	40	Heinemeier 2002, 273f
Denmark, Zealand	Øgårde SV	Ovis	AAR-4320	4900	50	Heinemeier & Rud 1999, 340
Denmark, Zealand	Ullerødgård	Cereal from pit A493	KIA-36139	4890	90	Esben Aasleff personal comment
Denmark, Zealand	Sigersted III	Hordeum	AMS 1	4780	70	Koch 1998
Sweden, Scania	Hindbygården	Bos taurus?	Ua-1575	5570	110	Hadevik 2009
Sweden, Scania	Almhov	Charred cereal (a23455)	Ua-20582	5095	45	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal (A190499)	Ua-21383	5065	60	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal, A6b	Ua-17156	5000	95	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal, A1942	Ua-32530	5000	40	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal, A61	Ua-17158	4990	70	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal, K24 (A32422)	Ua-32532	4940	40	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	s. scrofa and s. domesticus	Ua-22166	4960	50	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal, P04 (A32422)	Ua-23873	4930	45	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Mossby	Charred cereal	Ua-755	4925	115	Larsson 1992, 74
Sweden, Scania	Mossby	Charred cereal	Ua-753	4915	110	Larsson 1992, 74
Sweden, Scania	Almhov	Charred cereal, A2778	Ua-14491	4910	80	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal (A35862)	Ua-32533	4910	45	Nilsson &Rudebeck 2010, 112ff
Middle Sweden, Närke	Skumpaberget	Bos taurus	Ua-18718	5170	65	Hallgren 2008
Middle Sweden, Södermanland	Trössla	Bos taurus	Ua-22409	5105	45	Hallgren 2008
Middle Sweden, Gotland	Stora karlsö	Ovis	Ua-4952	5070	75	Lindqvist & Possnert 1997
Middle Sweden, Närke	Skumpaberget	Bos taurus	Ua-18719	5055	50	Hallgren 2008
Middle Sweden, Södermanland	Segersäng	H. nudum	Ua-32969	5025	45	Hallgren 2008
Middle Sweden, Södermanland	Trössla	Bos taurus	Ua-22408	4955	45	Hallgren 2008
Middle Sweden, Södermanland	Segersäng	H. nudum	Ua-32967	4940	40	Hallgren 2008
Middle Sweden, Gotland	Stora karlsö	Bos taurus	Ua-3248	4935	75	Lindqvist & Possnert 1997
Middle Sweden, Västmanland	Skogsmossen	T. dicoccum/spelta	Ua-15200	4880	110	Hallgren 2008
Middle Sweden, Närke	Skumpaberget	Bos taurus	Ua-18720	4810	75	Hallgren 2008
Middle Sweden, Västmanland	Skogsmossen	H. nudum	Ua-14835	4795	75	Hallgren 2008
Western Sweden, Halland	Laholm 197	Charred cereal	Beta-71658	5200	60	Svensson 2010
Western Sweden, Halland	Veddige 128	T. dicoccon	Ua-29267	5160	78	Johansson et al. 2011
Western Sweden, Västergötland	Karleby 10	Bos taurus	Ua-1367	4775	95	Persson 1999
Western Sweden, Halland	Veddige 258	T. dicoccon	Ua-27592	4750	50	Ryberg 2006
Western Sweden, Västergötland	Karleby Log B	Sus domesticus	Ua-1364	4710	100	Persson 1999
Western Sweden, Bohuslän	Skee 1616	Charred cereal	Ua-26850	4615	40	Westergaard 2008
Western Sweden, Västergötland	Karleby Log B	Ovis	Ua-13401	4530	60	Karl Göran Sjögren personal com.

Fig. 2. Table of the different Early Neolithic sites in Southern Scandinavia where primary agrarian evidence has been ^{14}C-dated.

tjern (5460±230 BP; 4827-3785 cal BC), Haraldstadmyr (5010±100 BP; 4037-3637 cal BC) and Haraldsvann (5010±70 BP; 3956-3661 cal BC) has been dated to this period (Henningsmoen 1980; Østmo 1988; Prøsch-Danielsen 1996: 85ff; Glørstad 2010: 275). Directly dated cereal grains are also missing for western Norway (Hordaland), although a wide range of sites from the Middle Neolithic (2800-2400 BC) have produced charcoal layers that have been interpreted as representing cultivation with the slash-and-burn method (Olsen 2009: 589ff) (figs. 11 & 12). Furthermore, cereals were present in pollen analyses ^{14}C-dated to the Middle Neolithic in western Norway (Hordaland), which document cultivation activities during this period (Hjelle et al. 2006: 147ff). In the central part of Sweden (Västernordland) direct ^{14}C datings of charred cereal grains from the Late Neolithic have been reported from Bjästemon and Lill-Mosjön, whereas we have no direct ^{14}C dates from central Norway (Trøndelag). However, a piece of charcoal from the site Egge in Trøndelag was ^{14}C-dated to the Early Bronze Age (3385±70 BP; 1745-1520 cal. BC) (TUa-3645); this came from a ploughmark that contained a grain of barley (Solem 2002: 6ff). A grain kernel from Stiurhelleren farther north in Nordland produced a slightly later ^{14}C dating to the Middle and Late Bronze Age. Pollen of cereals from Bakkan, also in Nordland, indicates when agriculture expanded to the vicinity of the Arctic Circle and beyond (Johansen & Vorren 1986: 740; Johansen 1990: 5). In northern Norway (Troms) a grain of barley from Kveøya was ^{14}C-dated to (3936±30 BP; 2564-2307 cal BC) (Wk-26504). Currently this is the only grain documenting agrarian activities this far north during the Late Neolithic. It must be treated with caution, because most ^{14}C datings place the cultivation of wheat and barley within the middle and later parts of the Bronze Age (Arntzen & Sommerseth 2010).

Domesticated animals

Domesticated cattle *(Bos taurus)* are observed throughout southern Scandinavia around 4000-3700 BC (figs. 1 & 2). Recently, what were presumed to be domesticated cows from Rosenhof LA 58 and 83 were dated to 4700 BC. But after a DNA analysis, they turned out to be small aurochses (Hartz & Lübke 2005; Noe-Nygaard et al. 2005). An early cow tooth from Lollikhuse was dated to (5890±55 BP; 4929-4612 cal BC) (AAR-7410-2). This is in fact probably an exotic pendant demonstrating direct or indirect contacts with farming societies in central Europe (Sørensen 2005: 305). Cow bones from Smakkerup Huse have also been used to argue that Ertebølle hunters had access to domesticated animals (Price & Gebauer 2006). These

bones were dated to (5059±68 BP; 3981-3701 cal BC) (AAR-3316) and (5060±61 BP; 3968-3711 cal BC) (AAR-3317) and were found in stratified Late Atlantic refuse layers. Unfortunately the actual site was eroded by transgressions and regressions in the Subboreal period, and we cannot rule out the possibility that these bones belong to an Early Funnel Beaker occupation. Sheep and goat *(Ovis/Capra)* also appear in southern Scandinavia during the period 4000 to 3800 BC and a few centuries later in western Sweden. Domesticated pigs *(Sus domesticus)* and wild boars *(Sus scrofa)*, found together in a pit at the Early Neolithic site Almhov in Scania, have been dated to (4960±50 BP; 3937-3645 cal BC) (Ua-22166) (Nilsson & Rudebeck 2010: 112ff). However, the identification of domesticated pigs has proven difficult, based as it often is on the criterion that they were smaller than wild boars and had a different length and anterior breadth of the third molar (Brinch Petersen & Egeberg 2009: 562). Future DNA analysis could resolve this issue. Currently there is no certain archaeological evidence of entire domesticated animals (except the dog) earlier than 4000 BC in southern Scandinavia. A summary of the early datings of cereal grains and domesticated animals in southern Scandinavia clearly demonstrates that we are dealing with a process of rapid expansion.

We lack direct ^{14}C datings of domesticated animals from the Early Neolithic in the southeastern part of Norway. From the western part of Norway (Hordaland) datings of *Bos taurus* and *Ovis/Capra* from Skipshelleren and faeces from *Ovis* from the site Budalen belong to the middle and later part of the third millennium BC. The same result emerged from a ^{14}C dating of a cattle tooth from the kitchen midden at Hammersvolden in Trøndelag in the central part of Norway. Farther north near the Arctic Circle (Nordland) an *Ovis* tooth has been ^{14}C-dated to the Early Bronze Age on Stiurhelleren (Johansen 1990: 5). A slightly later ^{14}C dating to the Late Bronze Age of a *Bos taurus* has been reported from Storbåthallaran (Nordland), which is located north of the Arctic Circle (Johansen & Vorren 1986: 742). Investigating the direct ^{14}C datings of cereal grains and domesticated animals has enabled us to follow the agrarian expansion towards northern Scandinavia (figs. 11, 12 & 13).

Cultivation and crop processing

Indirect evidence of cultivation has been reported in the form of cereal crop processing and threshing waste from Emmer *(Triticum dicoccoides)* used as chaff tempering in clay discs, which has been found in some pits from the Early Neolithic site at Lisbjerg Skole near Århus (Skousen 2008: 124). ^{14}C analysis of hazelnut shells from the pits (A-2087,

A-2092 and A2165) dates the material to (5190±90 BP; 4251-3785 cal BC) (AAR-8542) and to (4975±55 BP; 3942-3651 cal BC) (AAR-9225). Straw or chaff tempering is also found in clay discs from the Early Neolithic site Store Valby (Becker 1954: 134ff; Helbæk 1954: 198ff; Nielsen 1984: 119). Other evidence of crop processing can be revealed by the existence of quern stones. These have been reported from Early Neolithic sites in Denmark and Sweden (Erantisvej and Kallmossen), which both contain short-necked funnel beakers (Staal 2005; Hallgren 2008: 211). Moreover, wear on sickles from Early Neolithic sites also document harvesting activities (Juel Jensen 1994). The ^{14}C dates of the pits at Lisbjerg Skole are very important, because they document cultivation and crop processing which could be earlier than the *Ulmus-fall* (Andersen & Rasmussen 1993: 125ff). Currently our knowledge of cereal crop processing from Neolithic contexts in Scandinavia is still rather limited, but offers huge potential, whereas cultivation using slash-and-burn methods is better documented.

The earliest plough-marks from southern Scandinavia were found beneath a long barrow at Højensvej 7 near Egense on Funen. They covered an area of 85 square metres, thus illustrating intensive cultivation (Beck 2009: 7ff, in prep.). Some of the plough-marks were cut by a pit which was dated by a hazelnut shell to (4900±40 BP; 3770-3637 cal BC) (POZ-28068). Other plough-marks with more limited extensions have been identified beneath a few long barrows in Jutland and Funen (Jørgensen 1977: 7ff; Fischer 1980: 23ff; Ebbesen 1992: 96). We can conclude that the larger fields were cultivated using the ard to get the maximum yield from the soil as early as the beginning of the Early Neolithic.

From the southeastern part of Norway (Østfold and Vestfold) there are no plough-marks, although some could be concealed underneath some of the few megaliths from this region. Clear evidence of cultivation using the slash-and-burn method has been reported from western Norway (Hordaland) (Olsen 2009: 592ff). ^{14}C datings of the charcoal layers from several sites in this region range from the Middle to the Late Neolithic, making them contemporary with the evidence of domesticated animals and pollen analysis in western Norway. In the central parts of Norway (Trøndelag) and Sweden (Västernordland) evidence of cultivation is rather sparse (Asprem 2012; Gustafsson & Spång 2007). However, farther north beyond the Arctic Circle plough-marks from Moland (Nordland) have been dated by charcoal found in one of the tracks to the Late Bronze Age and Pre-Roman Iron Age (Johansen & Vorren 1986: 742). A simi-

lar ^{14}C result emerged from a ploughmark from Skålbunes in Troms, which is also located beyond the Arctic Circle (2273±35 BP; 400-209 cal BC) (Wk-20626) (Arntzen 2012). The meagre evidence of cultivation shows more or less the same tendencies in the rate of agrarian advance in Scandinavia (Figs. 11 & 12). Let us go through the secondary evidence from these agrarian societies.

The secondary evidence

A different material culture, found in southern Scandinavia at the beginning of the fourth millennium BC, points towards migrations of farmers from central Europe expanding into southern Scandinavia. It consists of point-butted axes (Nielsen 1977: 65ff), jade axes (Klassen 2004), battle axes (Zápotocký 1992; Ebbesen 1998: 77ff), short-necked funnel beakers (Koch 1998), clay discs (Davidsen 1973: 5ff) and copper (Klassen 2000). The structures include two-aisled houses (Nielsen 1997: 9ff), flint mines (Becker 1980: 456ff; Olausson et al. 1980: 183), long barrows (Rudebeck 2002: 119ff) and later Sarup enclosures (Andersen 1997) and long dolmens (Ebbesen 2011).

In the southeastern part of Norway material culture in the form of funnel beaker ceramics (Østmo 2007), thin-butted axes (Hinsch 1955), polygonal battle axes (Mikkelsen 1984) and megaliths (Østmo 1988) can be associated with the Funnel Beaker Culture. In the western part of Norway the agrarian expansion during the Middle Neolithic is associated with the sudden appearance of material culture containing thick-butted axes, battle axes and structures (two-aisled houses) all belonging to the Battle Axe Culture (2800-2400 BC) (Olsen 2009: 590ff). In the central parts of Norway artefacts like battle axes (Asprem 2012) and flint daggers (Hagen 1983; Apel 2001: 282) of type 1 can be connected to the agrarian expansion (Lomborg 1973) (fig. 10). In northern parts of Norway bronze artefacts from the Middle and Late Bronze Age together with rock carvings of ships have a southern Scandinavian origin which may be connected with the latest expansion beyond the Arctic Circle (Arntzen & Sommerseth 2010: 122ff; Rønne 2011: 58ff; Kaul 2011: 44ff). Furthermore a 12 m long three-aisled house found on Kveøya in Troms, dated to (2642±30 BP; 892-781 cal BC) (Wk-24533) may also have been connected with this advance (Arntzen & Sommerseth 2010; Arntzen 2012).

Axes in southern Scandinavia

The distribution of the Early Neolithic battle axes is significant, because they illustrate dense concentrations in central Europe, thus indicating an origin of these pioneering farmers within the Michelsberg and Baalberg cultures (Lüning 1968) (fig. 3). The earliest types of battle axes,

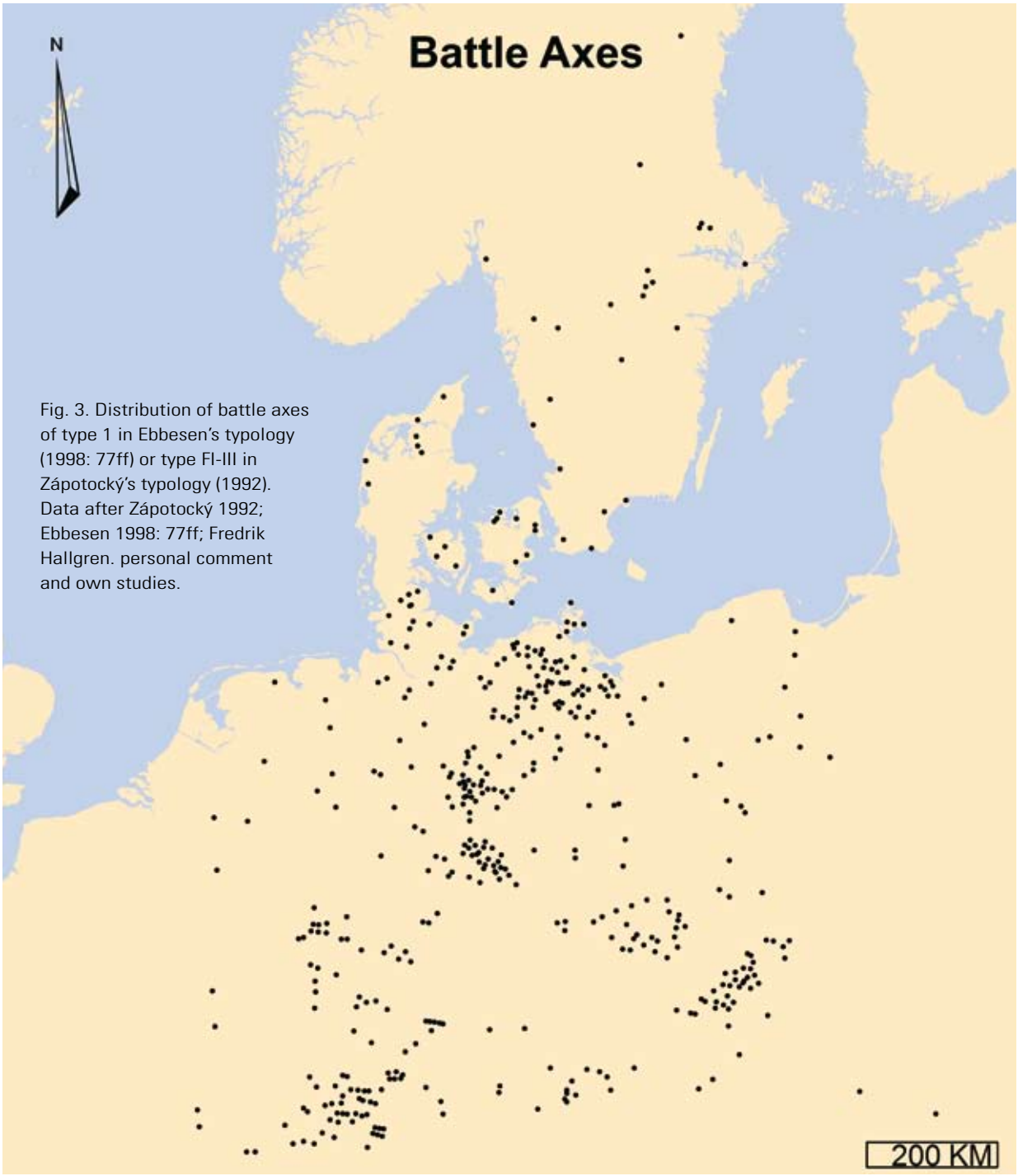


Fig. 3. Distribution of battle axes of type 1 in Ebbesen's typology (1998: 77ff) or type FI-III in Zápotocký's typology (1992). Data after Zápotocký 1992; Ebbesen 1998: 77ff; Fredrik Hallgren. personal comment and own studies.

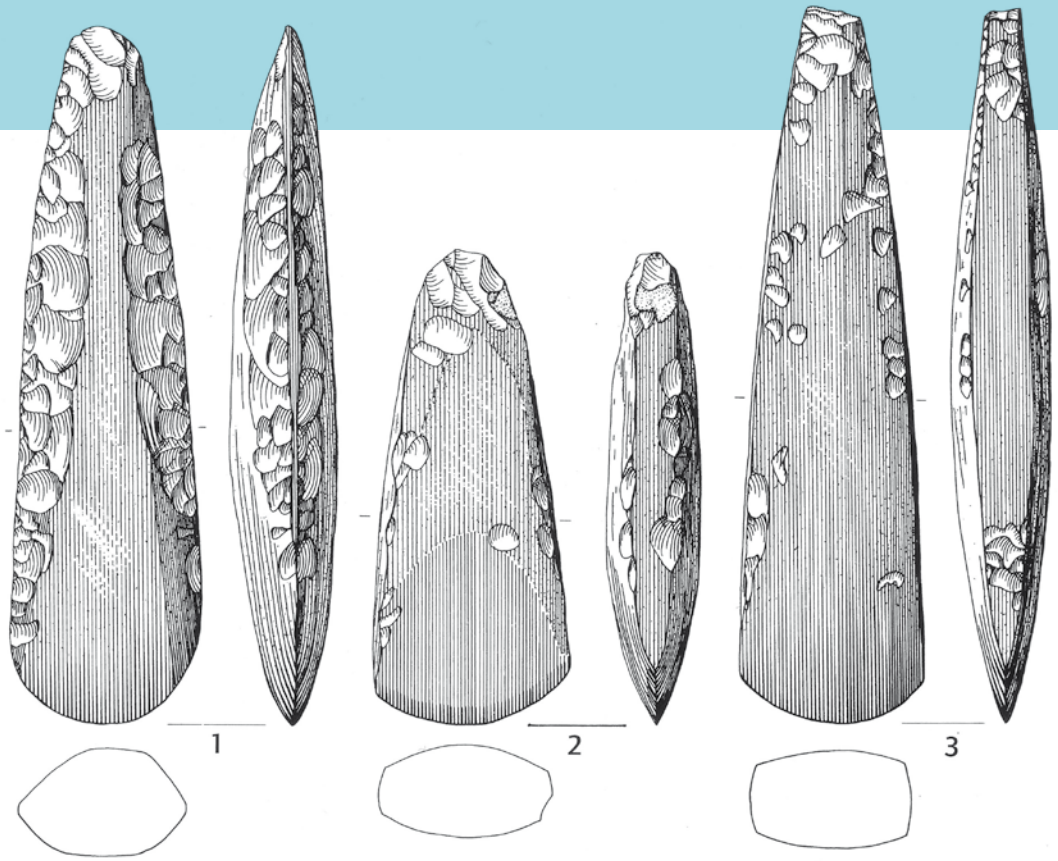


Fig. 4. Drawing of point-butted axes and their cross-section of type 1, 2 and 3. Type 1 has an oval cross-section. Type 2 has a three-sided cross-section. Type 3 has a four-sided cross-section. After: Petersen 1993.

type 1 in Ebbesen's typology (1998: 77ff) or type FI-III in Zápotocký's typology (1992), have been found in the Dragsholm burial. In this burial an antler pick was dated to (5090 ±65BP; 4036-3712 cal BC) (AAR-7418-2) and a human bone was dated to (5102±37; 3973-3797 cal BC) (AAR-7416-2), thus dating the earliest battle axes to the beginning of the fourth millenium BC (Brinch Petersen 2008: 33ff).

Particularly important too is the distribution pattern of polished point-butted axes of flint, which are associated with Early Neolithic sites with short-necked funnel beakers (fig. 4). Point-butted flint axes from ^{14}C-dated contexts and depositions demonstrate overlaps among the three types, but support the typology originally proposed by Nielsen (1977) (figs. 6, 7 & 8). The distribution of the point-butted axes indicates relatively dense inland habitation during the Early Neolithic (fig. 5). They seem to be concentrated in regions with light, easily arable soils. The point-butted and thin-butted flint axes from southern Norway (Hinsch 1955; Østmo 1988, 2007: 111ff) are probably related to the Early Neolithic agrarian expansion, whereas the point-butted axes from Trøndelag represent long-distance exchange networks with hunter-gatherer groups in the northern parts of Scandinavia (Valen 2012).

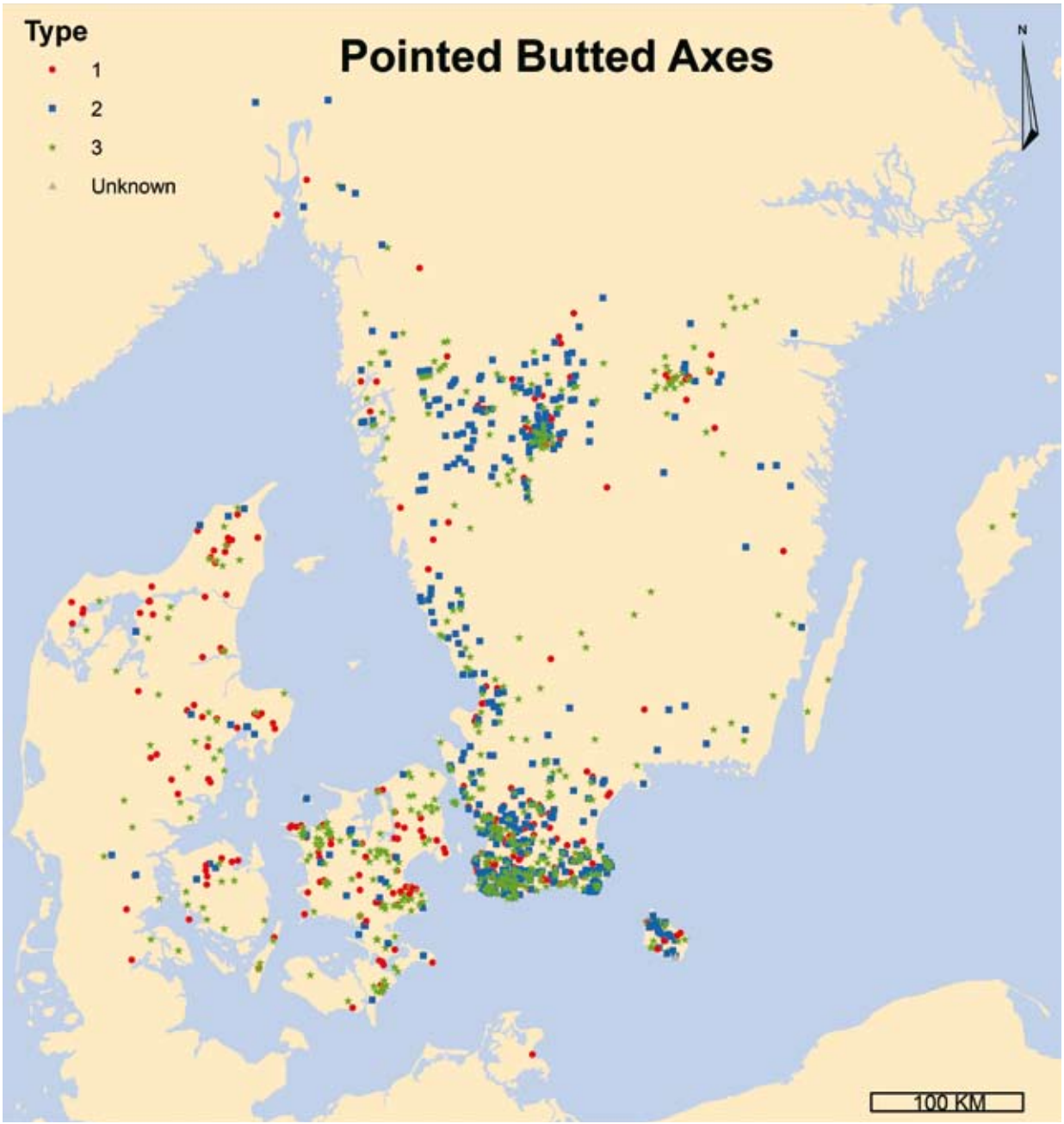


Fig. 5. Distribution of point-butted axes in Southern Scandinavia based on data from Denmark (Brøndsted 1938: 130ff), Scania (Hernek 1988: 216ff), Bohuslän, Dalsland, Halland and Vester Götland (Blomqvist 1990), Bornholm (Nielsen 2009: 16ff), central parts of Sweden (Hallgren 2008), Southern Norway (Østmo 1986: 190ff), central parts of Norway (Valen 2012) and own studies.

Depositions of pointed butted flint axes and their combination of types

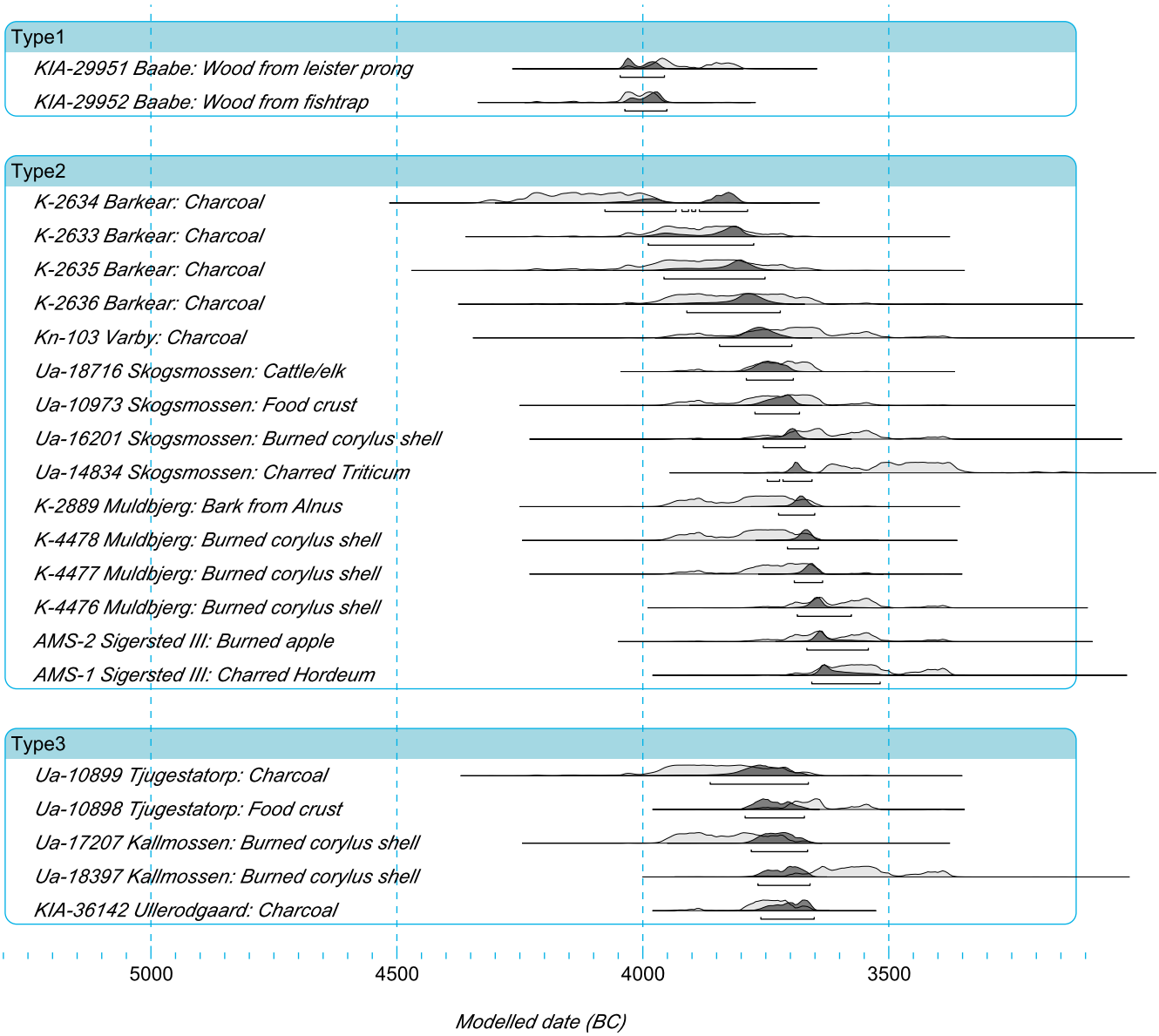
Site	Region	Nr. of axes	Polished or unpolished	1	2	3	Thin	Reference
Järavallen	Scania	11	unpolished	X				Rydbeck 1918, 9
Hammelen	Scania	2	unpolished	X				Rydbeck 1918, 9
Lackalänga	Scania	1+grinding stone	unpolished	X				Karsten 1994, 226
Svedala	Scania	1+grinding stone	polished	X				Rydbeck 1918, 9
Grönby	Scania	8	unpolished	X				Nielsen 1977, 121
Arrie	Scania	4	unpolished	X	X			Rydbeck 1918, 9ff
Ravnekær	Bornholm	5	polished and unpolished		X			P. O. Nielsen personal com.
Karaby	Scania	2	unpolished		X			Rydbeck 1918, 9
Dalby	Scania	2	polished		X			Rydbeck 1918, 12ff
Borgeby	Scania	2	polished		X			Rydbeck 1918, 12ff
V. Ågården	Vendsyssel	2	unpolished		X			Nielsen 1977, 121
Eslöv	Scania	2	unpolished		X			Nielsen 1977, 121
Fränninge	Scania	1+grinding stone	polished		X			Karsten 1994, 309
V. Ågården	Vendsyssel	3	unpolished		X	X		Nielsen 1977, 121
Li Markie nr. 7	Scania	3	unpolished		X	X		Rydbeck 1918, 11ff
Gualöv	Scania	3	polished		X	X	X	Karsten 1994, 348
Vanstad	Scania	2	polished			X		Rydbeck 1918, 16ff
Smeby Slöta	Västergötaland	5	polished			X		Nielsen 1977, 121
Ullerødgård	Zealand	3	polished			X	X	Rosenberg 2006
Kvistofta	Scania	3	polished			X	X	Karsten 1994, 215
Skegrie	Scania	2	unpolished			X	X	Karsten 1994, 294
Skurup	Scania	10	polished and unpolished			X	X	Karsten 1994, 303
Svedala	Scania	11	polished and unpolished			X	X	Karsten 1994, 274
Södra Åsum	Scania	2	polished			X	X	Karsten 1994, 310
Fjälkinge	Scania	2	polished and unpolished			X	X	Karsten 1994, 343
Kverrestad	Scania	3	polished			X	X	Karsten 1994, 328
Öster Sönnarslöv	Scania	2	unpolished			X	X	Karsten 1994, 347
Hörby	Scania	6	polished			X	X	Karsten 1994, 238
Bodarp	Scania	6	unpolished			X	X	Karsten 1994, 282

Fig. 6. Table showing the depositions of point-butted flint axes and their type combinations.

Evidence of agrarian activity is first observed from the Middle and Late Neolithic in the western and central parts of Norway. The Middle Neolithic battle axes found in these areas have parallels in the Battle Axe Culture, thus indicating communication between western and eastern Norway and the western part of Sweden (Olsen 2009: 587). Lines of communication went not only east and west but also south and north, since a huge number of flint daggers from southern Scandinavia have been found along the coast of Norway (Apel 2001). There must have been huge, systematic production and distribution of axes, and later of daggers and sickles, from these flint mines in southern Scandinavia. This is revealed

Fig. 7. ^{14}C dates of Early Neolithic sites or contexts containing point-butted axes.

All radiocarbon dates have been calibrated using the OxCal v4.1.7 program.



C-14 dates of Early Neolithic sites and contexts with pointed butted axes

Site	Type	BP	±	Lab nr.	Material	References
Baabe	1	5134	44	KIA-29951	Wood from leister prong	Hirsch et al. 2007, 25ff
Baabe	1	5203	36	KIA-29952	Wood from fishtrap	Hirsch et al. 2007, 25ff
Barkær	2	5270	75	K-2634	Charcoal	Liversage 1992, 59
Barkær	2	5100	75	K-2633	Charcoal	Liversage 1992, 59
Barkær	2	5090	100	K-2635	Charcoal	Liversage 1992, 59
Barkær	2	5010	100	K-2636	Charcoal	Liversage 1992, 59
Värby	2	4900	100	Kn-103	Charcoal	Salomonsson 1970, 72
Skogsmossen	2	4940	50	Ua-18716	Cattle/elk	Hallgren 2008, 233ff
Skogsmossen	2	4930	80	Ua-10973	Food crust	Hallgren 2008, 233ff
Skogsmossen	2	4850	80	Ua-16201	Hazel-nut	Hallgren 2008, 233ff
Skogsmossen	2	4680	70	Ua-14834	Charred Triticum	Hallgren 2008, 233ff
Muldbjerg	2	4980	70	K-2889	Bark from Alnus	Troels-Smith 1957, 1ff; Stafford 1999, 91
Muldbjerg	2	4940	65	K-4478	Burned hazelnutshell	Troels-Smith 1957, 1ff; Stafford 1999, 91
Muldbjerg	2	4930	65	K-4477	Burned hazelnutshell	Troels-Smith 1957, 1ff; Stafford 1999, 91
Muldbjerg	2	4830	65	K-4476	Burned hazelnutshell	Troels-Smith 1957, 1ff; Stafford 1999, 91
Sigersted III	2	4840	70	AMS-2	Charred apple	Koch 1998
Sigersted III	2	4780	70	AMS-1	Charred barley	Koch 1998
Tjugestatorp	3	5050	90	Ua-10899	Charcoal	Hallgren 2008, 233ff
Tjugestatorp	3	4865	55	Ua-10898	Food crust	Hallgren 2008, 233ff
Kallmossen	3	5025	60	Ua-17207	Hazel-nut shell	Hallgren 2008, 233ff
Kallmossen	3	4795	75	Ua-18397	Hazel-nut shell	Hallgren 2008, 233ff
Ullerødgård	3	4965	35	KIA-36142	Charcoal	Esben Aasleff personal comment

Fig. 8. Table of ^{14}C dates from Early Neolithic sites or contexts containing point-butted axes in southern Scandinavia.

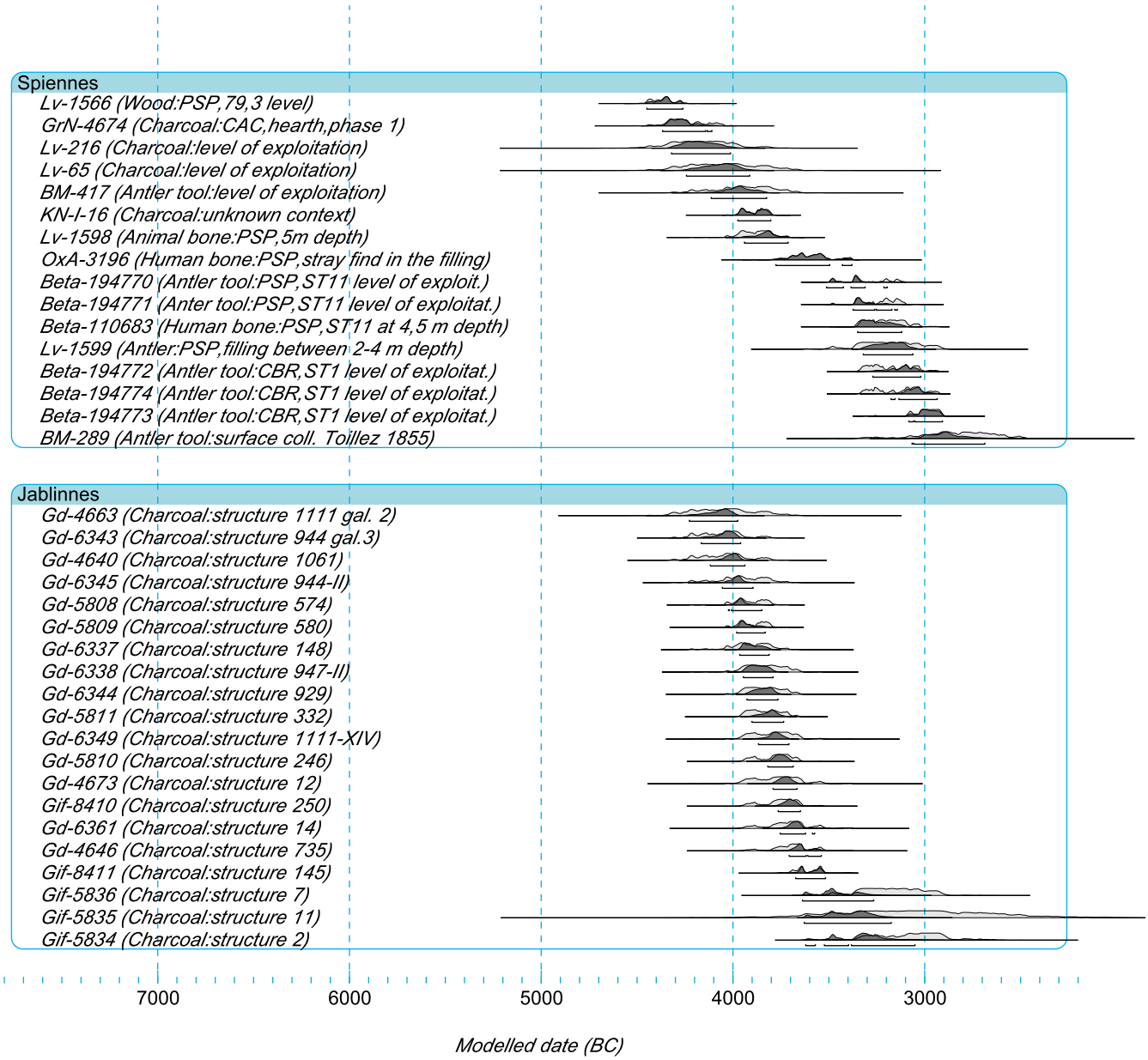
by clear concentrations of Neolithic axes, daggers and sickles near the flint mines in northern Jutland (Hov, Bjerre and Skovbakken), eastern Zealand (Stevns, now eroded by the sea) and Scania (Södra Sallerup) (Becker, 1980: 456ff; Olausson et al. 1980: 183; Sarauw 2007; Bech & Mikkelsen 1999: 65ff; Eriksen 2010: 81ff).

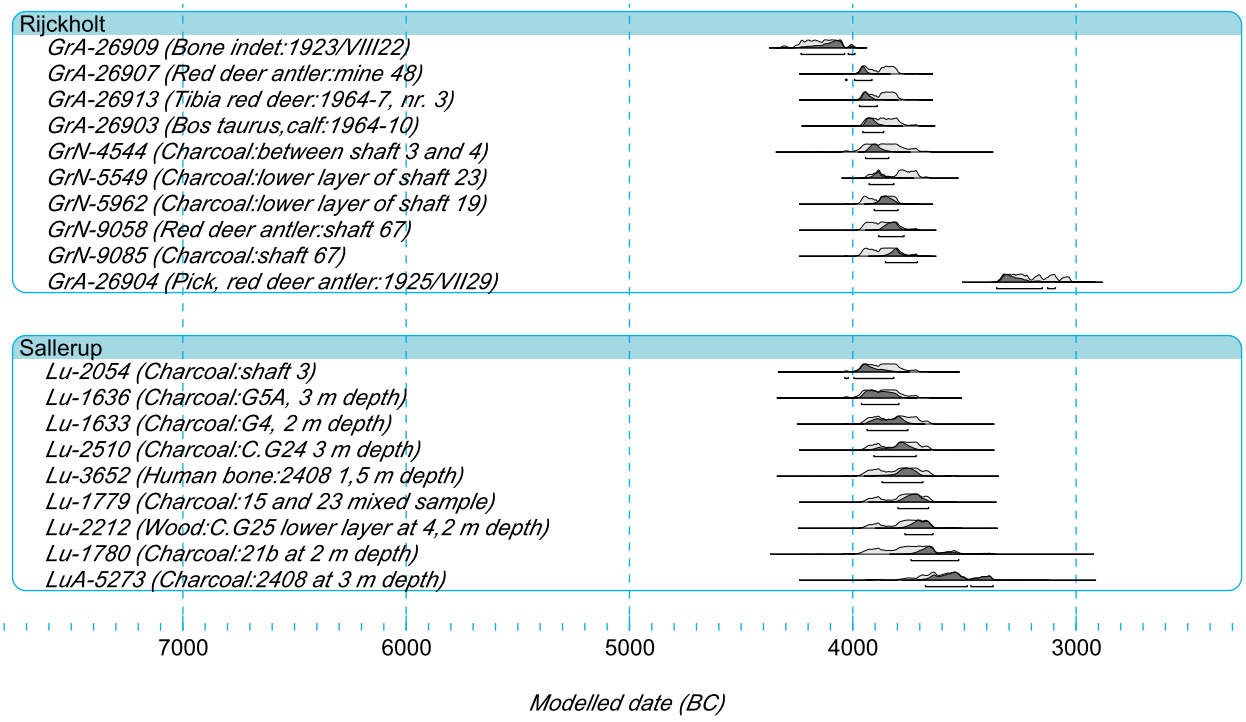
Flint mining

Deep mining for flint is a characteristic feature of the central European Michelsberg Culture (4400-3500 BC) (Lüning 1968). The mines at Spiennes in southern Belgium, Rickholt in the Netherlands and Jablines/Le Haute Château in northern France all begin their activities between 4400 and 4200 BC (Bostyn & Lanchon 1992; Collet et al. 2004: 151ff; Grooth et al. 2011: 77ff) (fig. 9). Preforms of point-butted axes found in all these mines prove that we are dealing with systematic production. The earliest evidence of mining in southern Scandinavia is docu-

Fig. 9. ^{14}C dates of Early Neolithic flintmines.

Flint mines at Spiennes in southern Belgium, Rickholt in the Netherlands, Jablines/Le Haute Château in Northern France and Södra Sallerup in Scania. Based on data from Bostyn & Lanchon 1992; Collet et al. 2004: 151ff; Grooth et al. 2011: 77ff; Olausson et al. 1980: 183; Elisabeth Rydebeck. personal comment. All radiocarbon dates have been calibrated using the OxCal v4.1.7 program.





mented at Södra Sallerup, which has been dated to 4000 cal BC (Olausson et al. 1980: 183). The practice of mining flint probably came together with these central European pioneering farmers. Many of the mines continued in use producing flint daggers and sickles in the Late Neolithic and Bronze Age.

Reasons for the different expansions in Scandinavia

The reasons for the different expansions in Scandinavia are still unclear. One of the reasons for the expansion during the Early Neolithic to southern Scandinavia could be the relatively easy access to some of the best flint resources in northern Europe. Clearly good flint resources did not play a role during the later expansions farther north. Another possible explanation could be growing population pressure combined with the fact that cultivation by the slash-and-burn method requires much space. These factors could have forced pioneering farmers during the Neolithic and Bronze Age to cultivate new lands farther north, thus pushing agriculture farther north. The various stagnations and declines might be explained by reactions against the agrarian way of life or variations in the climate conditions. The ability of grains to

grow in colder environments with short summers, together with positive climatic conditions for early agriculture, might be very important reasons for sudden expansions or stagnations. An example of stagnation and decline has been interpreted for the Pitted Ware Culture (3200-2300 BC). Instead of a consolidation phase in agrarian society during the Middle Neolithic, a return to a hunter-gatherer way of life along the east and west coasts of Sweden is evident. The classical Pitted Ware sites from Gotland illustrate specialized hunter-gatherer subsistence. However, there are also examples of Pitted Ware sites with a mixed economy consisting of agriculture with some hunting and fishing (Larsson 1992: 91ff, 2004: 61ff; Burenhult 1997).

Many of the expansions in Scandinavia could have consisted of small groups of pioneering farmers. Recently Rowley-Conwy (2011) has suggested that pioneering farmers expanded to the north in a process of leap-frogging, punctuated or sporadic immigration. A similar model has been presented by Zilhao (2001: 14180ff) to explain rapid Neolithic expansion in the Mediterranean. The expansion towards Scandinavia happened so fast during the Early Neolithic that boats must have been used, as indicated by very early Neolithic agrarian habitations on islands like Bornholm and Gotland (Lindqvist & Possnert 1997: 73f; Casati & Sørensen 2006: 39; Nielsen 2009: 9ff). Boats were probably also involved in the later expansions during the Neolithic and Bronze Age demonstrated by the distribution of thin-butted axes, battle axes, flint daggers and bronze artefacts along the western coast of Norway (Hinsch 1955; Apel 2001: 282; Asprem 2012; Valen 2012; Rønne 2011: 58ff).

Cultural dualism

Discussion of whether agriculture was introduced by migrating farmers or local hunter-gatherers during the Neolithic and Bronze Age still characterizes the debate in Scandinavia. During the Neolithic an agrarian way of life was practised on inland sites at the same time as hunting and fishing at sites near the coast, fjords or the larger inland lakes. Are we dealing with 'commuting' farmers or cultural dualism? If hunter-gatherers embarked on the venture of keeping domesticated animals all year round, they would have had to collect huge amounts of food for the winter months. In order to get enough food it would be necessary to cultivate larger fields of grain and grass so that sufficient straw and hay could be dried for the winter. This would require long-term skill in agrarian technologies to succeed. If these hunter-gatherers were to succeed as farmers, they would gradually need to integrate with agrarian societies. In particular, the use of slash-and-burn technique to clear the forest

for cultivation required planning several years ahead. Several experiments have shown that after two to three years of cultivation the nutrients in the soil were used up, with the consequence that the yield would fall drastically (Lünning 2000: 174; Ehrmann et al. 2009: 44ff; Schier 2009: 15ff). After this the field could be used as a grazing area for domesticated animals. But in order to continue cultivation it was necessary to start all over in another area, thus proving that this method requires access to huge areas. Recently, Kind (2010: 457) has proposed that the transition towards agriculture is determined by intensified social interaction between local hunter-gatherers and pioneering farmers, who are characterized as the "managers of neolithisation".

Cultural dualism could be indicated by evidence of actual cultivation found at a hunter-gatherer site. The Early Neolithic Bjørnsholm kitchen midden could be one such site, because pollen of barley *(Hordeum)* and wheat *(Triticum)* was found beneath the neighbouring long dolmen (Andersen & Johansen 1992: 38ff; Andersen 1993: 59ff). Visborg could be another example, because a burned layer beneath the kitchen midden indicates use of the slash-and-burn method (Andersen 2008: 69ff). A different case of cultural dualism could be the Early Neolithic Dragsholm man, who was buried in a kitchen midden and equipped as a warrior. He might have been a typical "manager of neolithisation" (Brinch Petersen 2008: 33ff). Cultural dualism has also been proposed between the Pitted Ware Culture (hunter-gatherers) and Battle Axe Culture (farmers). The early battle axe types within the Battle Axe Culture were concentrated at inland sites and are rarely found at the coastal Pitted Ware sites. This indicates two separate material cultures and thus cultural dualism. Later battle axe types, however, have been found at coastal sites, and this documents a gradual assimilation of Pitted Ware people into the Battle Axe tradition (Larsson 1992: 146ff; Iversen 2010: 32).

In Norway the process of cultural dualism might be indicated when a rapid transition to agriculture is evident. During the Early Neolithic in southeastern Norway, there is very little primary evidence of cultivation, which could indicate that agriculture only played a minor role in Early Neolithic subsistence (Prescott 1996: 77ff, 2009: 193ff). Recently Glørstad has interpreted the Early Neolithic in southeastern Norway as an expansion of big game hunting, not of agriculture (Glørstad 2010: 287). However, the sudden appearance of megaliths, polygonal battle axes and point-butted and thin-butted axes together with pollen from cereals could be interpreted as

pioneering farmers entering this area from southern Scandinavia (Østmo 1988). However, more investigation of this region is needed in the future. A rapid transition towards agriculture is also documented in western Norway during the Middle Neolithic by direct ^{14}C datings of cultivation layers. Whether agriculture was introduced by migrating farmers or local hunter-gatherers is still an open question (Hjelle et al. 2006: 147ff). If migrating farmers had arrived in large numbers, we should be able to find changes in material culture corresponding to those in the source areas. However, no such evidence has been found. A possible scenario could involve small groups of pioneering farmers entering western Norway by boat from southeastern Norway or western parts of Sweden at places with easily cultivable land (Olsen 2009: 590ff; Østmo 2010: 44ff). An expansion farther north along the western coast of Norway may be associated with the wide distribution of flint daggers during the Late Neolithic, and of bronze artefacts during the Bronze Age (Prescott 1996: 85; Apel 2001; Rønne 2011; Kaul 2011) (fig. 10). Currently it is difficult to conclude whether agriculture was brought to the middle and northern parts of Norway by migrating farmers or local hunter-gatherers. Future studies should concentrate on finds from sites located on easily cultivable land in Norway in order to gain new knowledge from these agrarian settlements. Many of these sites are located near the sea. It is probable that farming in Norway also involved more exploitation of marine resources than in other regions in Scandinavia.

Another way of documenting cultural dualism is by conducting DNA analyses. The burial site at Ostorf in northern Germany was originally interpreted as a hunter-gatherer enclave surrounded by agrarian societies, because the individuals showed a high intake of marine resources (Lübke et al. 2009; Shulting 2011: 21). However, three burials contained Palaeolithic/Mesolithic haplogroups U5 and U5a, while four other burials contained Neolithic haplogroups J, K and T2e (Bramanti et al. 2009: 139). The individuals at Ostorf are a rare example of hunter-gatherers and possible farmers who may have integrated with each other. Moreover, recent studies have shown that Palaeolithic/ Mesolithic haplogroup U (U4 and U5) exists among Neolithic individuals and Bronze Age populations in southern Scandinavia (Melchior et al. 2010: 6ff). This result therefore does not support a massive migration of Neolithic populations into Scandinavia. Arguably, it must be noted, the Neolithic material lacks precise dating, since it comes from a passage grave where there may have been reburials. All the preliminary DNA results from these analyses suggest a possible scenario with a small migration

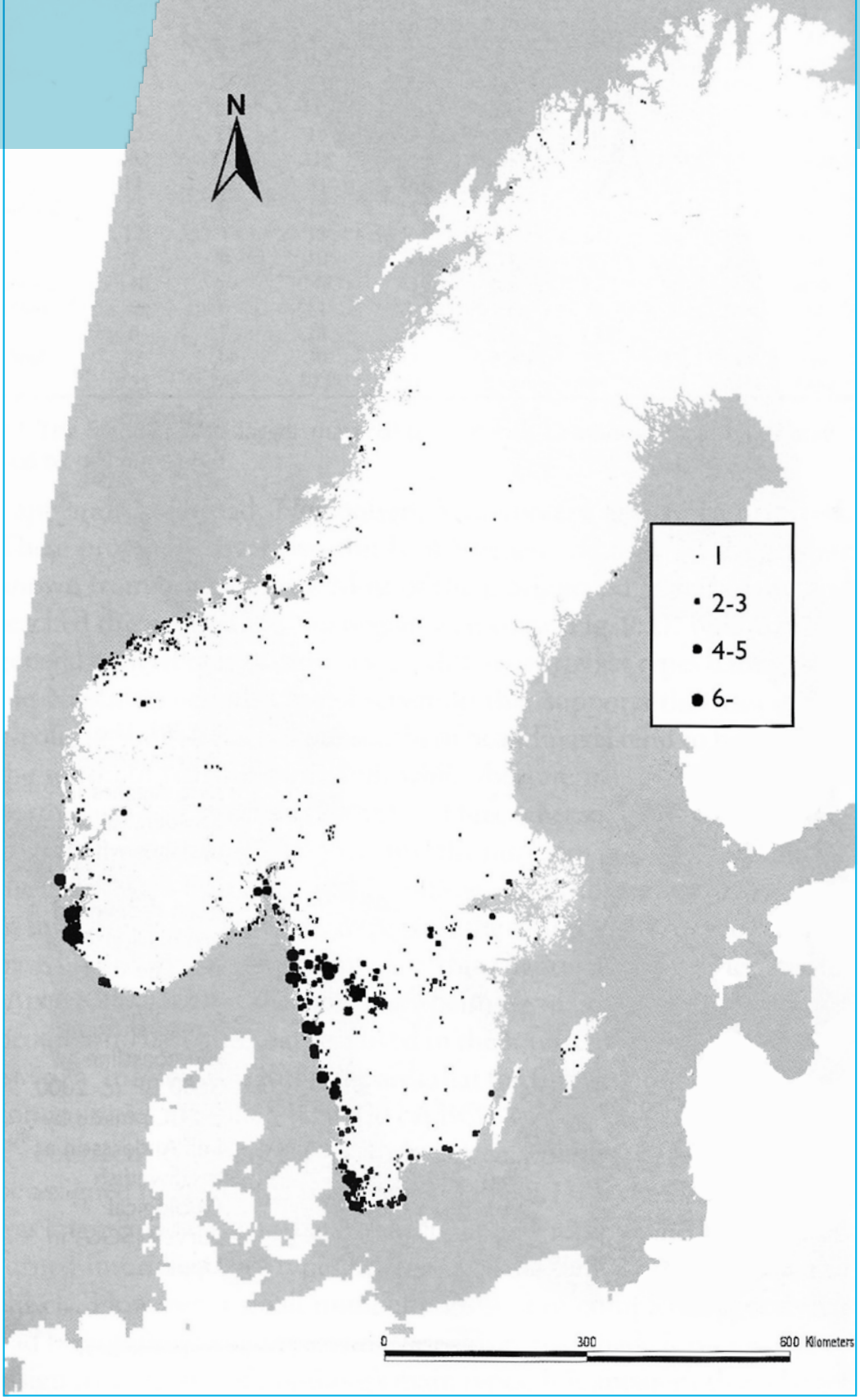


Fig. 10.
The distribution of type 1 flint daggers in Sweden and Norway. After Apel 2001: 282.

Fig. 11. ^{14}C dates showing the agrarian expansion towards and beyond the Arctic Circle.

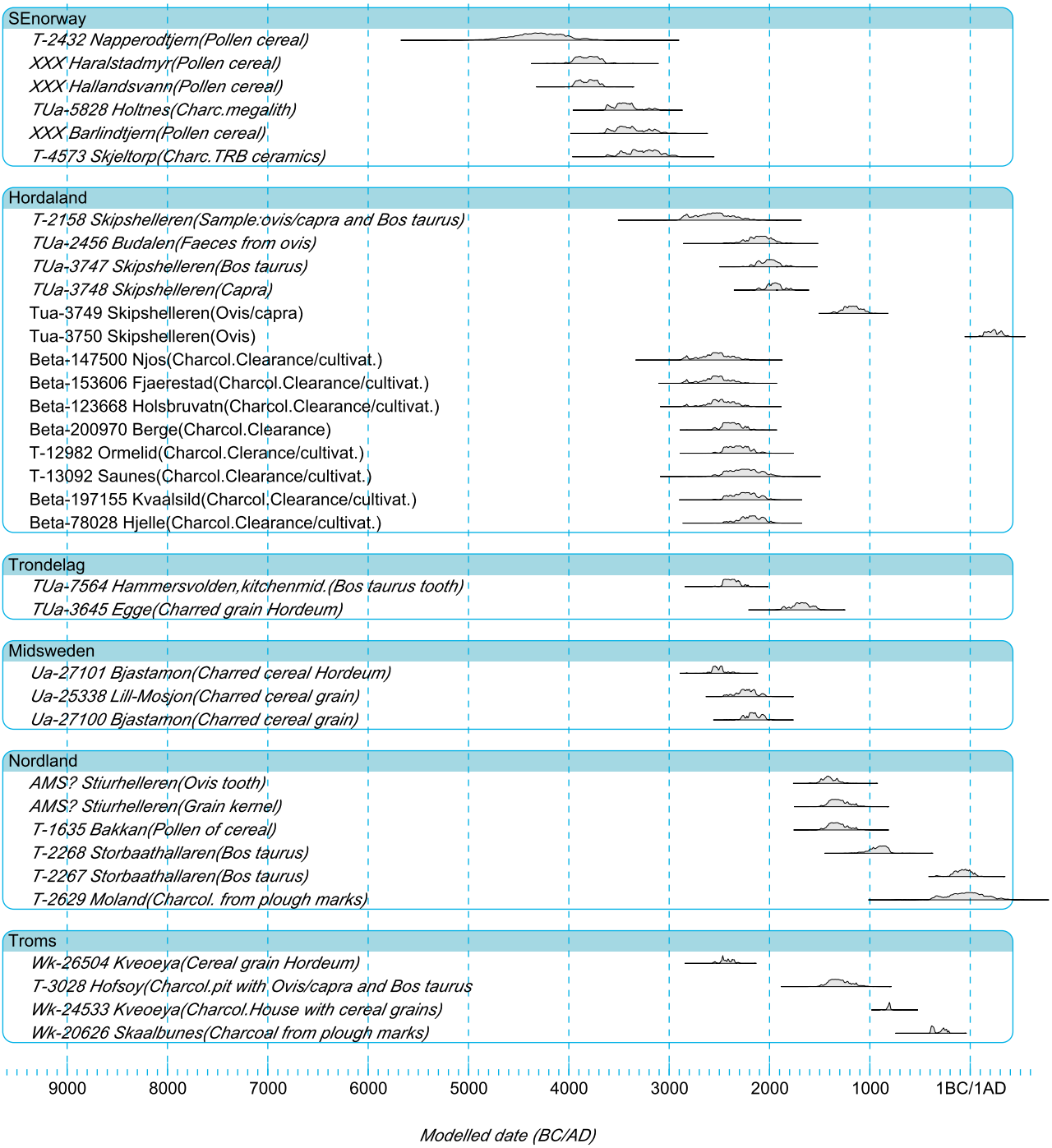


Table of ^{14}C dates showing the agrarian expansion towards and beyond the Arctic Circle

Xx	Xx	Xx	Lab no.	BP		References
Vestfold	Napperødtjern	Pollen of cereal	T-2432	5460	230	Henningsmoen 1980, 175
Østfold	Haralstadmyr	Pollen of cereal	XXX	5010	100	Østmo 1988
Vest-Agder	Hallandsvann	Pollen of cereal	XXX	5010	70	Prøsch-Danielsen 1996
Østfold	Holtnes	Context:Charcoal from megalith	TUa-5828	4660	80	Østmo 1985
Aust-Agder	Barlindtjern	Pollen of cereal	XXX	4630	100	Høeg 1982
Østfold	Skjeltorp megalith	Context:Charcoal near small funnel beaker	T-4573	4560	100	Østmo 1985
Hordaland	Skipshelleren	Sample date of bone fragm. Of ovis/capra and Bos taurus	T-2158	4020	120	Olsen 1976
Hordaland	Budalen 17	Faeces from a sheep	TUa-2456	3700	80	Nærøy 1994, 152
Hordaland	Skipshelleren	Bos taurus	TUa-3747	3635	65	Hjelle et al. 2006, 157
Hordaland	Skipshelleren	Capra	TUa-3748	3595	50	Hjelle et al. 2006, 157
Hordaland	Skipshelleren	Ovis/capra	Tua-3749	2955	50	Hjelle et al. 2006, 157
Hordaland	Skipshelleren	Ovis	Tua-3750	1790	45	Hjelle et al. 2006, 157
Hordaland	Njøs	Clearance/cultivation	Beta-147500	4000	90	Johannesen & Hjelle 2001
Hordaland	Fjærestad	Clearance/cultivation	Beta-153606	4000	80	Diinhoff 2004
Hordaland	Holsbruvatn	Clearance/cultivation	Beta-123668	3970	80	Lødøen & Hjelle 1999
Hordaland	Berge	Clearance	Beta-200970	3900	60	Melle & Simpson 2005
Hordaland	Ormelid	Clearance/cultivation	T-12982	3850	70	Bade et al. 2002
Hordaland	Saunes	Clearance	T-13092	3805	110	Pilskog 1997
Hordaland	Kvålsild	Clearance/cultivation	Beta-197155	3800	80	Slinning & Hjelle 2004
Hordaland	Hjelle	Clearance/cultivation	Beta-78028	3760	70	Gundersen & Soltvedt 1995
Trøndelag	Hammersvolden, kitchenm.	Cattle tooth	TUa-7564	3895	40	Asprem 2012
Trøndelag	Egge	Charred grain Hordeum	TUa-3645	3385	70	Solem 2002, 6
Västernordland	Bjästamon	Charred cereal grain A983	Ua-27101	3985	45	Gustafsson & Spång 2007, 80
Västernordland	Lill-Mosjön	Charred cereal grain, Hordeum from pit 24	Ua-25338	3790	55	Färjare & Olsson 2000, 32
Västernordland	Bjästamon	Charred cereal grain from A983.S4	Ua-27100	3750	45	Gustafsson & Spång 2007, 80
Nordland	Stiurhelleren	Ovis tooth	AMS?	3135	60	Johansen 1990, 5
Nordland	Stiurhelleren	Grain kernel 1	AMS?	3060	70	Johansen 1990, 5
Nordland	Bakkan	Pollen of cereals	T-1635	3070	70	Johansen & Vorren 1986, 740
Nordland	Storbåthallaren	Bos taurus	T-2268	2740	80	Johansen & Vorren 1986, 742
Nordland	Storbåthallaren	Bos taurus	T-2267	2050	60	Johansen & Vorren 1986, 742
Nordland	Moland	Context:charcoal from plow marks	T-2629	2010	150	Johansen & Vorren 1986, 742
Troms	Kveøya	Cereal grain of barley	Wk-26504	3936	30	Johansen 1990
Troms	Høfsøy	Context:charcoal from pit containing Ovis/capra and Bos taurus	T-3028	3060	80	Johansen & Vorren 1986, 745
Troms	Kveøya	Postholes to a house, charcoal, cereal grains	Wk-24533	2642	30	Arntzen & Sommerseth 2010
Troms	Skålbunes	Plough mark:charcoal	Wk-20626	2273	35	Arntzen 2012

Fig. 12. Table of ^{14}C dates showing the agrarian expansion towards and beyond the Arctic Circle.

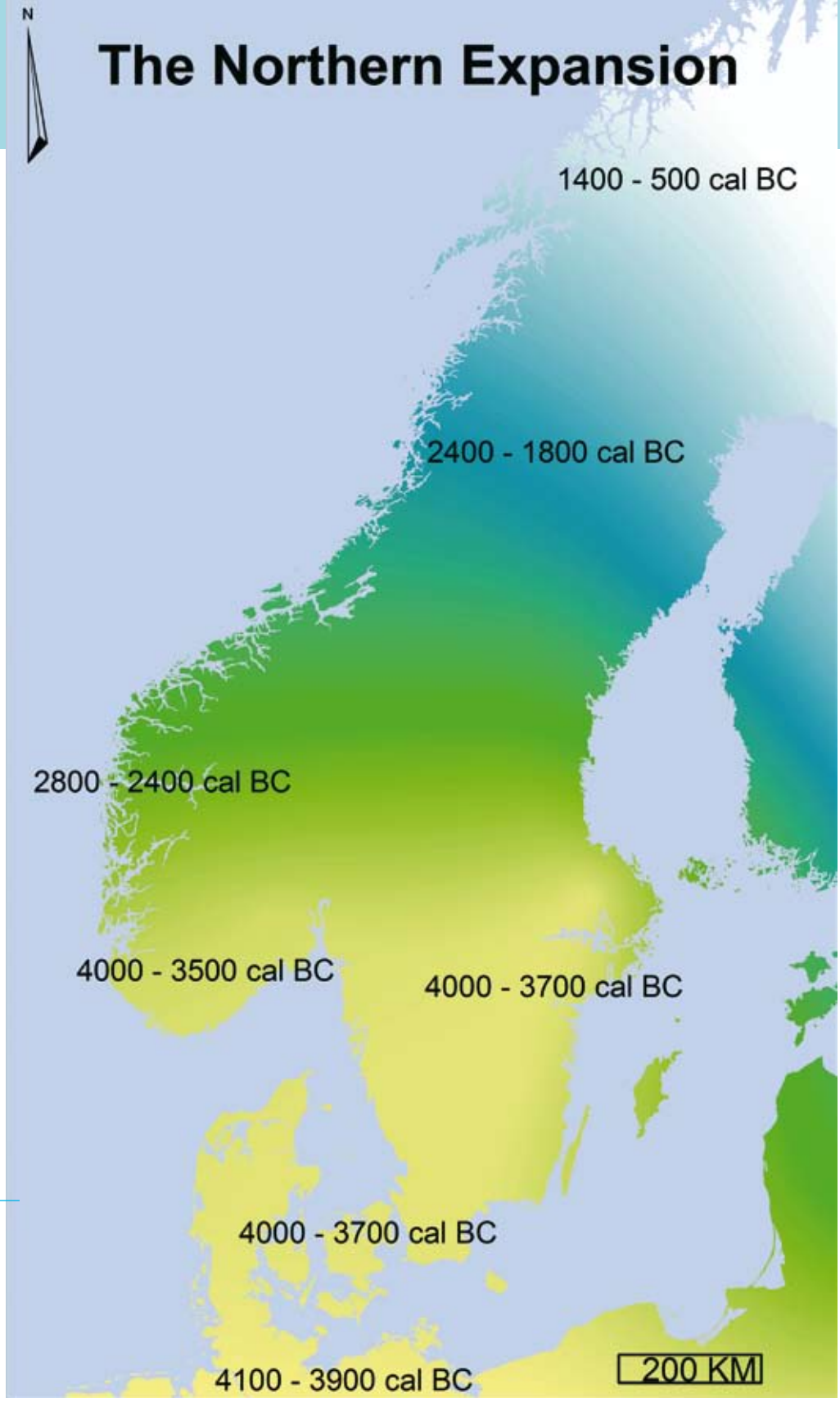
of pioneering farmers in many regions. After a while, the agrarian technology could have been adopted by surrounding hunter-gatherers, who in many regions of Scandinavia could have been superior in numbers to the pioneering farmers. This model argues for a cultural dualism involving a mixture of pioneering farmers and the integration of local hunter-gatherers who adopted an agrarian lifestyle.

Future research areas

Generally the hypothesis of cultural dualism can be proved or disproved by C-14 dating, stable isotope and DNA analysis. However, if the DNA influx from Neolithic pioneering farmers consists of Palaeolithic/Mesolithic haplogroups (D and U4 and U5) representing hunter-gatherers who became farmers, it will be difficult to detect any differences (Bramanti et al. 2009: 137ff). Stable isotope analysis has already been conducted in Denmark by Tauber (1981) and Fischer et al. (2007: 2125ff). Currently marine values of $\delta^{13}C$ and $\delta^{15}N$ have all been extracted from Mesolithic hunter-gatherers, while most of the Early Neolithic samples, except one from Sejrø, showing non-marine values. It is clear that human bones from the Early Neolithic coastal kitchen-midden sites are absent from these finds. The abrupt shift in $\delta^{13}C$ values in Early Neolithic skeletons in Denmark could be interpreted as a deliberate deselection of marine food as a resource (Andersen et al. 1986; Brinch Petersen & Egeberg 2009: 563; Milner et al. 2004: 9ff). However, this does not necessarily mean that farmers moved away from the coastal areas, as Funnel Beaker hunting stations are documented through the Early and Middle Neolithic (Skaarup 1972). But it could reflect a possible gradual decline in the use of marine resources.

Stable isotope analyses from Öland demonstrate a marked dietary shift during the second half of the third millennium, from a mixed marine diet to the use of exclusively terrestrial resources (Eriksson et al. 2008: 520ff). The result has been interpreted as the onset of the large-scale introduction of farming on Öland. Large-scale farming took place at the end of the Neolithic, not at the beginning. However, it is important to acknowledge that we are dealing here with an island in the Baltic Sea where it is only natural to exploit marine resources. The result therefore does not apply to the rest of southern Scandinavia, as proven by the results presented by Tauber (1981), but it demonstrates that local variations can be observed in the diet.

Fig. 13. Map showing a preliminary interpretation of the agrarian expansion in Scandinavia during the Neolithic and Bronze Age. Northern Germany (4100-3900 BC), southern Scandinavia, western and southern Sweden (4000-3700 BC), southeastern Norway (4000-3500 BC), western Norway (2800-2400 BC), central Norway and Sweden (2400-1800 BC) and northern Norway (1400-500 BC).


N
The Northern Expansion
1400 - 500 cal BC
2400 - 1800 cal BC
2800 - 2400 cal BC
4000 - 3500 cal BC
4000 - 3700 cal BC
4000 - 3700 cal BC
4100 - 3900 cal BC
200 KM

Concluding remarks

The agrarian expansion during the Early Neolithic in southern Scandinavia was a rapid process lasting only a few centuries between 4000 and 3700 BC. The speed of the expansion was fast and involved small groups of migrating pioneering farmers, possibly using boats as a means of transport. They originated from Middle Neolithic societies in central Europe. The reason for the expansion is still unclear, but growing population pressure combined with the fact that cultivation with the slash-and-burn method requires much space might have forced some pioneering farmers to move north. They brought with them a complete agrarian technology, structures, new material culture and ideology. The question of what happened to the local hunter-gatherers is still open to discussion. Either they became farmers within one or two generations, which could explain the settling of both inland and coastal sites where they could both exploit agrarian resources and engage in hunting and fishing activities; or we could be dealing with a cultural dualism consisting of pioneering farmers at inland-oriented sites and hunter-gatherers at coastal sites. Cultural dualism could be an interpretation when evidence of cultivation has been found at a hunter-gatherer site. Both explanations are possible, but currently the archaeological record in southern Scandinavia tends to favour cultural dualism during the earliest part of the Early Neolithic. The earliest expansion in south-eastern Norway occurs during the Early Neolithic (4000-3500 BC).

However, the evidence is rather limited and the importance of agriculture may have been rather low, and this contrasts with the sudden appearance of a different material culture. The material culture indicates that we could be dealing with small groups of pioneering farmers originating in southern Scandinavia. However, more investigations in this region are needed in the future. The next advance is observed in the western part of Norway during the Middle Neolithic (2800-2400 BC). The expansion could also have involved small groups of pioneering farmers entering western Norway by boat from southeastern Norway or western parts of Sweden, because thick-butted stone axes and battle axes come from these regions. The advance continued during the Late Neolithic (2400-1800 BC) to central parts of Scandinavia and towards northern Scandinavia and beyond the Arctic Circle during the Middle and Late Bronze Age (1400-500 BC). It is difficult to conclude whether agriculture was brought to the middle and northern parts of Scandinavia by migrating farmers or local hunter-gatherers. Future studies should concentrate on finds from sites located on easily cultivable land in Norway and Sweden in order to gain new knowledge from these agrarian settlements (fig. 13). Generally

the transition towards a Neolithic way of life in Scandinavia can be interpreted as a complex and continuous process of migration, integration and gradual assimilation between neighbouring farmers and hunter-gatherers, taking place at different rates from region to region depending on environmental as well as ideological factors.

Note 1.
We have to acknowledge that there are problems in using ^{14}C dates, since some 'wiggles', especially within the Early Neolithic, have been observed on the calibration curve (Litt et al. 2001).

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Fig. 1: Vementry, heel-shaped cairn. The facade is secondary and blocks the passage to the chamber (compare Henshall 1963: 177; Mahler 2011: 13). Photo: D. Mahler.

Shetland – the Border of Farming 4000-3000 B.C.E

Ditlev L. Mahler
Danish Prehistory

Introduction

The object of the three-year research project Shetland – the Border of Farming 4000-3000 B.C.E. is to gather, analyse and document the Shetland Islands Neolithic material in order to deepen our understanding of the Neolithic process and the social impact on the existing societies of the period in question, in the Shetland Islands as well as in Scandinavia. Recent research suggests that the Shetland Islands became Neolithic in several steps over a period of time (Mahler 2011: 13). The research project aims to survey the sequence and nature of the various elements in this process as a basis for a comparative analysis of the Scandinavian agrarian societies and their expansion.

As far as I know, landscape analysis has not been applied to the identification of the ritual landscape and cultural markers in the same landscape in the North Atlantic region (fig. 1). The project could provide us with a whole new perspec-

Fig. 2: Caldback at Unst seen from the south east. The passage grave is the northernmost of its kind in Europe still in existence (Henshall 1963: 162). Photo: D. Mahler.

tive on the understanding of the Neolithic process in the area and provide comparative material for Scandinavia. In the light of the well documented Early Neolithic southern Scandinavian material it should be possible to create a chronological order as a basis for understanding the Neolithic process in general and in the Shetland Islands in particular.

In the expansion of agrarian societies in the Neolithic, the Shetland Islands were the ultimate northern boundary at latitude 60°5' north. Within the timespan 4000-3000 B.C.E., an agrarian culture was established in the Shetland Islands with material and non-material elements characteristic of the Neolithic process all over Europe. These elements included monumental sites such as the chambered cairn at Caldback, Unst, which is probably the northernmost passage grave still existing in Europe (fig. 2), as well as polished tools for ritual use such as point-butted Felsit axes, geometrically ornamented ceramic ware, the use of the ard and the creation of gathering sites.

Another approach involves the comparative study of and models for island societies, for example comparing their demographic and economic development in terms of human intervention in virgin nature. Such a comparison can be based on pioneer societies with or without written sources on their development. Examples are the Lapita dispersal in Oceania or the Saqqaq Culture dispersal in Greenland, both c. 2000 B.C.E. (Mahler IP; Kirch 1988: 103ff; Grønnow 2004: 78; Grønnow IP). The reason the Shetland Islands formed the northern boundary for an agrarian expansion may have been maritime technological development. From a maritime point of view the Orkney Islands and Fair Isle are stepping stones in the Neolithic expansion, but still represented a considerable expansion. Shetland was not virgin land when the Neolithic people arrived (Edwards et

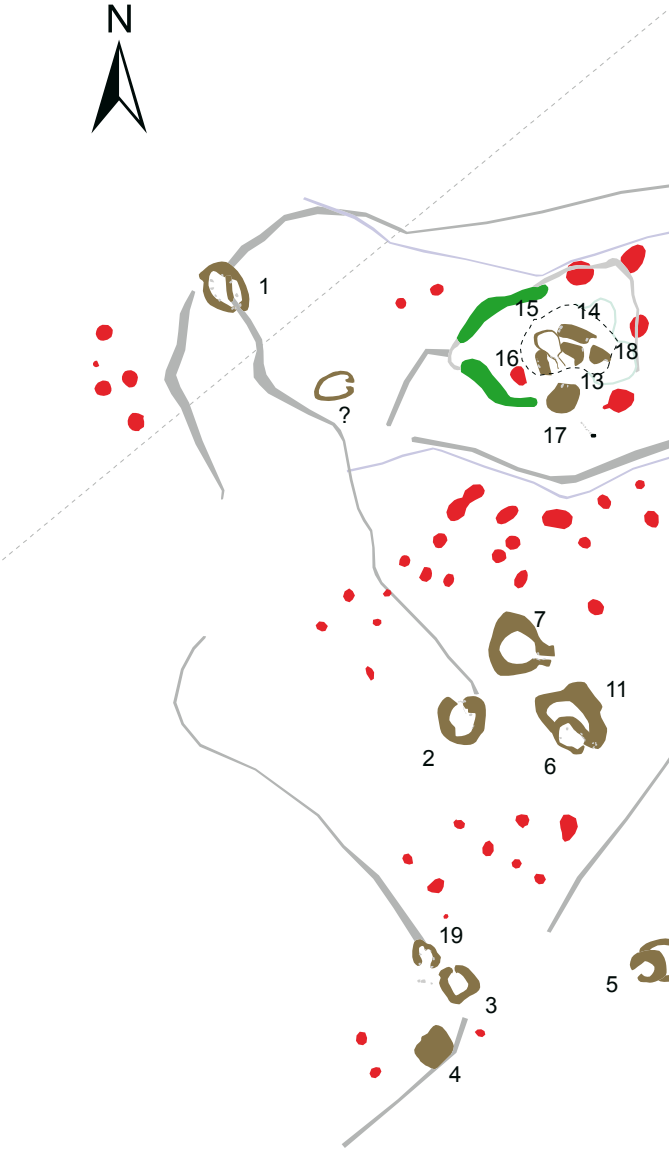
al. 2009: 118f; Melton 2009: 188; Gilmore & Melton 2011: 80). We cannot be sure that there was a stable Mesolithic population, but it is highly likely that Shetland had Mesolithic visits (Bennett et al. 1992: 241). It would be strange if Shetland was the only place in northern Europe that had no Mesolithic population, at least during some periods. It is unlikely, though, that there was a Mesolithic population that 'went Neolithic' (compare Sheridan 2010).

This summer's six weeks of fieldwork involved visits to 12 Neolithic sites, mainly in West Mainland and some sites on Unst. Of these 12 sites, six were mapped using precision GPS, and some of the results will be touched upon in the following.

New perspectives

During the fieldwork in 2010 a number of sites were surveyed to prepare for the mapping in 2011, as it was clear that the fieldwork had to be very selective. It was decided that the fieldwork in 2011 should begin at Brunt Hill, West Mainland. The site is a sandstone quarry and it was estimated that it might have been a quarry for stone ard points (fig. 3), a

Fig. 3: Brunt Hill. Broken rough-out of ard point? Length c. 25 cm. Photo: D. Mahler.



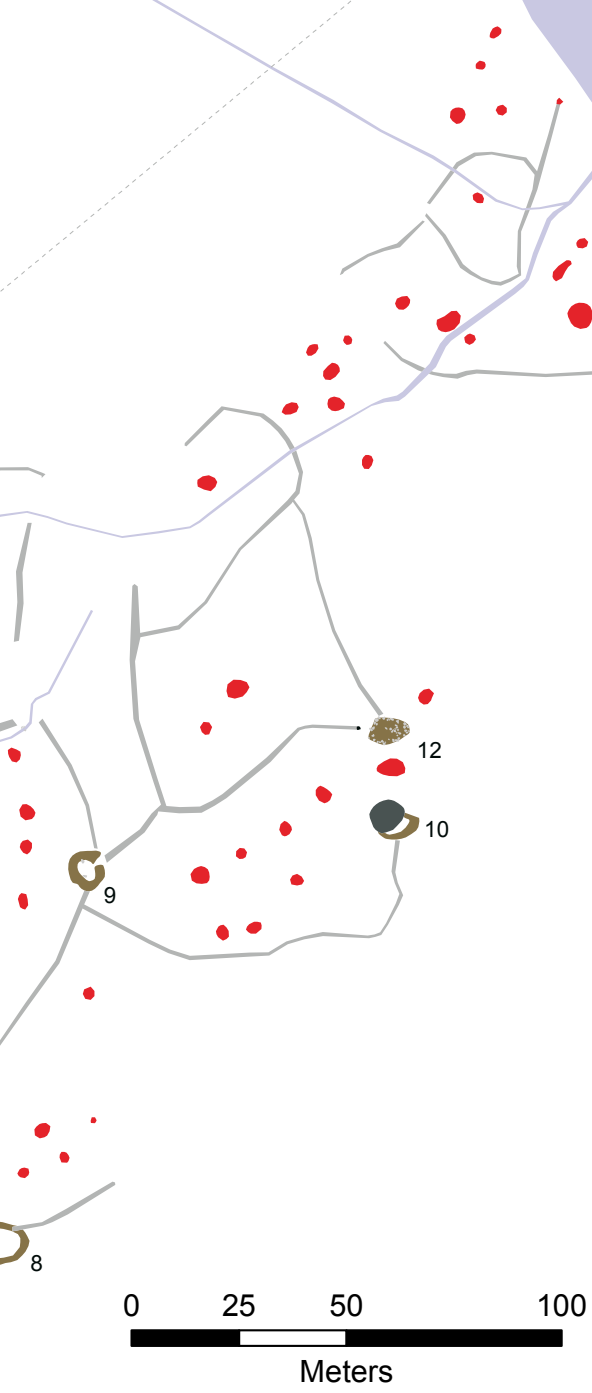


Fig. 4: Map of Pinhoulland.
Red dots: Clearance cairns.
Grey: Dykes.
Green: Banks. Blue: Water courses.
Brown: (House) structures.
Mapped by M. Hoydal, processed by P. Jensen.

well known feature in the Neolithic period (Rees 1986: 75). During the days at the site in 2011 it became clear that the ruined 19th-century farmstead nearby had seriously disturbed the possible prehistoric quarries. These look like shallow pits with debris from the production of rough-outs. It became clear that the deep pits must be of recent date, that there are at least 17 krobbs and four pens at Brunt Hill, and that the material for these structures was quarried at the site. Only 12 shallow pits of a prehistoric nature have survived until today (fig. 4).

At Stanydale we mapped an area well over 2.3 x 1 km^2 and several hitherto unknown structures were discovered. There are at least three cairns up on Hamars to the west of the hall and five north of Stanydale Village (Calder 1951: 185ff; Fojut 2006: 26f). Some of these show

signs of orthostats north of the cairns, all of them now fallen. Up at Lardie Hill there are some hundred metres of a boundary dyke just 50 m below the two cairns on the top. It appears that the dyke separates the land of the living from the land of the dead, and there is a parallel to this phenomenon in connection with the famous cairn at Vementry. The area contains at least six house structures besides the hall, and the many dykes hint at a possible relative chronology. At Stanydale there are at least four house structures that are likely to be older than the hall. One isolated structure not far to the west of the hall and three house structures to the north of the hall are linked by dykes (fig. 5). There are also known house structures to the south which will not be mentioned further here. The single house structure and the three linked by dykes – and two round field

Fig. 5: Stanydale House 2 seen from the north. The house, which lies 20 m west of the hall, can be seen as a shallow depression. Photo: D. Mahler.

Fig. 6: Pinhoulland seen from the north west down towards Voe of Browland. The cluster of houses is seen in the middle. Photo: D. Mahler.

systems – are interesting parallels to the suggested relative chronology at Pinhoulland.

Pinhoulland was surveyed during the 2010 field season and again during 2011, when some 360 x 215 m^2 of the cultural landscape was mapped. At first glance the structures – as many as 20 – were quite overwhelming, and besides a krobb and the 19th-century pen down by the coast, the site seems relatively undisturbed.

Most of the structures are on the gentle eastward slope down to Voe of Browland (fig. 6). The site consists of rather acidic grassland with areas of very wet, peaty ground, the remains of now fossilized small watercourses. In the case of Pinhoulland, dating can only be verified by coring or excavation, but it is very likely that Pinhoulland was in use during the

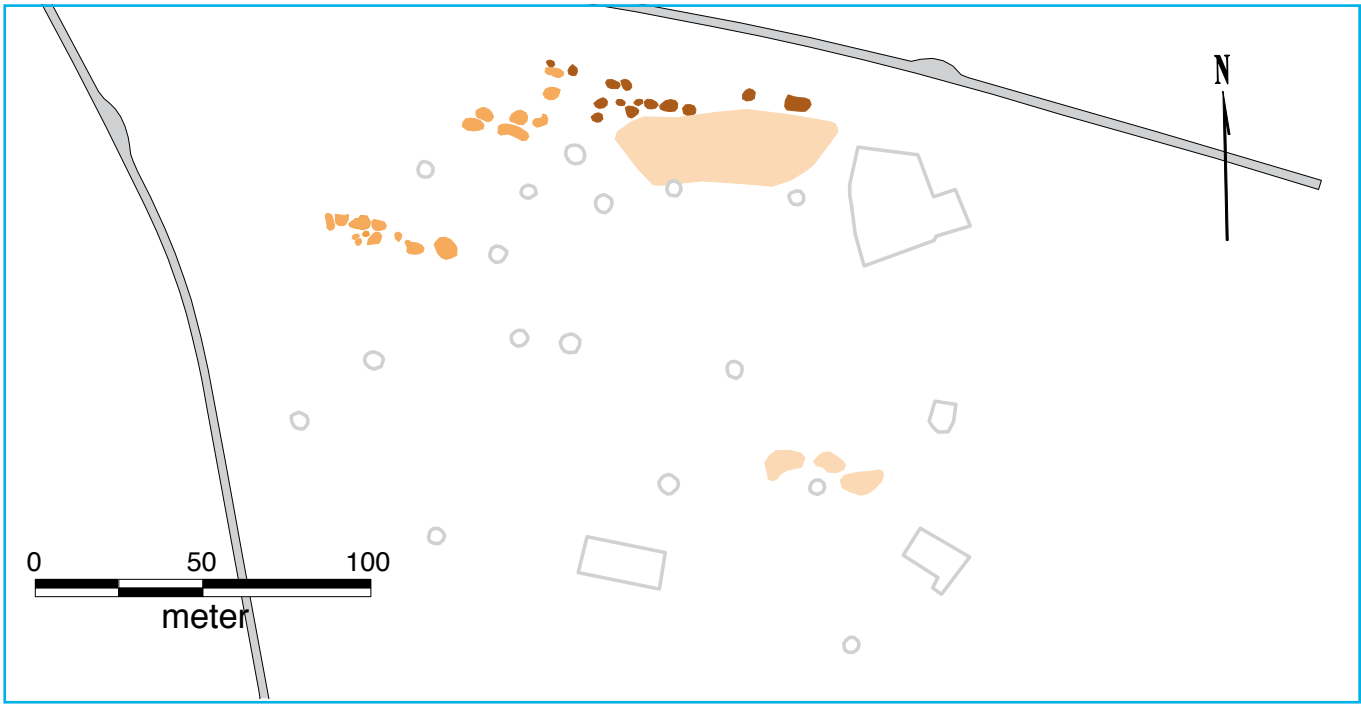
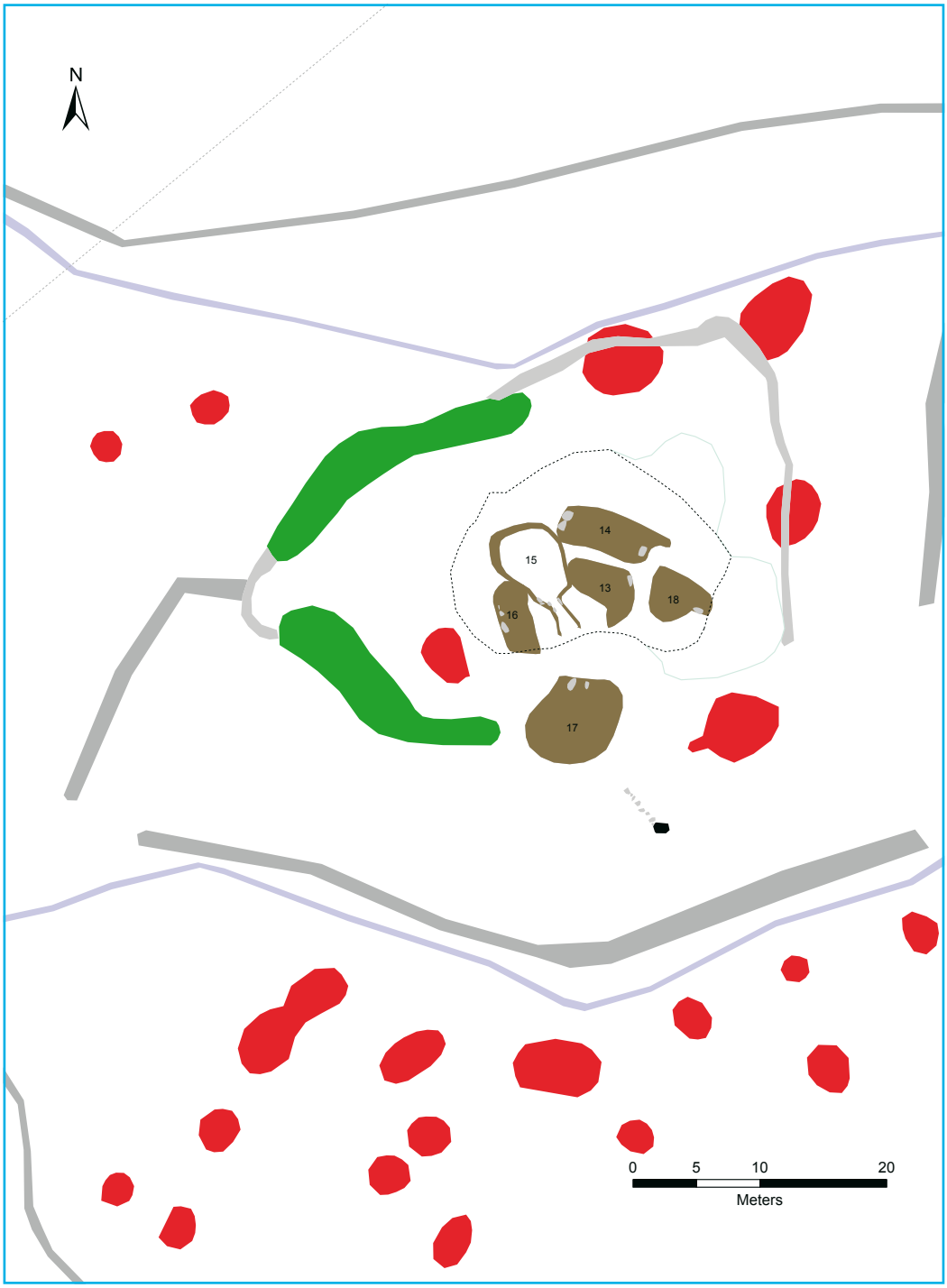


Fig. 7: Brunt Hill.
Grey: 19th-century structures. Beige: Quarries probably recent or of uncertain date. Dark brown: Shallow pits which could be of prehistoric date. Mapped and processed by the curator M. Hoydal.

Fig. 8 (right): Pinhoulland phase 3.
Red dots: Clearance cairns. Grey: Dykes. Green: Banks. Blue: Water courses. Brown: (House) structures. Black: An orthostat. Mapped by M. Hoydal, processed by P. Jensen.

Neolithic and Early Bronze Age (fig. 7). Houses 2, 6, 7, 9 and 11 belong to the pre-blanket peat strata, and must thus be older than the Late Neolithic or Early Bronze Age (compare Whittington 1980: 35). The many dykes connecting the house structures may indicate a relative chronology. Preliminary analyses indicate at least a relative chronology in three phases. One scenario could be that Houses 6, 7 and 11 constitute phase 1, viewed as single structures. It is impossible to say whether they could be contemporary, apart from the fact that 6 is younger than 11.

Phase 2 could be the houses that are interconnected with dykes, forming three groups: House 1-2 as one; Houses 3, 4, 19 and 5 as another interrelated group; and lastly Houses 9, 10, 12 as the third. The chronology of these groups is still unknown, but what we see today is very probably a diachronic picture. The houses in the cluster (Houses 13, 14, 15, 16,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17 and 18) are built together and with the exception of House 14 could have been in contemporary use and constitute the third phase. The nearest parallels to the cluster of houses (fig. 8) are Jarlshof House 8 and settlement types such as Skara Brae from Orkney (Hamilton 1956: 9ff; Childe 1931: Plan of Village). It is interesting that the chronology, moving from single houses to a group of houses linked by dykes, has a parallel at Stanydale. The difference is that at Pinhoulland the present chronology ends with a cluster of houses, and at Stanydale with the hall. Jarlshof House 8 has been dated to the Early Bronze Age, and Skara Brae is dated between c. 3100 and 2500 cal. BC (Shepherd 2000: 139; Clarke 1976: 26; Ashmore 1998: 142-147, 2000: 299-308). Thus it is reasonable to presume – at least as a model – that Pinhoulland actually began its settlement phases at some time during the Neolithic Period, and considering the number of houses this could have been quite early.

Further surveys have revealed a more complex settlement pattern, such as the single structure at Skiords in Aithsting and the two house structures at Uni Firth on Longa Ness, where dykes indicate that the houses could be contemporary. These few examples give a picture of variation in settlement structures: single house structures standing alone; small communities consisting of two or more households with field systems; and finally a cluster of houses such as the one at Pinhoulland consisting of five to six structures. As far as I know the house cluster at Pinhoulland stands alone on Shetland, but further surveys and mapping will undoubtedly reveal that this kind of settlement type is more widespread.

It is to be hoped that further results will follow during 2012 when the last data have been collected and processed.

Acknowledgements

I thank Alison Sheridan for the inspiring discussions we have had both in Edinburgh and on Shetland. Jenny Murray has been a great help during the fieldwork and in Lerwick Museum, and with Laurie Goodlad and John Hunter we have gone on exciting excursions, for example to sites we later decided to map. Chris Dyer helped us with the mapping on Unst, and we received much support from Amenity Trust and Val Turner. Finally I would like to thank Susan Dall Mahler for reading the proofs.

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Resources, mobility and cultural identity in Norse Greenland 2005-2010

Jette Arneborg & Christian Koch Madsen
Danish Middle Ages and Renaissance

The 2010 field season concluded six years of reconnaissances in the Norse Vatnahverfi area, between Igaliku Fjord in the north and Lichtenau Fjord in the south. The project has had a twofold aim: on the one hand the digital mapping of all Norse cultural traces in the landscape with a view to elucidating the social and economic strategies of the Norse settlers and the interaction between man and the changing surroundings; and on the other to enable junior researchers to participate in North Atlantic and Greenlandic Norse archaeology.

The fieldwork in 2005-06 consisted of pure reconnaissance projects conducted by two mature students from Copenhagen University, Niels Algreen-Møller and Christian Koch Madsen. The International Polar Year initiative from 2007 made it possible to widen the scope of the project to include small archaeological trial investigations in middens and cemeteries, and we embarked on a collaboration with Hunter College, City University New York (CUNY), the North Atlantic BioCultural Organization (NABO) and the Leverhumle projects Landscapes Circum Landnam and Footprints on the Edge of Thule (research collaboration with Aberdeen, Stirling and Edinburgh universities).

In the years 2007-2010 further reconnaissances were conducted in the area, and to date some 1000 ruins distributed over 115 ruin groups have been DGPS-surveyed. Small trial excavations have been conducted at selected Norse farms, a larger-scale midden investigation was carried out at the Norse farm Ø172, and two of the area's three churchyards have been excavated.

The project collaborates with researchers and PhD students from the USA, Canada, France and Scotland, all of whom have done fieldwork in the Vatnahverfi region. The project functions as an umbrella for the Northern Worlds

projects Landscape and livings, economy and hierarchy – pastoral farming in Norse Greenland by PhD student Christian Koch Madsen: Churches, Christianity and magnate farmers in the Norse Eastern Settlement by Jette Arneborg; and Greenland Dietary Economy by a researcher group consisting of Jette Arneborg, Jan Heinemeier, Niels Lynnerup, Jeppe Møhl, Erle Nelson and Árný Sveinbjörnsdóttir. All the projects are described in this report.

A few provisional results

In the latter half of the twentieth century the prevailing theory was that the Norse community was ill-adapted to the surroundings in Greenland, and that a combination of overexploitation of the natural resources and adverse climate change was the reason for the depopulation of the settlements at the end of the 1400s.

The American professor of geography and physiology Jared Diamond summarized the state of play in his famous book from 2005, Collapse – How Societies Choose to Fail or Succeed, and argued that the Norse Greenland society collapsed for three reasons.

- Firstly, they depleted the environmental resources on which they depended by felling trees, stripping off turf and overgrazing their pastures, which resulted in severe soil erosion.
- Secondly, they did not utilize additional available food sources such as fish, ringed and stranded whales.
- And thirdly, they had established a rigid social system that could not adapt to the changing world.

The most recent research results from the Vatnahverfi investigations seriously challenge the theories of maladaptation and unsustainable farming practices.

The Norse landnám did impact on the environment. The introduction of animal husbandry and the stripping-off of large areas of turf for house construction did cause increased erosion, but in the long run Norse interaction with the environment seems to have been sustainable (Massa et al. 2011; Schofield and Edwards 2011). Vatnahverfi for instance does not show erosion disasters of any consequence – many farms established artificial irrigation systems and they manured their grass fields, perhaps in the hope of increasing yields, or at least of preserving the status quo (Buckland et al. 2009; Golding et al. 2011).

In the Norwegian work The King's Mirror from around AD 1250 it is stated that the Greenlanders had good pastures and good, large farms, and that they kept many head of cattle and sheep for butter, cheese and meat. Yet the author also mentions that the Greenlanders in

Fig. 1. Gathering of material specimens. Niels Algreen-Møller, National Museum of Denmark, and Andy Dugmore, University of Edinburgh. Photo: Christian Koch Madsen.

addition subsisted on meat from reindeer, whale, seal and bear, and both the animal bone record (McGovern 1985) and the äC13 and äN15 values measured on Norse human bones show that the marine component of the diet increased over time. From the middle of the 13th century the subsistence economy shifted from a predominantly terrestrial diet to a more marine diet with seal as the prime meat producer (Arneborg, this workshop report, Arneborg et al. forthcoming).

In the first period settlement was concentrated in the inner and mid-fjord regions where pastoral farming was possible. The largest and wealthiest farms were situated in the inner fjords where conditions were by far the best. Large houses, festal halls, byres for cattle, warehouses and related churches were clear marks of status. There are indica-

tions that a smallish number of manors owned all the land and the farms on it, and the reduction in the number of farms with a related church in conjunction with the limited construction of much larger stone churches in a few core manors suggest a consolidation of power around a few great families from the 13th century on (fig. 3) (Arneborg: Project. Churches, Christianity and magnate farmers in the Norse Eastern Settlement). In the same period new radiocarbon dates show that marginal farms at less favourable locations were abandoned.

What we see in our archaeological record seems to be inconsistent. The dietary economy (cf. The Greenland Isotope Project) came to depend more and more on the marine resources that were only available at the outer coast. Pastoral farming declined and the extent of animal husbandry decreased at the same time as the elite consolidated their farms in the inner fjords (cf. The Church Project). This development could be interpreted as symptomatic of rigidity – but may in fact have been the opposite. Seals kept people alive, and as long as the elite

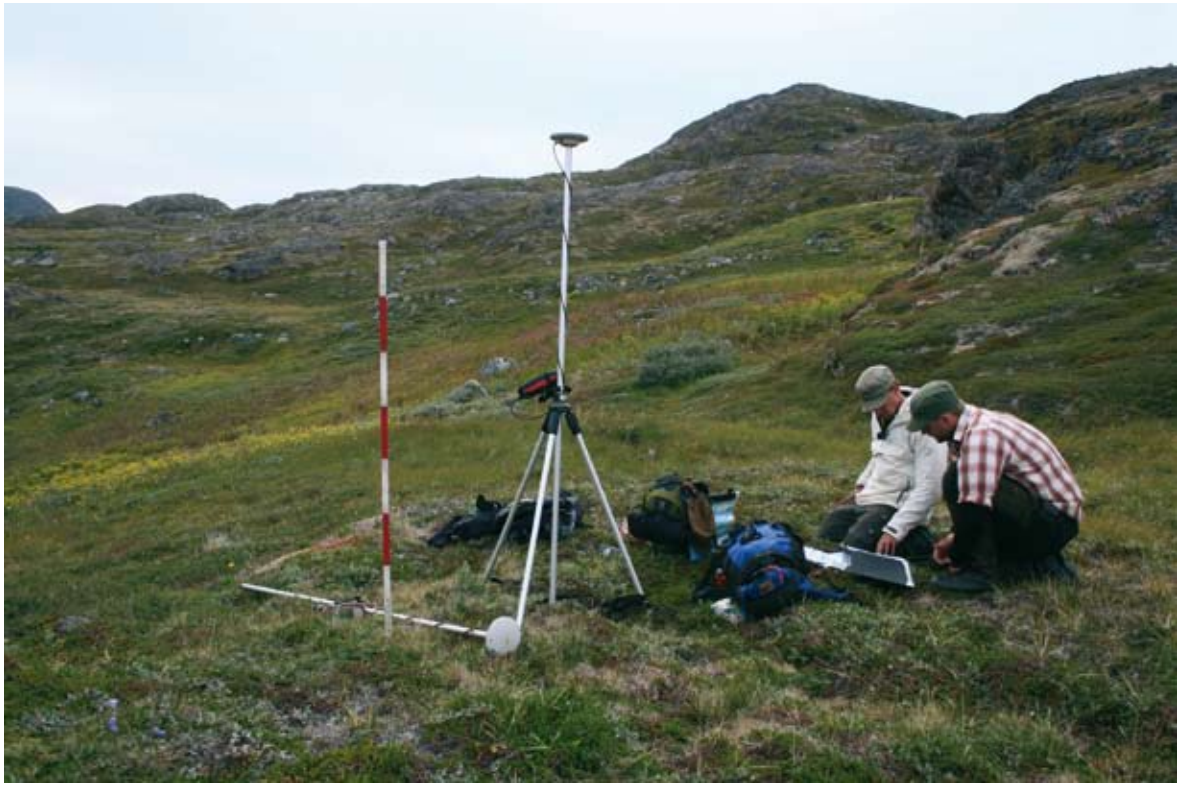

Fig 2.
GPS surveying of the ruins. Poul Heide, Århus University, and Christian Koch Madsen, National Museum of Denmark. Photo: Troels Bo Jensen.

were able to control the resources and maintain the perception of Norse Greenland as a society based on farming and land ownership, sealing would only support the prevailing social order. The concentration of settlement on the best pasture lands indicates a consolidation of power in the hands of the landowning elite; still, it does not seem to have led to unsustainable farming practices.

Publication is planned for 2013. As a preliminary to publication a workshop will be held in Copenhagen in the course of 2012 for the project participants and contributors to the publication.

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Pastures Found… Farming in Greenland (re)introduced

Christian Koch Madsen
Danish Middle Ages and Renaissance

The Norse settlements that were established in Greenland around the turn of the first millennium AD were based on farming practices and cultural traditions reaching back across the North Atlantic to Norway and wider Scandinavia. The PhD project *Landscape and Livelihood, Economy and Hierarchy: Pastoral Farming in Norse Greenland* aims at outlining the Norse Greenlandic farming communities as they developed from a shared North Atlantic *landnám* setup through nearly 500 years of existence on the unique and dramatically changing Arctic frontier. With the geographical focus on the central Eastern Settlement, South Greenland, and using recent precision survey data on ruins from this core Norse settlement area, the project explores how traditional archaeological data and research themes may be expanded and nuanced – for example by using critically and theoretically weighed historical evidence – to understand specific and complex human-environment dynamics (fig. 1). As exemplified in this short paper, for instance, the case study of pre-modern Greenlandic farming shows how initial inexperience in farming and herding in the specific Greenlandic setting led to catastrophic declines in livestock numbers; consequences, and subsequent adaptations which may also have been experienced and implemented by the Norse settlers.

Farming reintroduced

Some 450 years after the Norse population abandoned their settlements in Greenland in 1450 AD, livestock farming was reintroduced to Greenland. Certainly, small-scale gardening and the tending of a few domestic animals had been practiced ever since the earliest colonization in the 18th century (fig. 2) (e.g. Erslev 1877; Jespersen 1916; Kleivan 1983); however, from 1906 onwards, farming increasingly took on serious scope as a full-time professional occupation. This was the fulfilment of a vision sustained

Photo: C.K. Madsen 2006.

Fig. 1. View of modern sheep farm and hayfields in the central Vatnahverfi region, South Greenland. Like all existing Inuit sheep farms, this one at Tasilikulooq lies at the site of a Norse farmstead (E171); the 20th-century reintroduction of sheep farming in Greenland was, effectively, a second landnám developing along lines not too dissimilar to Norse settlement, thus enabling a discussion of aspects of potential overlap.

Fig. 2. Julianehåb Colony, present-day Qaqortoq, around 1830. Visible close to the fjord are, left, a parcelled-out garden and, right, three grazing cattle. Small-scale subsidiary household farming had been a typical element of the colonies, mission and trade stations ever since colonization (watercolour by J. M. Mathiesen 1800-1860).

since the earliest decades of Danish colonial rule (Bendixen 1927; Gad 1969), a vision which also seems to have been nourished by the historical awareness of the Norse settlers and by the prevailing disbelief in the shortcomings of their essentially European farming tradition (e.g. Wormskjold 1814).

Renewed farming in South Greenland developed from a Danish Government sheep-breeding experiment: in 1906, 19 Faroese sheep were sent to South Greenland, followed in 1915 by another 170 sheep, this time of Icelandic stock, to breed a stable population from which to expand sheep farming locally (Chemnitz 1920; Walsøe 1919). Except for a very few earlier and later imported sheep of varied origin (Austreheim et al. 2008; Johnstrup 1878; Walsøe 1919: 42), the entire present Greenlandic sheep population grew from these first individuals. As shown in fig. 3, by 1966 sheep numbers had reached a peak hitherto of an estimated 47,968 ewes (i.e. not including lambs, rams, and wethers), a population development spanning only 60 years.

From an archaeological perspective, this sheep population development is in itself an interesting observation; the aggregate 189 sheep imported in the early 20th century does not seem to significantly exceed the likely number of a Norse founding sheep population. Accordingly, the development from a *landnám* population platform to near-maximum sheep stocking levels could potentially be achieved in the specific environmental setting of South Greenland in as little as 60 years, i.e. a few generations. Besides providing an estimate of the potential rapidity of Norse livestock development, this covers so brief a timespan that it could problematize the identification of *landnám* phases in zooarchaeological bone assemblages from Greenland.

However, this and the following lines of argumentation all build on the premise that there is considerable overlap between Norse and recent pastoral farming practices, a premise that warrants pause for critical consideration. Renewed farming in Greenland did not develop in the form of the reoccupation of Norse farmsteads by Scandinavian descendants, as originally envisaged by Danish Government officials; instead it was realized by industrious Inuit; with only the most basic technological aids, and often in areas much isolated from established infrastructure, pioneer Inuit, from the 1930s onwards, reclaimed Norse farmsteads and fields (e.g. Christensen 1954; Kristiansen 1955). This was effectively a second landnám. Nonetheless, it was a landnám developing from a different cultural background and aided by mid-20th-century agricultural technology and knowledge. Clearly then, it is imperative

explicitly to single out both potential overlaps and obvious differences between Norse and recent Inuit farming, a discussion that can only be presented in summary form in this short paper.

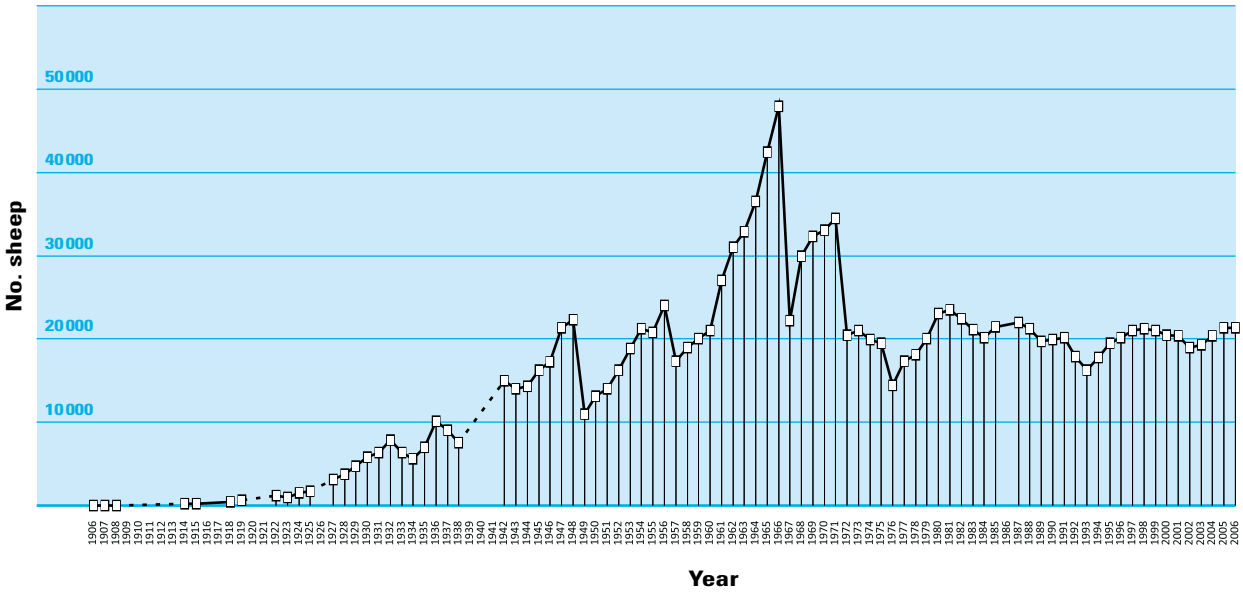
First, the project sections off the period 1906-1976, designated the period of *pre-modern farming*, as the most pertinent for a comparative case study. Such a division is obviously somewhat capricious and constructed, since Greenlandic farming developed continuously. However, the preceding phase of *colonial farming* was characterized by being small-scale, subsidiary household production (Bendixen 1927; Bentzen 1920: 35) tied to the colonial settlement pattern, i.e. the trade and mission stations that were, in turn, tied to Inuit coastal settlement (fig. 2) (Amdrup et al. 1921a, 1921b). Thus, apart from two farming settlements established at the inner fjord sites of Igaliku in 1782 (Bóbe 1915) and Narsaq in the 1880s (Amdrup et al. 1921b), both suggestively also sites of Norse magnate farmsteads, colonial farming had a geographical distribution markedly different from the Norse one, something that would also to a certain extent characterize the early settlement pattern of Inuit farmers.

The period of farming developments following 1976, here designated *modern farming*, is harder to delimit decisively from pre-modern farming; however, it is characterized by being the period in which Greenlandic farming emerged as a fully modernized, mechanized, and commercial occupation. This process of maturing was, naturally, already under way, but 1976 marks the year when the sheep-breeding station at Upernaviarsuk was converted into an independent institution (Heerfordt et al. 1980), future expansions in sheep farming came under detailed and centralized supervision, sheep breeding had been centred on fewer larger farms (fig. 8), and farmers from then on in general received increased government subsidies (Egede et al. 1982; Heerfordt et al. 1980; Laursen & Ørnsholt 1979). These developments were largely a result of the hard winter of 1975/76 (fig. 9), which left the Greenlandic sheep population at its lowest point since 1949; because of the improvements subsequently introduced, i.e. the transition to modernized intensive farming, 1976 also became the last catastrophic winter. To sum up, after 1976 Greenlandic sheep farming had evolved to such modern standards that comparison with Norse farming practices is generally unfeasible.

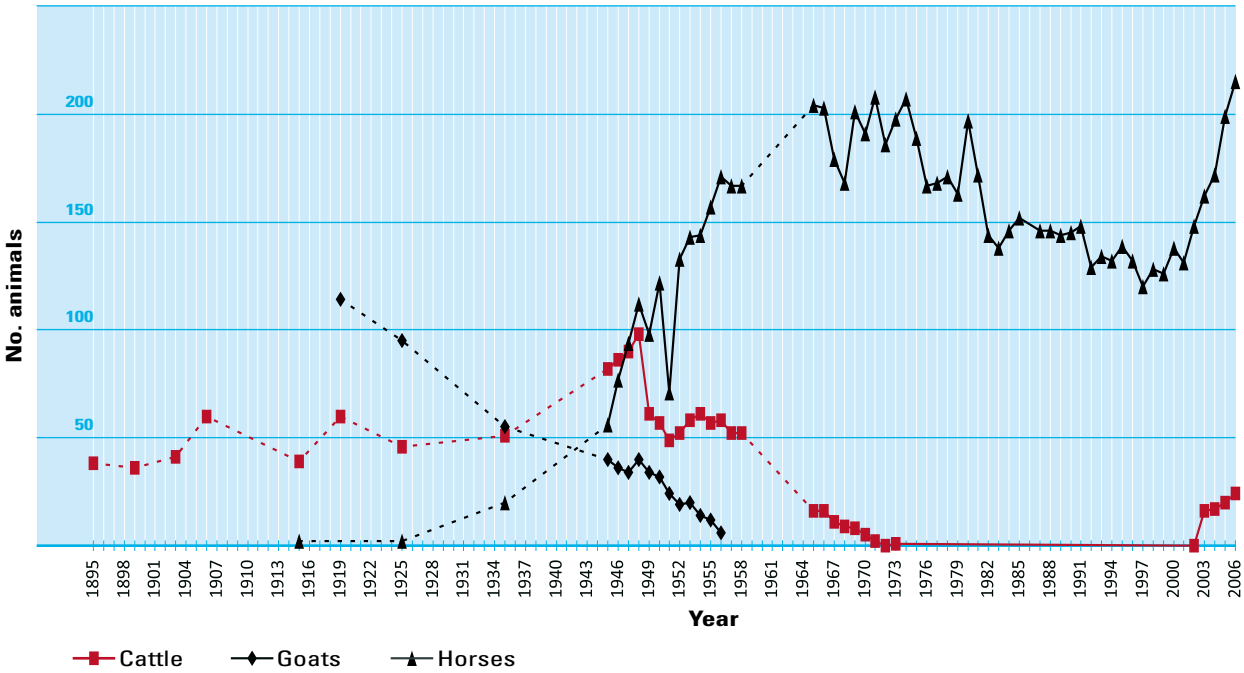
Pre-modern farming outlined

The period of pre-modern Inuit farming, then, is the one that seems most informative as regards Norse farming practices, among other reasons because, compared with the preceding period, it is richly

No. sheep in Greenland 1906-2006



Cattle, horses, and goats in Greenland, 1895-2006



and accurately documented. The animal husbandry initially practised during the pre-modern farming phase included all the species brought to Greenland by the Norsemen: goats, sheep, cattle, horses, and pigs, listed roughly in the order of their prevalence at the beginning of the period (cf. figs. 3, 4). Pre-modern farming also saw experimental breeding of rabbits, geese, and reindeer, as well as the keeping of quite a considerable number of chickens (Christensen 1946; Hansen 1926: 75; Kampp 1964; Walsøe 1936); however, as none of these domesticates were bred by the Norse settlers, they will not be considered here.

Fig. 3. Number of officially registered ewes in Greenland in the period 1906-2006; dotted lines indicate years with missing information. The sharp drops in the curve reflect the so-called 'catastrophic' winters, i.e. winters with heavy sheep losses, discussed in the text. Notice also the relatively stable population post-1976 after regulation and modernization of Greenlandic sheep farming (data aggregated from: Amdrup et al. 1921; Chemnitz 1920: 30; Hansen 1926: 75; Jensen et al. 1963: bilag 2; Kampp 1964: fig. 1; Walsøe 1919, 1936; Statistisk Årbog 1951-1985; Grønland: Statistisk Årbog 1983-2006).

Fig. 4. Number of cattle, horses, and goats in Greenland 1895-2006; dotted lines indicate years with missing information. Figures from 1896 to 1945 are only estimates, because there was no official register of livestock (data aggregated from: Amdrup et al. 1921b; Bruun 1895; Hansen 1926; Jespersen 1916; Knuthsen et al. 1906; Walsøe 1936; Statistisk Årbog 1951-1985; Grønland: Statistisk Årbog 1983-2006).

Interestingly, although goats were seemingly more numerous than sheep at the transition from colonial to pre-modern farming, they were completely phased out by the mid 1950s (fig. 4), a diachronic development quite opposite to that of Norse animal husbandry (Dugmore et al. 2007; Enghof 2003). In the latter context, the relative increase in goats has been ascribed to their greater resilience and broader food spectrum (McGovern 1992). However, the specifics of keeping goats in early 19th-century Greenland are unfortunately rarely touched upon in the 19th-century sources; one author (Jespersen 1916) notes that goats were in decline because the Inuit had no liking for goats' milk, thus also pointing to the seemingly arbitrary factors that sometimes influenced developments. Pigs in Greenland were always very few; experimental breeding culminated during and just after World War II, but was abandoned because it was simply too impractical (Christensen 1946; Jespersen 1916). Because of their low numbers and insignificant role in pre-modern farming, goats and pigs will not be discussed here either, leaving only sheep, cattle, and horses to be discussed.

During pre-modern farming these livestock were herded *extensively*, i.e. they

were mostly left free to graze in the mountains and valleys and fend for themselves throughout the year and rounded up merely for culling and shearing; only the cattle would be stalled and fed through the hardest winter months (fig. 5) (Heerfordt et al. 1980; Jensen 1951). In the South Greenlandic environment, with its highly fluctuating and often harsh winter weather, this markedly extensive mode of production was a very risky farming strategy: the result was that livestock were depleted during the hardest winters (fig. 9), sometimes in disastrous proportions, which accounts for these winters being termed *'catastrophic'* (e.g. Christensen 1950; Jensen 1958). This disadvantage of extensive farming was already realized by early farmers and observers (e.g. Bendixen 1927; Hansen 1926; Knuthsen et al. 1906; Walsøe 1936), and was indeed known from elsewhere in the North Atlantic; in the Faroes for instance, such catastrophic winters were called *felli* and were thought to occur on average every 14 years (Brandt 1985).

Fig. 5. Abandoned cattle byre at Igaliku, once the seat of the Norse bishop at Garðar (E47); both the stones of the byre and the hayfield in front have been reclaimed from the Norse farmstead. Such re-use of Norse vestiges was common in pre-modern Greenlandic farming (Photo: K. Krogh 1979).

That farming in South Greenland remained strikingly extensive throughout its pre-modern phase in spite of the known risks was thus not a result of poor judgement or inexperience; it was rather a direct consequence of factors specific to the Greenland setting, i.e. the very factors that characterized pre-modern farming and make it such an interesting case study: first, the pronounced lack of agricultural machinery up until the late 1960s (fig. 6), primarily caused by Greenland's distance from Denmark, meant that it was exceedingly hard to expand hayfields and thereby increase production of winter fodder (e.g. Christensen 1946, 1955; Jensen 1951; Walsøe 1919). Hay production was mostly limited to the re-use of relict Norse homefield areas, expanses that were quickly occupied (e.g. Christensen 1946: 152; Jensen 1951: 71). The slow increase in cultivated area during the phase of pre-modern farming is strikingly obvious from fig. 7. At the same time, livestock numbers increased dramatically, widening the critical gap between potential fodder resources and numbers of livestock in potential need of

Fig. 6. Raking hay at Qassiarsuk; because of Greenland's logistical remoteness from Denmark and the trade monopoly, agricultural machinery and aids were very few – essentially just a few tractors owned by the sheep-breeding station – until the 1970s. Instead, fields had to be improved and worked by hand or with the aid of horses (Photo: Vebæk 1964).

fodder (cf. figs. 3-4, 7), even though Inuit farmers also readily resorted to wild-growing fodder resources (Amdrup et al. 1921b; Bendixen 1927; Christensen 1955; Hansen 1926; Heerfordt et al. 1980; Jensen 1958; Walsøe 1919, 1936).

Apart from the spatial and, especially during the first half of the period, the technological overlap with Norse farming, points of prospective contrast with Norse farming should also be suggested: first, before the modern phase of farming, holdings were scattered among many livestock owners, some of whom were full-time farmers, but the majority of whom were to varying extents farmers/hunters (fig. 8) (e.g. Jensen et al. 1963: tab. 3). The former group was settled in the inner fjord areas on prime Norse

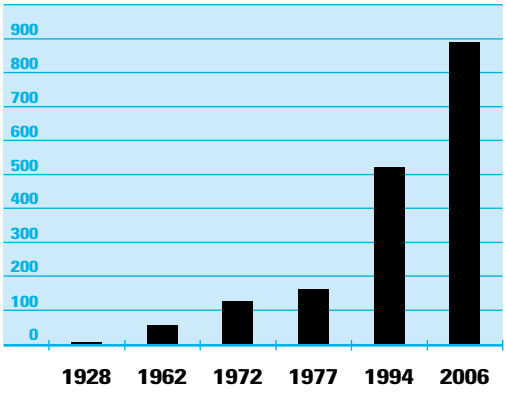


Fig. 7. The aggregate cultivated area in Greenland at intervals in the period 1928-2006. Note the very slow expansion in cultivated area up to the mid-1970s (data aggregated from: Heerfordt et al. 1980; Høegh 2007; Jensen et al. 1963; Walsøe 1936).

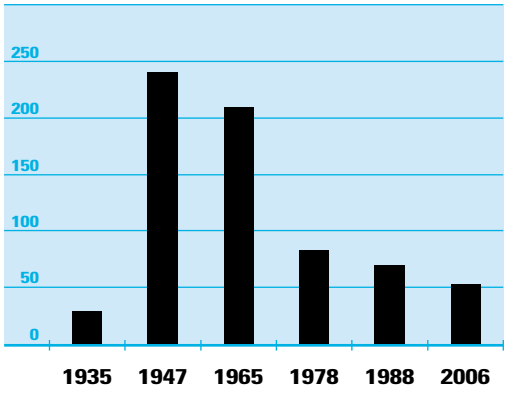


Fig. 8. The number of registered sheep owners in Greenland at intervals in the period 1936-2007. Notice the drop in the number of holdings after the catastrophic winter of 1975/76 and the subsequent professionalization of farming in Greenland (after Dietz 1989; Heerfordt et al. 1980; Høegh 2007; Jensen et al. 1963; Walsøe 1936: 162).

farmland, while the latter was found in the middle fjord and coastal areas. The distribution over several, mostly small-scale owners is probably somewhat similar to the Norse farming pattern. However, the middle fjord and coastal situating of the pre-modern holdings is surely linked to traditional Inuit settlement pattern and, according to the initial findings of the project, a trait rather opposite to than the same as Norse settlement; new, not yet published dates suggest that the Norse outer fjord and coastal sites were the latest to be occupied and the earliest to be abandoned.

In summary, the Norsemen in Greenland were farmers who increasingly turned to hunting, while the Inuit were hunters who increasingly turned to farming; perhaps Norse farming practices were, as a consequence, more effective than even the 20th century pre-modern ones, for instance in their use of manure and irrigation (cf. e.g. Christensen 1953; Knuthsen et al. 1906; Krogh 1982). In addition, pre-modern sheep farming steadily became a specialized, commercial venture – increasingly relying on subsidies and imports – while Norse farming remained self-sufficient household production with the classic North Atlantic composition of animal husbandry. A number of such overlaps and contrasts – suggestive rather than conclusive – are considered in the project, but lie beyond the scope of the present paper.

Centrally, four main points singled out from the history of pre-modern farming make for interesting comparisons with Norse farming:

1) the South Greenland landscapes can, in terms of available summer fodder biomass, naturally support quite a large number of livestock; agricultural surveys have through time projected sustainable sheep numbers between 55,000 and 900,000 (Egede et al. 1982; Kampp 1964; Laursen & Ørnsholt 1979); however,
2) summer fodder biomass is not the key factor regulating fluctuations in overall Greenlandic livestock populations; this factor is rather the availability of winter fodder, either occurring naturally or provided by humans;
3) because pre-modern farmers predominantly re-used Norse home-fields or naturally occurring resources for winter fodder hay production, we can fairly assume that fodder production in neither period can have greatly exceeded fodder production in the other;
4) as this amount of fodder could winter-feed only a fraction of the total number of livestock, Inuit farmers relied on extensive grazing; the Norse settlers, likely also to try and maximize their animal husbandry, would have had to rely to some de-

gree on extensive farming practices to compensate for the insufficient winter fodder production.

The environmentally regulated fluctuations in livestock numbers observed historically can therefore be taken as suggestive of similar fluctuations during the Norse occupation of Greenland.

'Catastrophic' winters

The inner part of the South Greenlandic fjords, where both Norse and pre-modern Inuit sheep farmers primarily set up their farmsteads, is an environmental niche characterized by a subarctic subcontinental climate; i.e. mean summer temperatures lie above 10°C and the growing season is somewhat longer than in the low-arctic outer fjords (Born & Böcher 2001; Cappelen et al. 2001; Feilberg 1984). By contrast, winters are colder and somewhat drier in the inner than in the outer fjord. More significantly, however, winter weather varies greatly in terms of temperature and precipitation depending on the wider meteorological conditions, especially the North Atlantic Oscillation (NAO), anomalies in this system leading to either cooler arctic winter weather or milder, wetter, and more unstable North Atlantic winter weather (ibid.). A further influence on South Greenlandic winter weather is the equally variable winds, among which the katabatic winds coming off the ice cap – especially the warm *Foehn* winds – are highly influential on the appearance of the South Greenland winter landscape. 'Catastrophic winters' occur when certain of these weather factors coincide.

However, it must be stressed that 'catastrophic winters' is not a meteorological term; rather, it is a 'hands-on' term tied specifically to farmer-livestock-environment dynamics, i.e. it is a farmer's perception of the severity of a specific winter in terms of the loss of livestock, more specifically sheep. Clearly, *severity* is not an objectively fixed magnitude, but a relative observation. Still, *severity* is central to the identification and description of this winter phenomenon, because some winters with minor livestock losses are not referred to as catastrophic. If we compare the historical use of the term (Christensen 1950; Jensen 1958; Heerfordt et al. 1980) with actual losses (fig. 9), 'catastrophic winters' can tentatively be defined as *winters when 10% or more of the total number of ewes* were lost. As shown by fig. 9, there were ten such recorded 'catastrophic winters' in the period 1906-1976, plus an additional four years with population declines not recorded as 'catastrophic'. It should be noted that some yearly declines do not appear as grave as they really were; for instance, in 1932/33 and 1933/34, as many as 30-40% of the ewes were actually lost, but

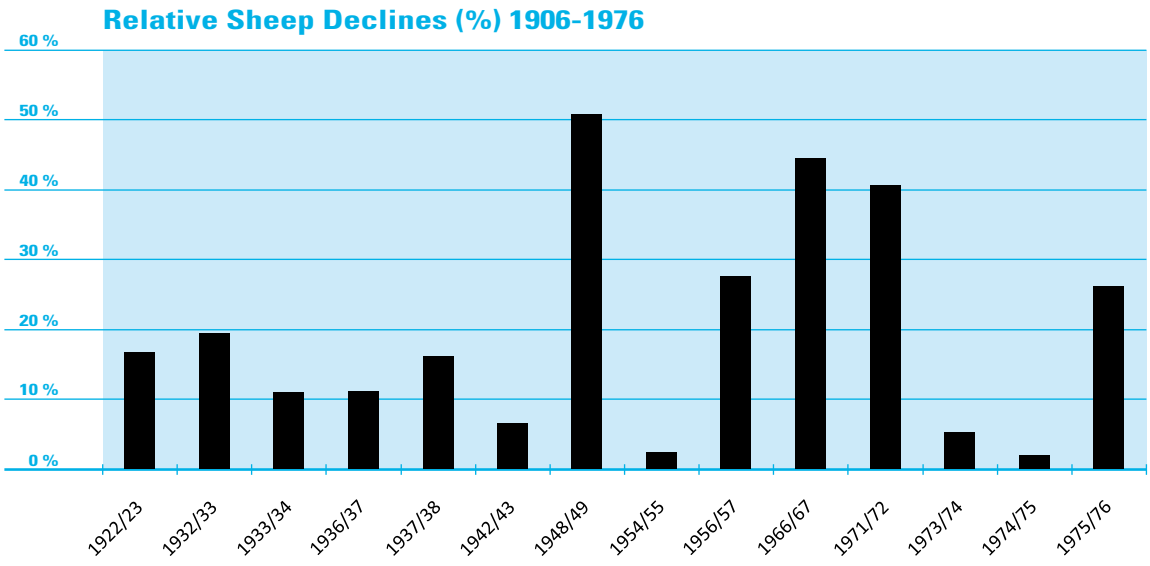


Fig. 9. Recorded relative sheep declines (% of the previous year's population) in the period 1906-1976. Historically termed 'catastrophic winters' were those when 10% or more of the total stock was lost during a single winter.

because of a subsequent mild spring a larger proportion of lambs survived and were added to and counted among the stock the subsequent year. Finally, although fig. 9 covers the entire pre-modern phase of farming, population declines in 1906-1925 should be viewed with some caution, because livestock records from the early years are somewhat uncertain.

A characteristic of the 'catastrophic winters' of pre-modern farming was exceptionally cold winter/early spring temperatures over prolonged periods. Additionally, they came in two varieties: On the one hand, there were the winters when the prolonged cold was accompanied by deep snow cover that was not occasionally thawed by *Foehn* winds or breaks of mild temperatures; this resulted in farmers running short of fodder, a deficit they could not remedy by grazing the animals, because of the deep snow cover (Christensen 1950). However, equally disastrous were winters when *Foehn* winds or generally mild weather thawed only part of the snow cover, but subsequent quick freezing led to the formation of an ice shield that the sheep could not dig through in their search for forage (Born & Böcher 2001; Heerfordt et al. 1980).

In the historical records of pre-modern farming (fig. 3) such 'catastrophic winters' occurred on average *every seventh*

year, i.e. with double the frequency expected for instance in the 18th-century Faroes (Brandt 1985). However, fig. 9 reveals that the *severity* of such catastrophic winters was quite variable, with losses ranging from c.10% to 50%. Also shown in fig. 9 is the circumstance that in 7 of the 10 instances, the 'catastrophic winters' occurred in 2 or 3 successive years; these years must surely have been extra hard on the farmers. Following 'catastrophic winters', repopulation on average occurred within 4.1 years (calculation based only on those years where repopulation actually occurred), although it varies from 2 to 8 years depending on the severity of population decline.

While such crude statistics are certainly in themselves suggestive for farming strategies employable by Norse farmers, they also need to be formulated in terms of climatic data in order to be truly convincing; after all, Norse settlement spanned a period of quite striking climatic and environmental change, i.e. the transition from the *medieval warmth period* (MWP) to the *little ice age* (LIA) (e.g. Ogilvie & Jónsson 2001; Patterson et al. 2010; Xoplaki et al. 2011). Comparing 'catastrophic winter' records and different meteorological and climatic data is still an ongoing process, the results of which can only be summarily reported here. But as an example comparisons of the records of sheep numbers and meteorologically observed mean annual temperature in the inner fjord area in 1906-1976, e.g. at Narsarsuaq (Cappelen 2007), do show some correlation; however, the correlation is not strong, clearly signalling that while low temperatures are part of the explanation for 'catastrophic winters', they are not the whole explanation. Inclusion of meteorological data on winter precipitation in the same period (ibid.) results in much stronger correlation, emphasizing snow cover as an important factor; unfortunately, detailed winter precipitation records are only available for the period after 1960 and therefore provide little statistical verification.

Somewhat surprisingly, the strongest positive correlation found so far between 'catastrophic winter' sheep declines and climate data overlapping the period of pre-modern farming comes from ice-core records from the Greenland ice cap, especially the Dye-3 ice core (Dahl-Jensen et al. 1998; Vinther et al. 2010). Simply explained, these data sets provide a relative temperature record back through time which can be divided bi-seasonally – winter and summer season – on the basis of their $^{16}O/^{18}O$ stable isotope content, henceforth referred to simply as $\delta^{18}O$ *data*. Significantly, it has recently been demonstrated that winter-season Dye-3 $\delta^{18}O$ data mainly ties in with the

NAO signal and display high correlations with southwestern Greenland temperatures, whereas summer-season Dye-3 $\delta^{18}O$ data generally tie in with temperature records from Greenland's east coast and NW Iceland (Vinter et al. 2010). In short, the Dye-3 $\delta^{18}O$ data reflect temperatures in the vital winter season and mainly in the geographical region that is of interest to the present study; this, in all likelihood accounts for the correlation with recorded sheep declines (for discussion, see below). Besides the considerable degree of correlation with sheep-number fluctuations, the $\delta^{18}O$ data is useful because, unlike the meteorological records, it can be extrapolated back in time to periods of Norse farming.

Sheep population and $\delta^{18}O$ data

Fig. 10 shows the sheep population in 1906-1976 and corresponding seasonally separated $\delta^{18}O$ data; what are immediately visible are correlative 'dips' in the curves. However, equally visible are instances of correlation with only one set of $\delta^{18}O$ seasonal data, correlation shifted seasonally to either side, or very little correlation at all (cf. figs. 9&10). Clearly, both data sets need to be carefully evaluated for potential biases before an actual model for $\delta^{18}O$ data/sheep-decline dynamics can be formulated. As expected, seasonal $\delta^{18}O$ data alone do not explain all of the 'catastrophic winter' sheep declines. Part of the upcoming project work is to refine the model, adding new data such as ice-core accumulation rates (Andersen et al. 2006) and determining the exact prevailing weather of the specific 'catastrophic winters'; i.e. when exactly did the 'killing' cold and snow set in? But even working simply with some basic statistics has a number of interesting implications.

To begin with, the years prior to 1926 must be left out of consideration simply because of poor data quality, i.e. very insecure population counts and such low sheep numbers that decline percentages are too easily exaggerated. Thus, the potential 'catastrophic winter' of 1922/23 must be omitted, leaving only the nine winters of 1932/33, 1933/34, 1936/37, 1937/38, 1948/49, 1956/57, 1966/67, 1971/72, and 1975/76 in consideration (note, however, that 1936/37 is not mentioned historically as a 'catastrophic winter'). Using the $\delta^{18}O$ data means of these recorded 'catastrophic winters' as a critical mean (dotted line fig.10, 13a-c) – henceforth termed Winter Critical Mean (WCM) and Summer Critical Mean (SCM) – for when sheep-decline/$\delta^{18}O$ data correlation can be expected (i.e. a catastrophic winter will occur when winter and summer seasonal $\delta^{18}O$ data < WCM/SCM), seven instances occur in the period 1926-1976. Of these, three instances correspond with actual recorded 'catastrophic winters', three cor-

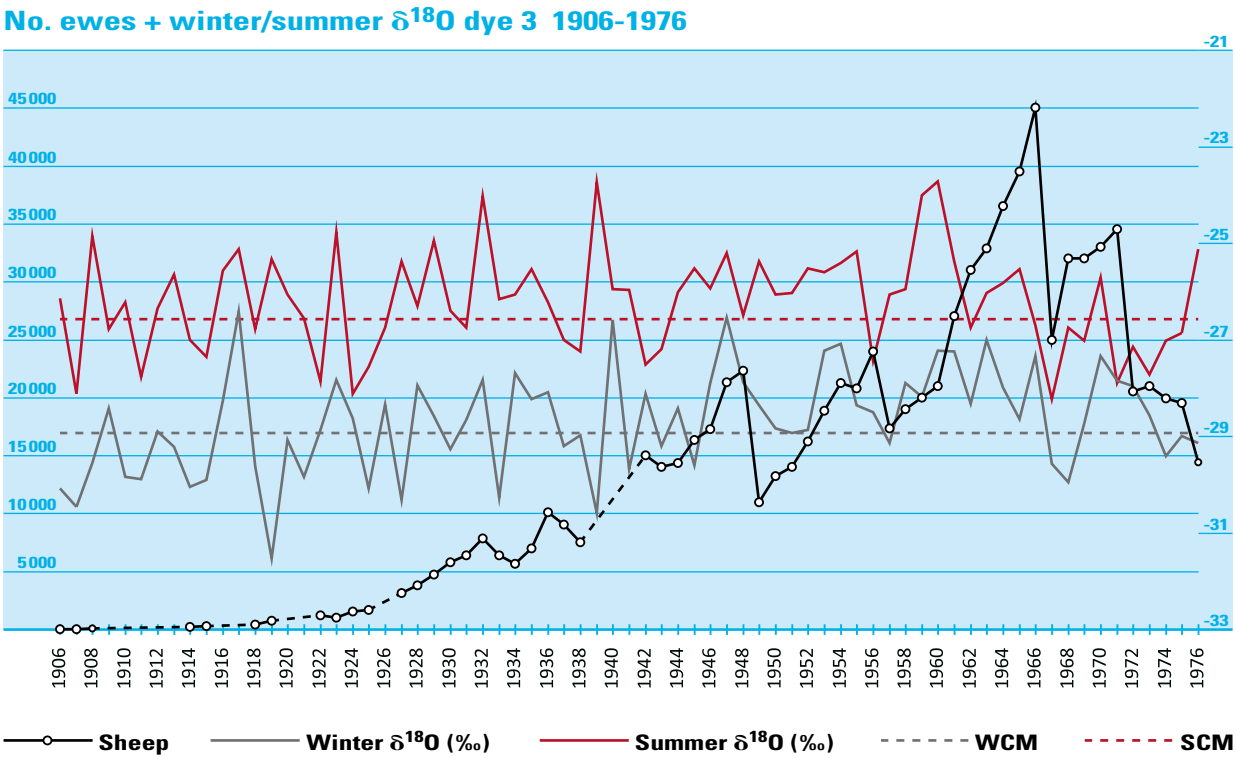


Fig. 10. Graph showing correspondences between number of ewes (black line) and seasonal winter (dark grey line) and summer (red line) $\delta^{18}O$ data (after Vinther et al. 2010); broken dark grey and red lines – termed winter critical mean (WCM) and summer critical mean (SCM) – show mean values for the 9 recorded catastrophic winters 1926-1976 used in the inferential extrapolation to the Norse period.

respond with winters with smaller sheep declines, and one does not correlate at all (cf. figs. 9 & 10). While yet imperfect, the model does thus seem to account most predominantly for years with sheep losses, although not necessarily of 'catastrophic' proportions.

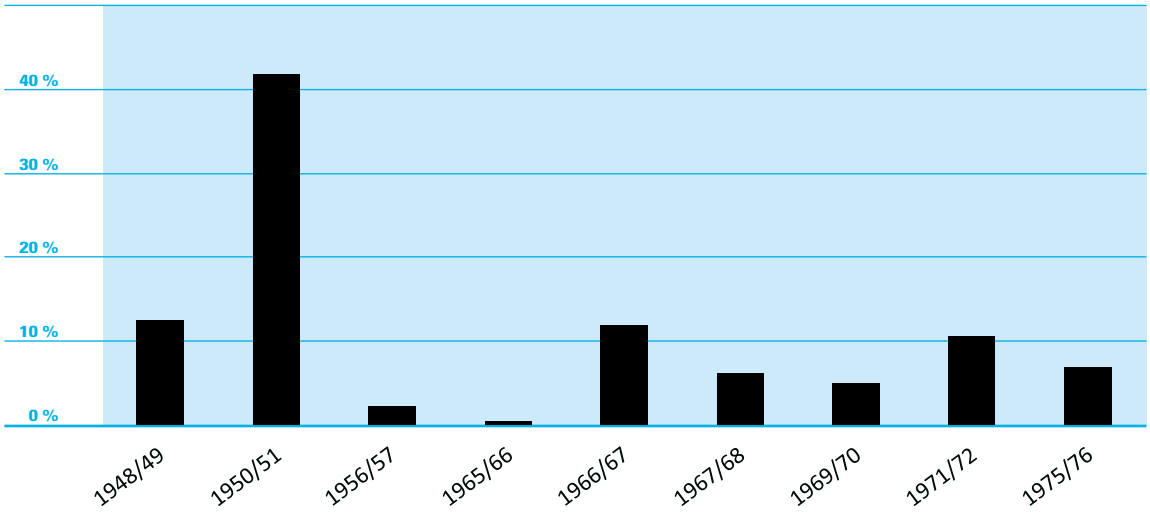
Horse population and $\delta^{18}O$ data

In the graph (fig. 4) of recorded numbers of horses in Greenland from the colonial phase of farming until today, two things are immediately evident: first, that the population seems to have fluctuated markedly, an interpretation that is however partially due to the generally low number of horses (between 56 and 216) and the consequent exaggerated dips when this is shown in the chosen graphic resolution; the second thing that is evident is the lack of detailed population counts prior to 1945, and in the interval 1958-1965; this critically limits the comparative statistical value of the data set.

Recorded declines in the horse population during the pre-modern phase of farming are shown in fig. 11. If we also accept the >10% decline as a limit for 'catastrophic winter' horse losses; there were only four such winters: 1948/49, 1950/51, 1966/67 and 1971/72. Of these four declines, the 1950/51 one was the most distinctive, with a c. 42% (51 horses) loss; it is furthermore the only catastrophic decline to occur in a year without a parallel catastrophic sheep population decline. This could indicate that the 1950/51 decline had other causes, e.g. purposeful culling or disease. Of the five recorded <10% horse population declines, two occurred in years with parallel sheep losses, while three did not; however, these years are extremely problematical because the yearly difference has a range of only 1-13 horses, i.e. so few that declines can by no means be convincingly attributed to environmental factors.

The overlap of years with both horse and sheep population declines, also in some instances correlating with $\delta^{18}O$ data (cf. figs. 12&10) suggests what has already been mentioned historically: i.e. that horses were herded extensively during pre-modern Greenlandic farming and were liable to equal fluctuations. However, the correlation is not strong, especially considering that horses are more susceptible to harsh winter conditions than sheep and that horse-population declines would accordingly be expected to follow $\delta^{18}O$ data even more closely. They do not, suggesting perhaps that horses were, in fact, stalled and fed somewhat differently from sheep. How-

Fig. 11. Recorded relative horse population declines (% of the previous year's population) in the period 1945-1976.



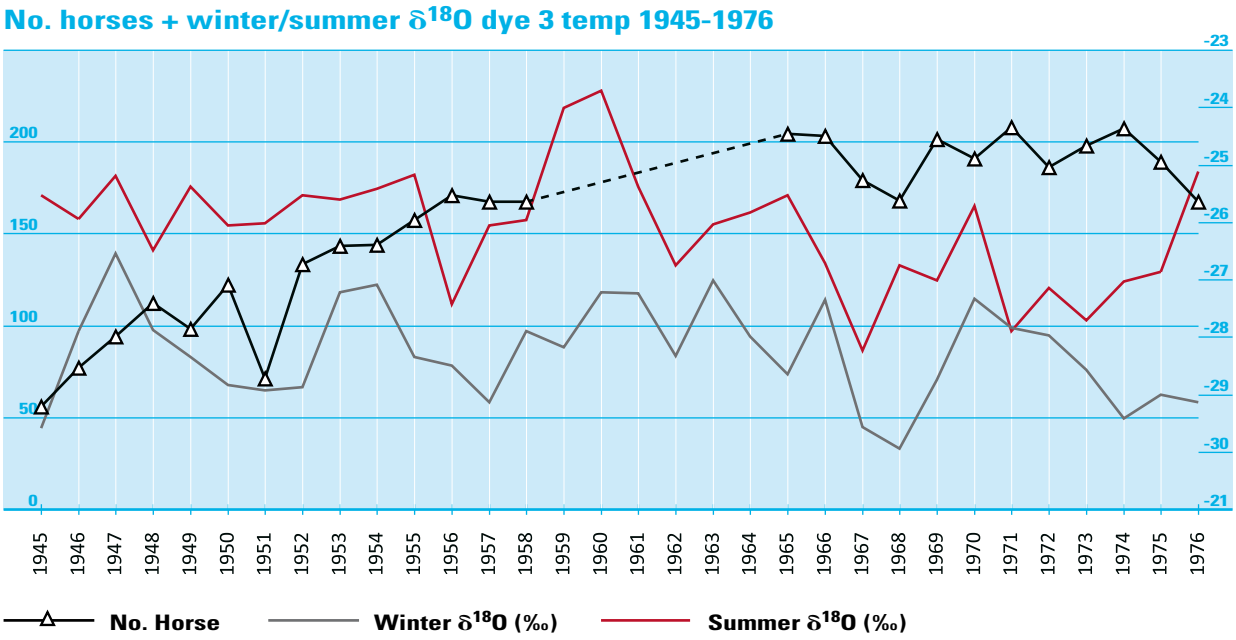


Fig. 12. Graph showing correspondences between number of horses (black line) and seasonal winter (dark grey line) and summer (red line) $\delta^{18}O$ data (after Vinther et al. 2010). Note especially both winter and summer seasonal $\delta^{18}O$ data values for 1967, corresponding to a significant decline in the horse population as well as the sheep population (fig. 10).

ever, a comparison for the year 1966/67 in figs. 9-12 merits special attention because it appears to have been a year of equal severity for both sheep and horses; in the $\delta^{18}O$ data too this year stands out (cf. figs. 10 & 12) with extremely low values for both winter and summer: -29.57 and -28.24‰ respectively. It is therefore not unreasonable to say that such low seasonal $\delta^{18}O$ data values strongly suggest extremely critical winters.

Cattle population and $\delta^{18}O$ data

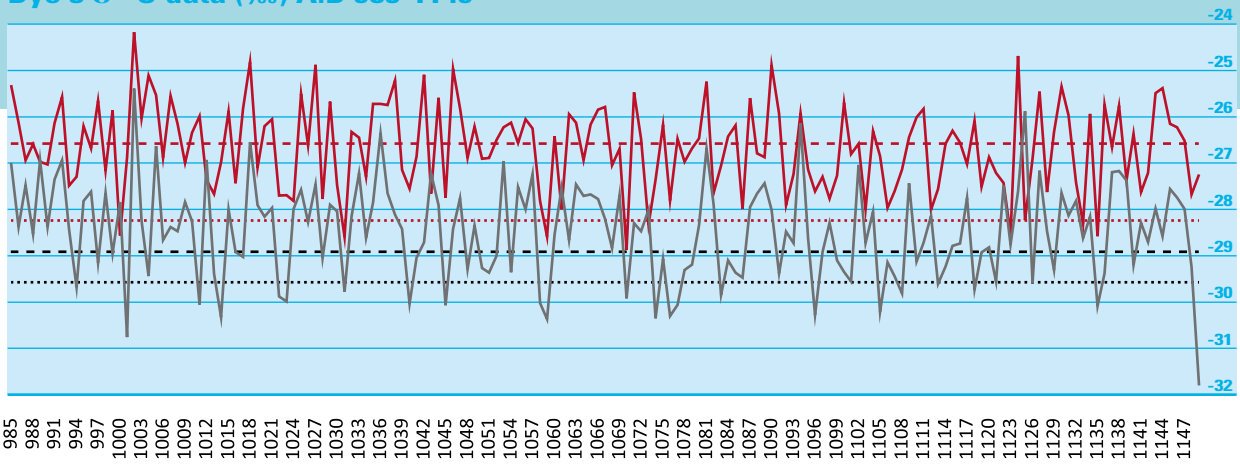
As displayed in fig. 4, accurate yearly cattle counts did not become customary until after the Second World War, and the period 1958-1965 also lacks published cattle counts. Cattle farming was temporarily abandoned in 1973, the year after the 'catastrophic winter' of 1971/72, until revived in 2002. Fig. 4 also shows that cattle farming in Greenland never involved many animals; the 98 registered in 1948 being the highest number recorded. The cattle data set is therefore of even poorer quality and comparative value than the one for the horse population, for which reason graphs reproduced for the other livestock have been omitted for cattle.

Nonetheless, fig. 4 offers some significant information; in spite of missing data: in the period from 1895 until around the end of the 1930s, the Greenland cattle population seems to have been pretty stable and to have begun to expand markedly only as sheep farming did through the 1940s, a development that accords well with the historical record (e.g. Christensen 1946). The high point in cattle numbers, 1948, coincided with a peak in sheep numbers; a preliminary optimum in livestock expansion without corresponding expansion in fodder production that, as mentioned above, resulted in grave losses of cattle, horses, and sheep during the 'catastrophic winter' of 1948/49. Unlike sheep and horses, cattle were stalled and fed during the hardest winter months, but in spite of this measure, cattle were still depleted by 38% during the 1948/49 winter. This is of special interest because the Norse settlers also stalled and fed their cattle during the hardest winter months (e.g. Berglund 2001; Nørlund & Stenberger 1934); the potential identification of such exceptionally hard winters, equally affecting extensively grazed livestock and stalled and fed livestock, would evidently be highly significant.

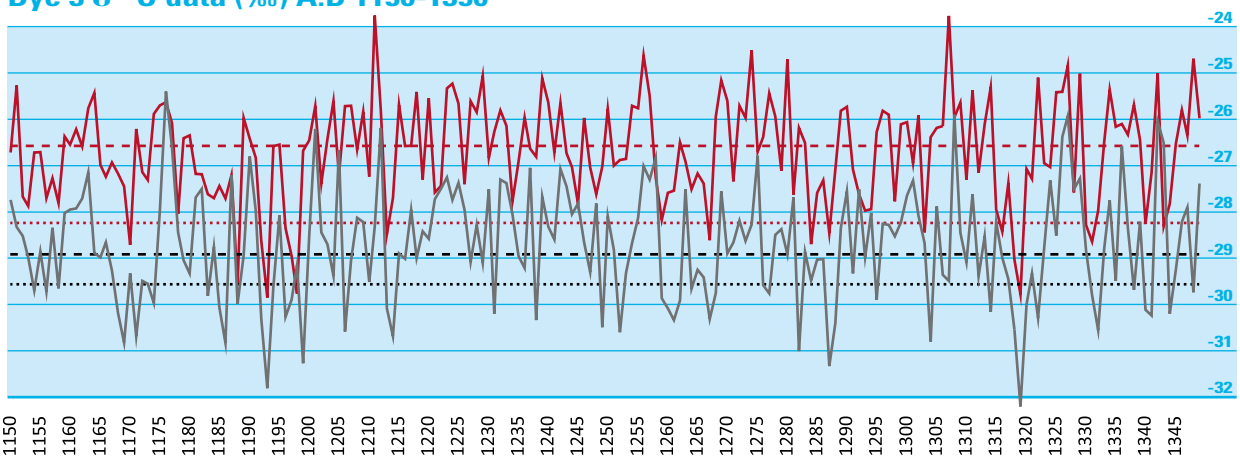
However, the seasonal $\delta^{18}O$ data for 1948/49 shows no corresponding exceptionally low values, revealing that ice-core temperatures alone cannot demonstrate all of the 'catastrophic winters'. The catastrophic winter of 1948/49 is described as having freezing temperatures, but little snow from early October, then in January heavy snow and cold, followed by thawing, which then suddenly turned into week-long icy storms that created an ice shield over the vegetation that the animals could not dig through (Christensen 1950). After a relatively mild February and March, hard winter weather set in again in late April and lasted well into June. From this description, one would indeed expect $\delta^{18}O$ values for both winter and summer that were exceptionally low; but they were not; nor do mean temperature records from the measuring station at Narsarsuaq – situated in the inner fjord core of the sheep-farming area – show any remarkable lows for 1948/49 (Cappelen 2007). The 1948/49 winter does, however, stand out as a low, as do almost all the recorded 'catastrophic winters' in the *PC1 time series* that consists of average aggregate data from seven Greenland ice cores (Vinther et al. 2003). This would seem to suggest that correlating different ice-core records could potentially

Figs. 13a-c. Dye-3 winter and summer $\delta^{18}O$ values (full dark grey and red curves) (after Vinther et al. 2010) with indication of winter critical means (WCM, broken dark grey lines), summer critical means (SCM, broken red lines), extreme critical winter (ECW, dotted dark grey lines), and extreme critical summers (ECS, dotted red line).

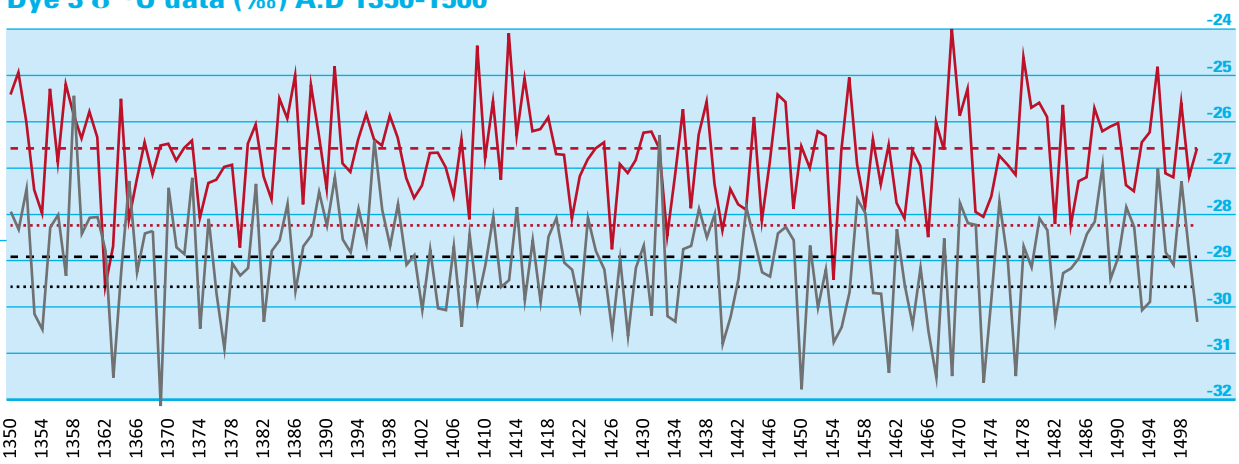
Dye 3 $\delta^{18}O$ data (‰) A.D 985-1149



Dye 3 $\delta^{18}O$ data (‰) A.D 1150-1350



Dye 3 $\delta^{18}O$ data (‰) A.D 1350-1500



make the livestock-climate model more precise. Again, however, temporal overlap with the relevant comparative periods is problematical.

$\delta^{18}O$ data and Norse 'catastrophic winters'

The main reason for trying find signals corresponding to 'catastrophic winters' in historical pre-modern farming and $\delta^{18}O$ values is, as mentioned, because the latter data set can be extrapolated back to the Norse occupation of Greenland and thereby substantiate potential frequencies of occurrences of such winters during the Middle Ages, assuming that animals were herded somewhat similarly, i.e. predominantly in an extensive farming strategy. Figs. 13a-c show the seasonal Dye-3 $\delta^{18}O$ data with indications of the WCM/SCM calculated on the basis of the records of pre-modern Inuit farming.

This simplified, preliminary model must be interpreted with certain reservations; the WCM/SCM limit did not, when used on $\delta^{18}O$ data from the pre-modern period of farming, single out only truly 'catastrophic winters'; with equal frequency it indicated winters with <10% sheep declines, and one instance of non-correlation (see above). The observations from values extrapolated back into the Norse settlement period can therefore, for now, only be read in terms of relative probability: *observed $\delta^{18}O$ values falling below both the WCM/SCM during the period of Norse settlement have a high probability of reflecting the occurrence of a harsh year for extensively grazed livestock with resulting population decline, although not necessarily of 'catastrophic' proportions, and with a slight chance of no population decline at all.* Generally, there were 13 years with sheep population declines in the period 1926-1976, i.e. a sheep decline resulting from harsh winters occurred every 3.8 years on average (fig. 9). For the preliminary identification of truly catastrophic winters, the extremely critical summer and winter $\delta^{18}O$ values (ECW/ECS) of 1966/67 are suggested (figs. 13a-c).

When we use this model to identify winters that were probably hard on livestock during the Norse period (figs. 13a-c), their relative frequency seems to have varied greatly (tab. 1). The frequency, of course, depends somewhat on how the settlement period is divided up temporally, especially because harsh winters clearly have a tendency to cluster, but here we have chosen to work mostly with 50-year units, because this is the timespan (1926-1976) upon which the model was also based. For the Norse *landnám* period AD 985-1049 harsh winters seem to have occurred considerable less often than during pre-modern farming, while the subsequent 100 years until

Year A.D.	Harsh Winters	Harsh Winter Average	Critical Winters
985-1049	13	4,92	1
1050-1099	15	3,33	2
1100-1149	13	3,85	1
1150-1199	23	2,17	6
1200-1249	8	6,25	1
1250-1299	16	3,13	2
1300-1349	14	3,57	4
1350-1399	14	3,57	1
1400-1449	20	2,50	3
1450-1499	16	3,13	2

Tab. 1. The modelled averaged frequencies of harsh winters, i.e. winters with probable livestock declines, and the number of extremely critical winters, based on the 1966/67 seasonal $\delta^{18}O$ data, separated only by intervals of 50 years (note that the first landnám interval is 64 years).

AD 1149 were roughly comparable. Extremely critical years occurred only once or twice every 50 years. Overall, this would seem to indicate that during the initial settlement of Greenland, and especially during the landnám, reliance on an extensive farming and herding strategy was quite feasible and sustainable.

During the period AD 1150-1199, harsh winters suddenly seem to have appeared with much greater frequency – in fact at almost double the rate of the preceding period – as did critical winters, which all fell towards the end of the period. This would have put a serious strain on one or two generations of Norse farmers, perhaps prompting changes in livestock composition, farming strategies, and general subsistence economy. At this time, such changes cannot be confirmed directly in the archaeological material, because of the lack of finely stratified bone collections or construction chronologies from the Norse Eastern Settlement. It does, however, correspond rather well to the overall shift in ^{13}C stable isotope values in human bones after c. AD1250, signalling a shift towards a significantly more marine diet (Arneborg et al. 2008). Yet, because the extremely harsh half century was followed by the seemingly most favourable 50 years for extensive farming during the entire Norse settlement period, the effects of the harsh years may have been cancelled out and extensive farming strategies may even have been reinforced.

The period AD 1250-1400 saw years comparable to, or only slight worse than, those in the pre-modern phase of farming; that is, extensive herding was risky, but probably generally sustainable, partly because seriously critical winters were still infrequent and livestock had time to recuperate before a new catastrophic depletion. From AD 1400-1500 onwards, however, harsh winters for extensively herded livestock would seem to have occurred with increased frequency, probably making the risks of extensive farming too great to sustain this mode of farming. If, however, extensive herding had been a significant element in Norse farming throughout most of the settlement period, a possibility for which the $\delta^{18}O$ data would seem to allow, this change could have been difficult and would have re-

quired redirection of a small labour force, which at the time was heavily directed towards the exploitation of marine resources (Arneborg et al. 2008).

Conclusion

One aim of the PhD project *Landscape and Livelihood, Economy and Hierarchy: Pastoral Farming in Norse Greenland* is to incorporate historical evidence of 19-20th century Inuit farming in Greenland. Such evidence serves to identify key practical and environmental issues likely to face anyone trying to farm on the edge of the Arctic; it allows the archaeologist or scientist to view the landscape, so to speak, through the eyes of Greenlandic farmers and to approach a more dynamic 'dwelling' perspective (cf. Ingold 2011): the Norse settlers must have existed as opportunistic and adaptive farmer/hunters finding their livelihood in landscapes that were intricately familiar and structured, but also landscapes that were constantly changing, posing to some aspects of their livelihood, while creating opportunities in others.

Through the case study of the period of *pre-modern Inuit farming*, the paper gives a preliminary example of how the historical evidence can be used to explore scenarios of environment-farming dynamics, not only for the historical period, but, using seasonal ice core data, potentially also for the Norse settlers. The proposed model can clearly be refined and corrected to generate even more statistically sound and graduated findings, and the model still needs testing against other archaeological and environmental evidence. However, the initial results suggest that extensive farming, i.e. the labour-effective mode of farming where the livestock are left to graze mostly unsupervised throughout the year, was a risky, but feasible and sustainable farming strategy throughout most of Norse settlement in Greenland. Only after AD 1400 does extensive farming seem to have become an extremely precarious strategy; at this point, however, farmers might have had a hard time redirecting a sparse labour force into farm work and changing their basic subsistence economy, which was by then heavily dependent on marine resources. If Norse farmers were unwilling or unable to break with the continued reliance on an extensive farming strategy, it could have influenced settlement economy, and ultimately led to abandonment, as environmental conditions for extensive farming grew increasingly worse.

As mentioned, the proposed model, and inferences drawn from it, assumes that Norse farming remained markedly extensive throughout the settlement period. This assumption is clearly unsatisfactory; following decades of harsh winter weather and livestock declines, the Norsemen

would certainly be expected to react within their capability to improve their situation and reduce livestock losses. Given the lack of complementary archaeological evidence, the model can therefore only be used to explore 'what-if' scenarios, rather than 'so-that' scenarios. However, given the historical example of the Faroes, even the most catastrophic livestock declines need not always result in adaptive response; until the 18th century, sheep farming was the mainstay of the farming economy, yet severe sheep declines resulting from hard winters are abundantly recorded without this ever leading to a large-scale move to an intensive herding strategy (Brandt 1985; Joensen 1979; Kampp 1950). Besides being suggestive for the above study of livestock-environment dynamics, the historical Faroese example also cautions us that farming strategy is just one element of a complex farming system that works as a totality, i.e. changes are determined by a range of different factors; and outlining and describing other such factors in the Norse Greenlandic farming settlements is the next step in the PhD project.

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Churches, Christianity and magnate farmers in the Norse Eastern Settlement

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Danish Middle Ages and Renaissance

The written sources give the impression that the Christianization of the Norse Greenlanders was an element in the Crown-initiated Christianization of western Scandinavia around the year 1000 AD. However, AMS datings of skeletons from *"Tjodhilde's Church"* in Qassiarsuk – *Brattahlid* – show that at least some of the Icelandic colonists must already have been Christian when they settled in Greenland (Arneborg et al. 1999). The early Christianization of the Greenland population does not however preclude the possibility that there were also attempts from the centre – the Norwegian King and later the Roman Church organization – to influence the development of the Church in Greenland.

The Greenland Norse churches are always related to a farm. The ruins of the larger, striking churches are clearly traceable in the landscape, and their datings were established by Aage Roussell's dissertation *Farms and Churches in the Medieval Norse Settlements of Greenland* from 1941. It is the general consensus that the large churches functioned as a kind of public (parish) churches, but after the find of *"Tjodhilde's Church"* in 1961 the researchers became aware of a group of smaller and more unassuming churches whose dating and function were less clear.

There is no doubt that *"Tjodhilde's Church"* is from the early Norse period (Krogh 1982; Arneborg et al. 1999), and indeed some scholars regard the difference between the large churches and the small ones as chronologically determined, such that the smaller churches represent an early phase in the church-building (Keller 1989). Another theory takes its point of departure in the different functions of the churches, viewing

the small churches as private prayer-houses or chapels on the medieval Icelandic model with privately owned churches (Krogh 1982).

The project "Church, Christianity and magnate farmers in the Norse Eastern Settlement" was launched in 2001, and archaeological investigations were conducted at selected small churches in the field seasons 2001, 2002, 2007, 2008 and 2010. The aim of the archaeological investigations has been to gather material for dating and to gain insight into the Christian life of the Norse Greenlanders. The overall goal of the project is to elucidate the function and role of the Christian churches in Norse-Greenlandic society.

The AMS datings of the small churches ascribe them to the *landnam* period around the year 1000. The size of the church building, the number of churches and the number of burials in the related churchyards seem to indicate that the small churches were built by the individual landnam families and functioned as 'family churches'. In time several of these 'family churches' were closed down, while others developed into public (parish) churches which, against a fee to the farmer-owner, served the surrounding churches. This process should be viewed in a social and economic perspective and reflects a development towards fewer but richer magnate farmers. The Norse community became more hierarchical, and it is assumed that the fees to the church-owning

Figure 1. Excavation of mass grave, 2010. Jade De La Paz, CUNY, USA, Pauline Knudsen, Greenland National Museum & Archives, and Christian Koch Madsen, National Museum of Denmark. Photo: Jette Arneborg.

Figure 2. Cross-section I of the mass grave. The burials are positioned side by side in the dug grave and covered with the side of a ship. The lateral 'stripes' show where the joins between the individual ships' planks were. The planks were joined with iron rivets. Note the dark area around the middle of the picture where a small child had been placed between two adults. Photo: Jette Arneborg.

farmers played a not insignificant role in this development.

After minor investigations at all the small churches in the central part of the Eastern Settlement, the fieldwork in 2008 and 2010 was concentrated on a single church, the one at the ruin group Ø64 in Igaliku Fjord, where a small trial investigation of the actual church building was conducted, and a number of burials in the churchyard were excavated, including a large mass grave containing at least nine adults, women and men, and three small children. The material from the investigations is now being processed. Among other things genetic analyses of the skeletons are being done. There is much to indicate that the deceased in the mass grave were first-generation immigrants to Greenland, and strontium analyses of their teeth will reveal where they came from. Carbon and nitrogen isotope analyses will reveal the dietary habits of the dead, and anthropological studies will elucidate living conditions in the early years of the Norse settlement in Greenland.

The intention is to continue the project with a focus on the concentration of power in the Greenlandic community and the development of the church landscape from many small to fewer larger churches. There will be a further focus on the way life was lived. The project will be funded by the Ministry of Science, the Commission for Scientific Investigations in Greenland and the US National Science Foundation.

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Greenland dietary economy

Jette Arneborg
Danish Middle Ages and Renaissance

The Greenland Dietary Economy project provides answers to the question of what the Norse Greenlanders ate – and more generally what the economic basis was for the life of the Norse settlers in Greenland, and whether there were changes during the period when the Norse-Greenlandic settlements were occupied.

The Norse-Greenlandic society endured from the end of the tenth to the latter half of the fifteenth century, and during that period Greenlandic society underwent several transformations. In the period from the first settlement until c. 1200 the religious, social and economic power was concentrated in fewer hands, but the final and definitive change came towards the end of the 1400s when the settlements were totally depopulated.

The Norse Greenlanders based their society on two economies – and each was equally important to the continued existence of the society: long-distance trading in walrus tusk, which was necessary to imports of among other things iron, which was in turn one of the preconditions of the Norse Greenlanders' production of their own food. The Norse Greenlanders had established permanent settlements in South West Greenland, where it was possible to have the grazing economy required for their stocks of cattle, sheep and goats. They hunted walrus on their hunting expeditions to northern West Greenland.

The Greenland Dietary Project focuses on Norse subsistence and food produc-

Fig. 1: Recent farm and Norse ruins at Sillisit in Tunulliarfik Fiord. The Norse ruins can be seen as dark green patches in the newly harvested field. Photo: Jette Arneborg.

tion – and especially on how they handled the climate changes that came in the course of the 1200s. It became colder and windier. At the same time the volume of ice in the fjords rose, cooling down the pastures, which became less productive, and at the same time making both internal and long-distance communications difficult.

Carbon and nitrogen isotope analysis of human and animal bones shows respectively the proportion of marine to terrestrial diet (ä^{13}C) eaten by the individual, and where in the food chain (ä^{15}N) the individual ate. The results of analyses of bones from the Norse settlers themselves, their domestic animals and the animals they hunted, show that in time the Norse diet became more and more marine. In other words, the Norse Greenlanders gradually grew more dependent on the diet they caught in the sea, first and foremost seal. In keeping with the results from the isotope analyses, the younger the deposits, the more seal bones we find in the Norse middens; and at the same time the composition of bones from the domestic animals shows that in time only the large farms were able to keep cattle. The smaller farmers gradually replaced their cows with the less resource-intensive sheep and goats. To optimize the yield from grass fodder the farmers also established irrigation systems and manured their pastures. But despite these measures it also became necessary to harvest the resources of the sea, and it was not only the less prosperous farmers who exploited this possibility. The development from a mainly terrestrial diet to a more marine one was general. At the prosperous farms too seal meat was often on the menu.

So what role did the increased dependence on the marine resources play for the development towards depopulation? Up to a certain point the Norse Greenlanders were flexible, and viewed in isolation they could have survived in Greenland by basing their diet 100% on the marine resources as the Inuit did. But socially and culturally this was not an acceptable solution, and if we are to get closer to an explanation of the depopulation of the Greenlandic Norse settlements these factors too must be considered in the discussion.

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The project is to be published in Journal of the North Atlantic.

Fig. 2:
The Norse population in the Western Settlement supplemented their diet with carribou meat. Fewer carribous in the Eastern Settlement limited hunting opportunities in this area. Photo: Jette Arneborg.

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Agriculture on the edge. The first finds of cereals in Norse Greenland

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The project

The Norsemen settled in Greenland with a thousand-year-old tradition as farmers. They continued their practices from Iceland and Norway with an agriculture mainly based on livestock, but did they also try to grow cereals or other crop plants in Greenland?

A few possible pollen grains from cereals and flax and a number of quern stones found at excavations of Norse farmsteads indicate that the Norse farmers did try to cultivate crops. The subject has nevertheless not been investigated in detail.

In this project the question of Norse agriculture is investigated using the analyses of samples from Norse refuse layers. The aim is to find remains from crop plants, e.g. cereal grains or threshing waste. Through phosphate analyses of soil samples from the infield and outfield areas at several Norse settlements, the project also aims to investigate the possible use of manure.

The fieldwork

In 2010 and 2011 a number of Norse farmsteads were visited in order to find preserved midden layers suitable for sampling.

In 2010 samples were taken from four sites (Ø33, Ø35, Ø36 and Ø37) in the Qorlortup Itinnera valley and from the midden at Gardar (Ø47, Igaliku). Samples for phosphate analyses were also taken from the infield area at Ø37. A more detailed description of the 2010 fieldwork can be read in Henriksen 2011.

In 2011, six Norse sites were investigated. The placing of the sites is shown in figure 1. The excavation team this year, besides the author, consisted of Christian Koch Madsen, (National Museum of Denmark), Inge Kjær Kristensen (Museum Salling), Konrad Smiarowski (City

University of New York, USA), and Michael Nielsen (University of Greenland and the Greenland National Museum & Archives) (fig. 2).

The two sites, Ø3 and Ø4, were sampled in the area north of Tasiusaq. At both sites the ruins are well preserved and only influences to a minor degree by modern farming. The middens are very dry and the organic remains are therefore almost completely degraded. Nevertheless carbonized material is still preserved in the two middens and a series of soil samples were taken for flotation. Samples for phosphate analysis were also taken at both sites with a distance of 20 metres between the samples. All in all, an area of 12 hectares was covered by the sampling at Ø3 and Ø4.

North of Igaliku and the Bishop's residence Gardar, a little farmstead, Ø49, is situated at the end of the Igaliku Fjord. Just south of the dwelling, a 70-centimetre thick midden layer was found. The midden is still well preserved with remains of bone and other organic matter. From this midden a series of soil samples were taken.

Twelve kilometres southeast of Igaliku, Ø 64 is situated at the head of the Kujalleq Fjord. This site has been excavated several times. In 2008 a trench was dug through the midden (Arneborg et al. 2009) and was still clearly visible on the surface, permitting ease of sampling. As already recorded in 2008, the midden was degraded, but as pieces of charcoal were clearly visible in the profile, a series of soil samples were take for flotation. Samples for phosphate analyses were taken from an area of 3.5 hectares around the ruin.

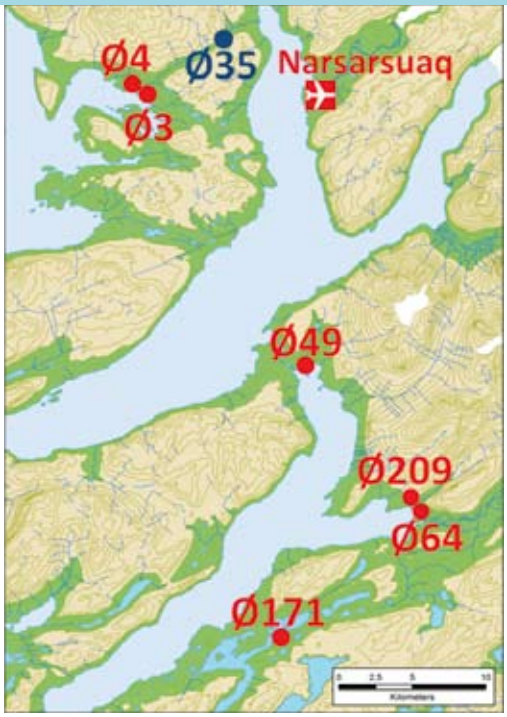

Fig. 1: Locations of sites visited in southern Greenland. The red numbers are sites visited in 2011. The blue number is Ø35, visited in 2010.

Two hundred metres north of Ø64 another smaller ruin group, Ø209, was investigated. Just next to the dwelling a 15-centimetre thick midden layer was found under the remains of wall turfs. The midden was dry and degraded but contained a lot of charred material. A number of samples could thus be taken for flotation.

Fig. 2:
The excavation camp at Ø3. From left: Michael, Konrad, Inge and Christian. Photo: Peter Steen Henriksen.

The last ruin group visited was Ø171 in Vatnahverfi. Here thick, well preserved midden layers had earlier been recorded in a drainage ditch. As a result of a high groundwater level, the organic remains of bones and wooden artefacts were well preserved. Samples from two profiles were taken as there were good preservation conditions for both carbonized and uncarbonized material.

A total of around 165 kilograms of soil was sent to Denmark for further analyses.

Results from the analyses

So far soil samples from Ø35, Ø36, Ø37, and Ø47 have been analysed. The most important find is rachis segments from Barley found in the bottom layers of the midden from Ø35 in the Qorlortup Valley (fig. 1). The find of rachis segments indi-

cates that the Barley had been grown in Greenland. This part of the crop is removed during the threshing and it is unlikely that cereal crops were imported unthreshed, as this would be very space-consuming.

The samples also contain seeds and other parts from wild plants and even parts from seaweed.

These finds can help to form a picture of the local vegetation and the use of the natural resources.

The future work

In the coming year the rest of the macrofossil samples and the soil samples for phosphate analyses will be analysed. On the basis of the results, a strategy for a more dedicated sampling of macrofossil samples from Norse ruins will be made.

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C

Networks in the North:

Communication, trade and culture markers

Approximately 1.7 square metres of furred and de-haired sealskin were used to make this West Greenlandic woman's costume. Photo: Roberto Fortuna.

C

The following projects constitute the research theme:

- **'Cultural contacts across the Skagerrak and the Kattegat in the Viking Age'**
  Anne Pedersen, head of project, Danish Middle Ages and Renaissance

- **'Communication, cultural encounters and identity in Scandinavian Viking Age'**
  Maria Panum Baastrup, PhD student, Danish Prehistory

- **'Greenland's Runic inscriptions'**
  Lisbeth Imer, head of project, Danish Middle Ages and Renaissance

- **'Skin clothes of the Northern Worlds'**
  Anne Lisbeth Schmidt, head of project, Research, Analysis & Consulting, Conservation Department

- **'Trade as a cultural encounter**
  Peter Andreas Toft, head of project, Ethnographic Collection

- **'Buildings on the North Atlantic islands and in Greenland – diffusion and innovation'**
  Niels Bonde, head of project, Danish Prehistory, Unit of Environmental Archaeology

Associated the research theme:

- **'The Carpenter-Meldgaard Endowment**
  – A research program based on the archives of the late Jørgen Meldgaard'
  Bjarne Grønnow, head of project, Ethnographic Collection
  Presented by Martin Appelt, Mari Hardenberg and Ulla Odgaard, Ethnographic Collection

- **'Nørremølle – the largest Viking silver hoard of Bornholm'**
  Gitte Tarnow Ingvardson, head of project, Danish Prehistory

- **'Pre-Christian cultic sites of the Iron and Viking Ages'**
  Lars Jørgensen, head of project, Danish Prehistory
  Presented by Josefine Franck Bican and Susanne Klingenberg, Danish Prehistory,
  Anna Severine Beck, Køge Museum

A common sea – the Skagerrak and the Kattegat in the Viking Age

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In the Viking Age the Skagerrak and the Kattegat were connecting elements in a complex network of political, social and economic relations. This network had not arisen suddenly; on the contrary, the links across the sea can be traced much further back in the archaeological material; but in the Viking Age and in the early post-Viking Middle Ages the first written evidence appears – the rune stones, the Frankish Annals from the beginning of the ninth century, the trader Ohthere's account of his journey around the year 890, the Norse sagas, the skaldic poems and the historical chronicles of later times. The statements in the sources are often brief, and the information in them does not necessarily match. Each of the individual writers would have had his own goals, but as a whole they paint a chequered picture of changing political alliances, friendships and hostilities, rebellious conditions and peaceful coexistence. The links were close, and southern Scandinavia must have been a core area with the Skagerrak and Kattegat as the common inner sea (fig. 1).

Fig. 1. The Skagerrak and the Kattegat – a common sea. Map: Anne Pedersen.

The natural conditions created the basis for traffic between the regions. In Norway the Oslo Fjord area turns naturally towards the south and thus towards western Sweden and Denmark, and western Sweden is naturally oriented towards the west via the great rivers that flow into the Kattegat. Not only the coastal area but also Västergötland seems to have had easier access to the world towards the west than towards

Fig. 2.
One of two soapstone vessels fished up from shallow water at Hals Barre off the mouth of the Limfjord in 1904.
Photo: National Museum.

the east. The same is true of parts of southern Sweden, and to the west Denmark has a long and much-pitted coastline facing the Kattegat. Navigation northward and southward was (and is) also favoured by the prevailing winds. For the trader Ohthere, who described his long voyage from northern Norway to Denmark at the end of the ninth century, the voyage from Kaupang in Vestfold to Haithabu at the foot of the Jutland Peninsula took just five days. Even in less ideal conditions, time consumption was therefore unlikely to have been any serious obstacle to the maintenance of close relations between individuals and local societies.

The written sources give us an impression of the overall political circumstances and the social groups that were involved in the maintenance of the political power relations. In the year 813 the Danish kings Harald and Reginfred had to journey north and fight for their authority in Norwegian Vestfold, where princes and people had refused to submit. Nor was the balance of power stable in the subsequent centuries. The sources speak of conflicts, but not of how the al-

liances and networks of the elite were sustained and rendered visible; nor of whether and if so how the local communities in the individual regions were affected. Was there for example a direct link between political power and economic exchanges? In this case archaeology can supplement the statements of the written sources at several levels.

Part of the economic incentive behind contacts across the Skagerrak and Kattegat was presumably the demand for raw materials from Norway and Sweden: soapstone for cooking vessels, especially from southern Norway, Bohuslän and Halland (fig. 2), Eidsborg slate from Telemark for whetstones (fig. 3),

Fig. 4.
Twelve unfinished axe-heads of iron from Gjerrild Strand in Djursland. The axe-heads are mounted on a fir stock and probably come from Norway or Sweden. Photo: National Museum.

Fig. 3.
Whetstone of Norwegian schist excavated at Viborg Søndersø. Photo: National Museum.

high-quality iron (fig. 4), and presumably also resources like antler and furs, and from around the year 1000 mica schist from western Norway for quern stones. The project 'Cultural contacts across the Skagerrak and Kattegat' seeks to establish which 'services' or impulses (specific objects, ideas, cultural behaviour etc.) went in the opposite direction and in which conditions. At what level of society, for example, were the production and transport of goods organized? The point of departure is the material culture of the period viewed both as concrete evidence of exchanges within the networks in the area, and as a meaning-bearing and communicative element that could be used actively in the efforts of an individual, a group or a community to promote their interests. A couple of find groups may serve as examples.

In Denmark there is a particularly dense concentration of finds of Norwegian and Swedish origin in the Kattegat region: in northern Jutland, Funen and northwestern Zealand. Whetstones and soapstone vessels found along the west coast of Jutland show the transport routes, while the settlement finds give an impression of consumption patterns and the extent of trade. Norwegian and Swedish finds, on the other hand, give us insight into the production environments.

Such a potential environment emerges in western Sweden between Götaelven and Ätran, where several soapstone quarries are found, for example at Hagakullen in Lerum Parish east of Gothenburg, at Källsagården in Vallda Parish and Blixered in Tölö Parish south of Gothenburg, as well as in Nösslinge around 60 km farther to the south west. At Skäggered immediately north west of Gothenburg iron slag has been found as well as a possible iron extraction furnace which has been C^{14}-dated to the 900s, and at Alleby not far from there four possible iron extraction furnaces have been excavated, one possibly from the 800s. Iron extraction and forging require fuel. Among other places, traces of charcoal production have been noted north of Gothenburg at Djupedal Fornborg, where one of the pits has been C^{14}-dated to the Viking Age, while a charcoal stack in Bergum Parish, around 15 km farther inland, is from the eleventh century. In Halland too charcoal stacks have been recorded, and although they are often dated to more recent times, at least some of them seem to be from the Viking Age. The raw materials may have been consumed locally, but they were also traded. Analysis of soapstone from Haithabu shows for example that some of the finds come from the quarry at Källsagården on the Onsala Peninsula, from which they may also have been shipped.

Another well known group of sources that sheds light on the connections across the Kattegat is the rune stones and the similarities that can be seen between rune stones from northern Jutland and western Sweden. Perhaps the clearest example is two rune stones from Hobro in eastern Jutland (DR 127) (fig. 5) and Ås in Västergötland (Vg 112), both raised around the year 1000. The inscriptions are more or less identical: "Thore raised this stone after his fælle Karl the good, a very well-born youth" (Hobro), and "Thore raised this stone after his fælle Karl, a very well-born youth" (Ås). Such a close match is hardly coincidental. One can imagine that Karl had fallen during a stay in Denmark – close to Hobro lies the ring fort Fyrkat, built around 980 – after which Thore raised a memorial stone at or near the place of his 'companion's' death and another one on coming home to Västergötland. The close connection between the two stones is supported by the rune types used. Irrespective of the circumstances of Karl's death, the inscription was clearly meaningful in both places – why else pay for a rune stone both in Jutland and in Västergötland? – which in turn suggests strong family ties or perhaps partnership in economic or military respects. The word fælle (kinsman, companion, partner) was used of men who took part in the same Viking expedition, but an interpretation as trading partner is also possible.

Fig. 5. Rune stone from Hobro in eastern Jutland. Photo: National Museum.

Close alliances or family ties are perhaps also the background for certain similarities in the burial customs of the time. Equestrian graves are a well known phenomenon from the Denmark of the 900s, but they also appear among the graves in southern Norway especially, and to a lesser extent in southwestern Sweden, for example in the landscape Finnveden at the lake Bolmen, where one finds both equestrian graves with full riding gear and graves with spurs, in both cases equipment that gives an impression of status. In contrast to Denmark, though, the dead have been cremated, and the sword is a rare weapon in the equestrian graves. Were these men who had stood out from the general population by virtue of their wide-ranging connections? And had they won a special position in society, for example by controlling the exploitation and transport of sought-after raw materials? Differences in local customs can also be traced in Denmark, for example at Kumlhøj in Djursland, where a man was buried with nine arrowheads of iron (probably in a quiver, and with the related bow), equipment one would rather expect to find in southern Sweden. Was he himself a stranger in Djursland, or should the explanation of this choice of equipment be sought elsewhere?

That the men of the time could range wide is illustrated by two rune stones in Sävesjö, around 60 km north east of the lake Bolmen, one raised by Vråe to his brother, who died in England (Sm 77), the other by Vråe's daughter Tova, who speaks of her father as Håkon Jarl's 'marshal' (Sm 76). Who this Håkon Jarl was cannot be determined with certainty, but he may be been Canute the Great's nephew (the son of Canute's half-sister Gytha) and ally, a member of the Norwegian Ladejarls. He drowned in the Pentland Firth between Orkney and Scotland in 1029.

Other find groups such as silver hoards and coins, both western European and Arab, present similar evidence of links around the Skagerrak and the Kattegat. The breadth of the archaeological material underscores the importance of a cross-disciplinary approach to the issues of the project, and the geographical framework in itself requires the building of bridges between different research traditions,

registration practices and antiquarian legislations, for example concerning the use of metal detectors, which especially in Denmark have contributed to a pronounced growth in metal finds from the Viking Age. One of the challenges of the project is for that very reason to expand contacts with environments in Denmark, Norway and Sweden. The interest in the ideas of the project is there, and a joint seminar is planned with the aim of gathering and discussing the complex material in an overall perspective with the Skagerrak and the Kattegat as the shared point of departure. The seminar will build further on results from earlier symposia organized by Gilleleje Museum (2006) and the Office of the State Antiquary in Sweden UV Väst (2004) under the heading *Archaeology around the Skagerrak and Kattegat*.

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Networks in the north – foreign artefacts in the hands of the Vikings

Maria Panum Baastrup
Danish Prehistory

This PhD project has the working title "Communication, cultural encounters and cultural identity – the itinerary of items during the Viking Age of southern Scandinavia". The aim is to analyse the contacts among southern Scandinavia, the English/Irish area and the European Continent during the Viking Age (750-1050 AD) on the basis of evidence of imported metal items – primarily different types of jewellery and mountings.

The metal items in question were produced on the Continent and in the English/Irish area (fig. 1). However, they ended up in southern Scandinavia through a widely ramified network. After a thousand years or more in the soil they have reappeared. In particular, the use of metal detectors by eager amateur archaeologists has led to a myriad of relevant finds. This increase in finds permits us to conduct new analyses of the Vikings' foreign activities and of the circulation of various groups of items. Which types

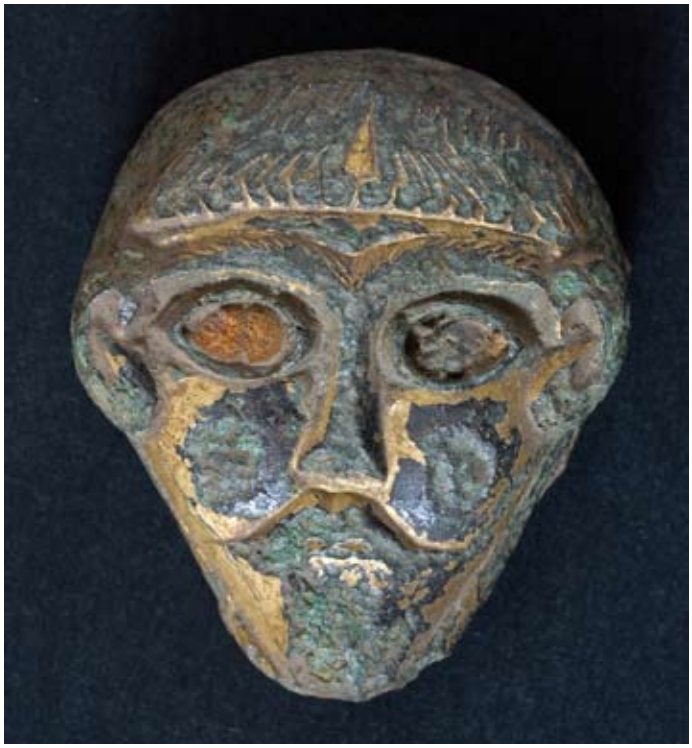


Fig. 1: Gilded mask with eyes of amber found near Øster Vandet in Thy. It is from the 8th or 9th century and was originally placed as a mounting on an elegant casket from the English/Irish area. Later on the mask was filled with lead to be re-used as a weight. Several examples of similar English/Irish mountings, re-used as weights, have appeared at Viking settlements in Denmark in recent years. Photo: The Museum of Thisted, 2010.

(a)

of items were of special interest as imports, and how did the items circulate in the southern Scandinavian area?

The reception or rejection of various artefacts represents conscious choices and may be due to ideological or economic factors. The treatment of the imported items – for instance whether the metal items were altered into jewellery or the like – reveals which designs were preferred, and which foreign social groups the Vikings tried to copy. The occurrence of the foreign items thus gives us unique insight in the thinking of the Vikings, their ideas and their conscious choices (figs. 2a-d).

(b)

Fig. 2: These brooches with cross-motifs are standardized "everyday" jewellery that the Vikings brought home from the western and continental European area. They contribute to the documentation of early Christian currents in the world of the Vikings, much earlier than the year 965 that is traditionally considered the year of the official transition to Christianity in Denmark. Photo: C. Krause and M. Baastrup.

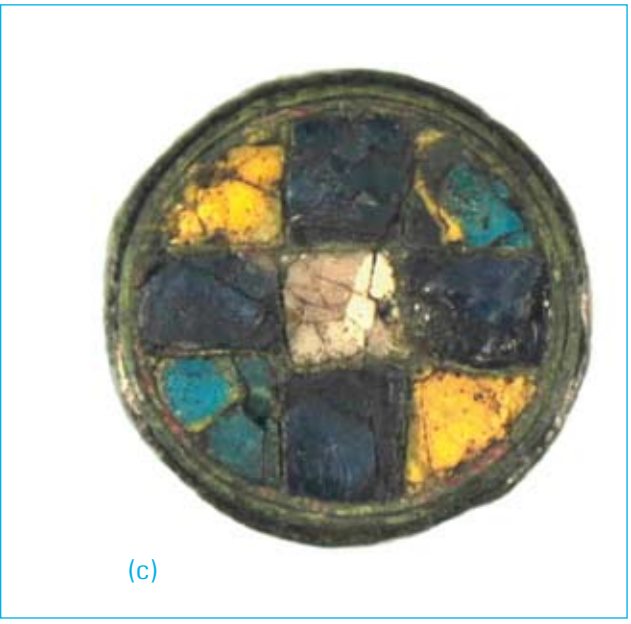
The project is based on three case studies:

The first study is an analysis and interpretation of the metal artefacts from Gl. Lejre near Roskilde (for instance Christensen 1991, 1997, 2004). Gl. Lejre is among other things the site of one of the most important magnate farms from the Late Iron Age and the Viking Era (500-1000 AD).

The second study presents the imported metal artefacts from Tissø in western Zealand (see for instance Jørgensen 2003), which like Gl. Lejre can be considered as a magnate farm which existed from the middle of the sixth century to around 1000 AD.

The last case study takes its starting point in a complete survey and analysis of imported metal items in Denmark. Did different types of settlement attract different types of imports, and how did these imports circulate?

The main focus of the three studies is the cultural exchanges that took place among communities in England, Ireland (fig. 3), the Continent and southern Scan-



(c)

(d)

Fig. 3: Circular mounting of bronze which would originally have been on a reliquary. The mounting was produced in the Irish area, and after coming to Scandinavia it was furnished with a pinning device on the back so it could function as a fibula. The mounting was found at Vindinge near Nyborg on Funen. Photo: Jørgen Nielsen, Odense Bys Museer.

dinavia. In the archaeological record available today we can observe a movement of ideas and impulses towards the North, and an acceptance and integration, to a certain degree, of these ideas in the material culture.

However, the circulation of imported metal items in our part of the world is also interesting – for how, in the northern part of the network, were the foreign items and the contacts with the neighbouring areas administered?

The project is coming to an end, and the whole dissertation will be handed in to the University of Copenhagen for assessment during the summer of 2012.

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Nørremølle – the largest Viking silver hoard of Bornholm

Interactions in the Baltic Sea

Gitte Tarnow Ingvardson
Danish Middle Ages and Renaissance

The Viking Age hoards of Denmark are composed of objects produced in many different areas, from the British Isles in the north vest to the Caliphate in the south east. The hoards stand as testimony to the Vikings' extensive network, and tell the story of both peaceful and aggressive interactions in the Viking Age. In this article I sum up some of the results from my research project on one of the largest Viking Age silver hoards of Denmark – the Nørremølle hoard of Bornholm[1].

A treasure of approximately 2½ kilos of silver was deposited in the first half of the 11th century at a Viking settlement on the east coast of Bornholm. The hoard is composed of a heterogeneous group of objects: 1194 coins, 170 pieces of jewellery and 87 other silver objects such as ingots, rods, melts/lumps and silver plates. The majority of the coins are German, but there are also a large number of English coins, and a smaller group of Kufic, Scandinavian, and Bohemian coins. The hack silver consists of ingots and jewellery produced mainly in the West Slavonic territory and in Scandinavia. The treasure was located with a metal detector in August 2006 and was excavated by the Museum of Bornholm. Archaeological investigations show that the hoard was situated only a few metres from the remains of a burnt-down Viking house. The exact find spots for all the objects in the hoard are recorded and the deposition place of the hoard and its surroundings has been investigated by archaeologists. The exemplary find history of the hoard gives us rare insight into the story of the treasure, its content, its owner and the society in which the hoard was gathered and buried (fig. 1).

[1] The analysis was conducted over six months and was funded by The Heritage Agency of Denmark. It will be published in Journal of Archaeological Numismatics (JAN) 2012 vol. 2.

Fig. 1:
A German penny minted in the period 1024-1045, probably at Luneburg by Duke Bernhard II, gives a terminus post quem for the hoard of 1024. The composition of the coin material shows that it is very unlikely that the hoard was deposited after 1040. Photo: National Museum

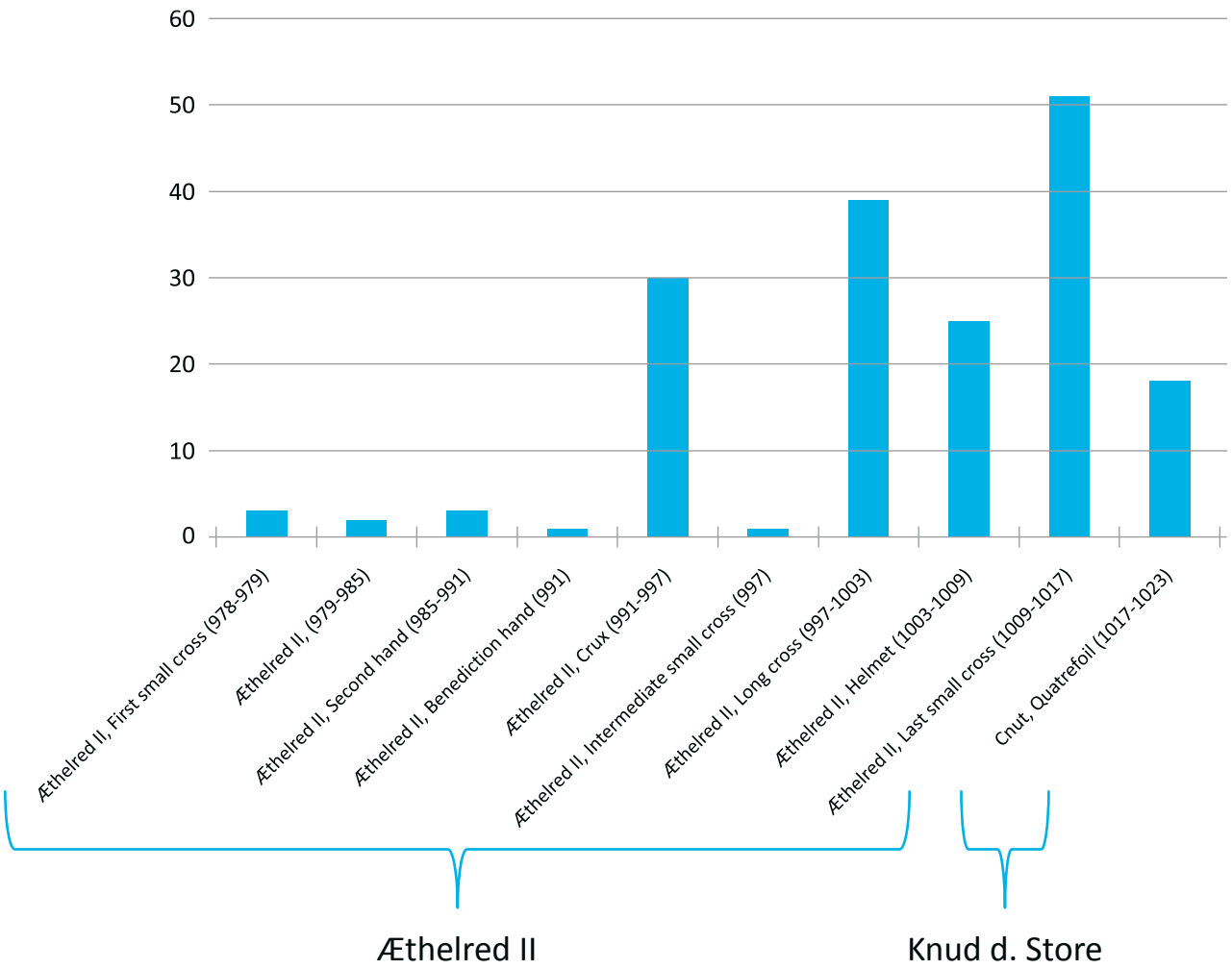

Fig. 2: Unlike the Tyskegård hoard of Bornholm, where only one coin type was represented, there are many different English coin types in the Nørremølle hoard, as illustrated in the graph.

The following questions are central to the analysis of the hoard. What is the content of the hoard? How and why was the hoard gathered and by whom? And where and why was the hoard deposited and why was it not recovered?

In order to answer these questions I have chosen a contextual approach in my analysis of the Nørremølle hoard. The biography of the Nørremølle hoard can be divided into three contextual stages.

1) The primary context – production time and place
2) The secondary context – traces of use
3) The tertiary context – deposition

These stages are described by Kemmers and Myrberg (2011: 89ff). In their work they use this approach in the study of coins, but the methodological approach is valid for any archaeological object.

711 German coins can be attributed to a specific town and 25 German mints are represented in the hoard. Coins minted in northern Germany particularly dominate the Nørremølle hoard. More than 40% (301 coins) of the precisely located German coins are the so-called Otto-Adelheid pennies (983/991-1040) minted in Goslar. This is a common feature in hoards deposited at the beginning of the 11th century in present-day Denmark, Scania and Poland. This suggests a very intense trade between northern Germany and southern Scandinavia/the Baltic. The many German coins can be explained by the discovery of the silver mines in Harzen in the second half of the 10th century. The plentiful supply of silver resulted in large-scale coin production in the years that followed. The second largest group of coins was minted in England. 144 English coins can be attributed to 27 mints. Even though coins from the London mint represent a large percentage of the coins, the distribution among the English mints seems more widespread than that of the German coins. This picture is confirmed if the English coin types are included in the survey (fig. 2).

In the light of hoards like Tyskegård on Bornholm, the English coins in the Danish Viking Age hoards have been interpreted as the result of Danegeld (Moesgård 2006: 405ff). The Tyskegård hoard is composed of 81 coins all of the same type, Ethelred II's long cross minted in c. 997-1003, and none of the coins bears test marks. This is not the case in the Nørremølle hoard, which is composed of many different English coin types. Furthermore, 98% of the English coins in the Nørremølle hoard have been tested for their silver content, as shown either by test marks and/or by bending, which indicates that the coins were in circulation for some time outside the British Isles. The English coins in the Nørremølle hoard are therefore probably the result of trade rather than raid.

Traces of use cover a variety of features such as fragmentation, test marks and bending to which the object was subjected after it left the mint or the workshop. In my opinion there are three important aspects which may have influenced the secondary treatment of the objects. Are differences in traces of use due to geographical aspects, due to chronological

aspects and/or is the secondary treatment influenced by the material of the objects?

The Nørremølle hoard primarily consists of objects originating from five areas: Germany, England, western Slavonia, southern Scandinavia and what I call the Kufic group (a heterogeneous group of coins from Iran, Russia, Syria and Iraq). Within the different geographic areas there are both some very distinct differences and similarities (Table 1).

97% of the objects in the Nørremølle hoard have been tested for silver content as shown either by test marks or by bending. There are very few objects with nicks, which confirm that nicks are a chronologically earlier feature (Rispling 2004: 3). Bending, on the contrary, is a dominant feature in all the areas. If we take a closer look at objects with pecks and notches, the western groups (Germany, England and southern Scandinavia) show a high degree of conformity: around 90% of the objects, which are almost exclusively coins, have been tested with pecks, and around 20% have been tested with notches. This leads to the conclusion that the coins had probably been in circulation in the same areas, or at least in areas with the same tradition for testing the silver. The Kufic coins on the other hand present a different picture, as 43% have been tested with pecks and 69% with notches. This confirms the idea that notches are a phenomenon associated with the eastern areas. The Kufic coins are the oldest group of coins in the Nørremølle hoard. If the test marks were made during their circulation on Bornholm one would expect that the Kufic coins showed more pecks. The analysis of the test marks therefore indicates that the coins were mainly tested before they reached Bornholm.

	Fragments	Peck	Nick	Notch	Bend	Test marks/Bend
West Slavonia (127 p.)	90%	1%	0%	9%	82%	83%
South Scand. (45 p.)	16%	91%	0%	23%	98%	98%
Germany (846 p.)	15%	93%	1%	23%	99%	100%
England (204 p.)	20% (33%)	90%	0%	18%	94%	98%
"Kufic" (72 p.)	74% (75%)	43%	3%	68%	92%	99%
All objects (1451 p.)	34%	75%	1%	29%	92%	97%

Table 1: Pecks are defined as small impacts of a knife in the surface of the coin (Malmer & Lagerqvist 1987: XVIII; Kilger 2003). Nicks are defined as small scratches with a knife on the surface towards the edge of the object (Malmer & Lagerqvist 1987: XVIII). Notches are defined as small cuts with a knife in the edge of the object (Rispling 2004: 4f, type C).

A large percentage of the jewellery (75%) in the Nørremølle hoard derives from the western Slavonic area. Only 12 out of 127 objects (10%) from the western Slavonic area show test marks, and the group is thus differentiated from the German, English, southern Scandinavian and Kufic groups. This is most likely due to the character of the objects rather than their origin. All the objects from the western Slavonic area are jewellery. The majority of the jewellery is fragile silver-foil beads or mesh beads, whereas the bulk of the objects from the German, English, Scandinavian and Kufic areas are coins. It is evident that fragile foil beads and mesh beads were not suited for silver tests like pecking and notching. The few objects that have been tested all bear their test marks on a part of the object which is solid silver.

A small excavation at the Nørremølle site showed that the hoard was deposited near a now-removed large stone (fig. 3). Several settlement remains such as trenches, pits and post-holes were found near the deposition place. Of special interest are the traces of a pair of roof-bearing posts just a few metres north of the deposition place of the hoard. The post-holes have been interpreted by the excavator as the western part of a north-east-southwest orientated house. The post- holes contained Baltic Sea Ware, sherds of soapstone vessels, an originally complete miniature vessel, a fragmented amber bead, and some fragmented iron objects. This dates the house to the Late Viking Age, and the house might be contemporary with the Nørremølle hoard. The soil in and around the post-holes was full of charcoal and the post-holes contained a large number of fragments of burnt wattle-and-daub and charred grains. It is therefore likely that the house was burnt down. Despite the fact that the Nørremølle hoard is the largest Viking treasure found so far on Bornholm, and the hoard must have represented a fortune, there is nothing except the treasure to indicate that the Nørremølle site was unusual.

The Museum of Bornholm has undertaken small archaeological excavation campaigns at the find spots of 29 Viking hoards. Most of the hoards are apparently located at ordinary settlements. Surveys on Gotland have shown that the many Viking Age hoards on the island were often deposited on the outskirts of settlements, in areas where smiths' work took place. The hoards have therefore been interpreted as raw material for the smith (Carlsson 2010: 7ff). On Bornholm 11 hoards were located on the outskirts of a settlement area, but only one (Nordre Stensebygård) was associated with to smiths' work. Most of the hoards (15) were deposited in or close to what the excavator has interpreted as longhouses.

Only three hoards were deposited in areas without settlement traces. This indicates that the majority of the Viking hoards of Bornholm should not be interpreted as raw material for a smith.

The composition of the coins in the hoards of Bornholm reveals strong contacts with Scania, in terms of both their primary context and their secondary treatment. The jewellery of the hoards shows strong contacts with the western Slavonic area. The archaeological record of the hoards indicates that the inhabitants of Bornholm were sailors with trading connections both north and south. They brought back their accumulated wealth, which was often deposited at what appear to be ordinary settlements sites. If, where, and to what extent trade was carried out on Bornholm at the beginning of the 11th century is an open question. In both settlement pattern and coin material there are clear indications of a radical change in the economic situation on Bornholm towards the end of the 10th century (Horsnæs 2012; Watt 1988: 113ff). There are few indications of a flourishing trading environment on Bornholm at the beginning of the 11th century in the current archeological record. It is to be hoped that future research on the settlement patterns of Bornholm will permit us to reach further into the world of the Viking treasures of Bornholm.

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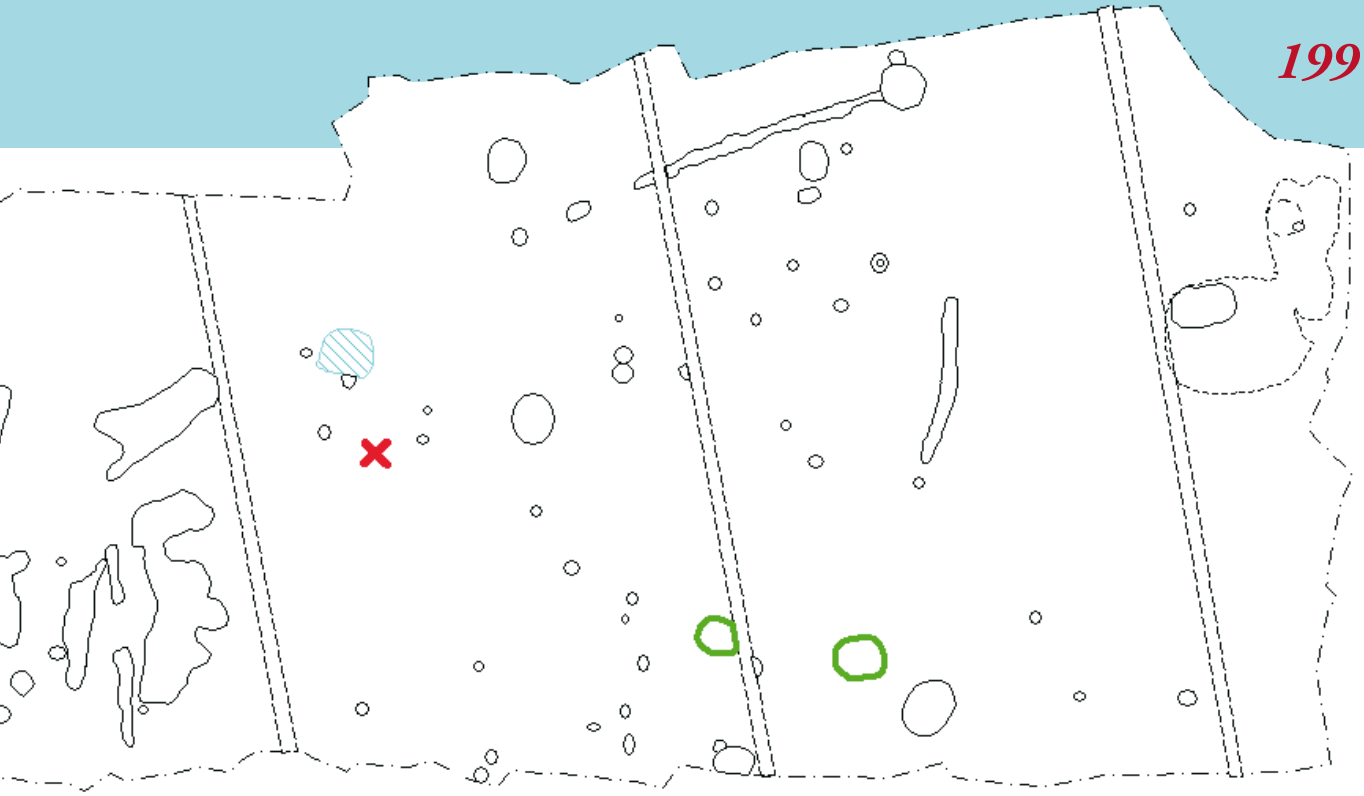

Fig. 3: During the excavation the plough soil was removed in two to three layers, and every layer was thoroughly investigated with metal detectors. The excavation method was chosen with the purpose of recovering more of the hoard, and 118 objects belonging to the hoard were found during the excavation. The excavation campaign had a very limited budget, and as the recovery of the hoard was given highest priority, the excavation area was dictated by where objects from the hoard were most likely to be encountered in the plough soil. This unfortunately means that the information on other archaeological features is limited. Green: Traces of roof-bearing posts. Red: The Nørremølle hoard. Blue: Trace of now-removed stone. Excavation plan: BMR 3419 Nørremølle.

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Greenlandic runic inscriptions

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Danish Middle Ages and Renaissance

In Greenland the farms of the Middle Ages are better preserved than anywhere else in northern Europe. The ruins of the Norse settlement lie as oblong mounds in the landscape, and in some places stone-built walls up to a couple of metres in height still stand. The cold climate and agricultural exploitation that is not yet too intensive mean that the preservation conditions are especially good compared with the occupation of the countryside in the rest of the north. In particular, organic material such as wood and bones is found plentifully and helps to nuance the picture of everyday life. The Norse settlements in Greenland therefore give us a glimpse of life in the countryside in the Middle Ages unlike anything seen before with modern Danish eyes. It is because of the favourable preservation conditions that we are able today to research the tradition of writing that the Norse settlers left. More than half of the preserved Greenlandic inscriptions were written on wooden sticks, reindeer bones and whalebone. With the Greenlandic material we are therefore able to describe the tradition of writing as it looked in the countryside and on the magnates' farms in the Middle Ages.

The material comprises more than 150 inscriptions, mainly runic inscriptions, but also a small handful of inscriptions written in Latin letters. Inscriptions in Latin letters are far too often overlooked

Figs. 1a & b.
Disease-expelling amulet from Qorlortup Itinnera with the inscription ... *ora pro sanc[tus]...ora sanc[tus]. Skessa(?),* which translates as '... pray for Saint... ... pray Saint. Sorceress(?).'
Scale 10 cm.
Photos: Lisbeth M. Imer.

in the discussion of the interpretation of runic inscriptions or in discussions of the use of writing, but if one is to describe the tradition of writing as a whole, these constitute an important source for the understanding of the overall picture. Generally speaking, the inscriptions are found first and foremost in the Western and the Eastern Settlements, but a very small number have been found as stray finds at various Inuit settlements (for example Illutalik) and as building elements in modern houses (Frederiksdal). A single runic inscription (Napasut) comes from the Middle Settlement, and interestingly this is on a tombstone, although no church has as yet been demonstrated in this Norse settlement. The northernmost runic inscription found is the small slate from Kingitorssuaq, which was found some 40 km north west of Upernavik. In all, a good 100 inscriptions come from the Eastern Settlement, while about half as many have been found in the Western Settlement.

The plan is to publish the inscriptions in a single publication dealing with the tradition of writing in Norse Greenland. So far the artefacts have been investigated, drawn, described and collected in a catalogue. The drawing work in particular has proved to be a methodologically excellent tool, because in making a drawing one is forced to consider every single crack and rune (cf. Imer 2009a, 2009b, 2011). In terms of presentation too it gives the reader more help to show the inscription as a drawing than to describe the individual runes.

In connection with the collection and review of the inscriptions several new readings and interpretations of inscriptions have come to light. One example is a c. 10 cm oblong wooden stick (figs. 1a & b) with runes on two of the four sides. One of the edges of the stick has been cut off, so the bottom part of most of the runes on side A is missing, and the top is missing from the last five or six runes

on side B. The last sequence on side B has earlier been read as siesi(t) (Stoklund 1994: 9), but this disregarded the fact that the top of the runes is missing. The word siesi(t) gives no linguistic meaning. I have instead read the inscription as skes(s)a, where the last rune is to be read as an a-rune, since the top of the object is missing. A new reading of an inscription often leads to a new interpretation, and this is also the case here. The whole text is a Latin text that is full of either errors or abbreviations. Clearest are the Latin words ora pro 'pray for', and the object should probably be interpreted as an amulet for driving out illness or protection against illness, like other known runic amulets from the Middle Ages. It was very common to give the illness a name to pin it down or bind it, and then to expel it (Gustavson 2010; Imer 2010), and this is a tradition known all the way back to the oldest known runic amulets in the North (Stoklund 2004: 37). However, there is no Latin word that corresponds to the reading skes(s)a; but the Norse word skessa, which means 'sorceress' or 'giantess' is quite in keeping with the new reading. In addition, in front of the last word there is a very clear separator consisting of four dots, whereas the separators in the rest of the inscription consist of two dots. The last separator should probably be regarded as a marker showing that the last word is to be read separately from the rest of the text. Inscriptions of this kind, where the Norse language has been mixed with Latin, are also known from Herjolfsnes, where one of the cross-arms has the Norse inscription Jesus Kristr hjalpi, that is 'Jesus Christ help', and along the trunk of the cross we see the Latin inscription [Ch]ristus natus est nobis, that is 'Unto us Christ is born'. In other words people wrote both in their mother tongue and in Latin with runes.

A good number of new objects with runes have also appeared. In most cases these are isolated runes on warp weights or bind-runes that have earlier been viewed as owners' marks. These have not earlier been incorporated in overviews of the Greenlandic inscriptions. Inscriptions or runes on warp weights are however so common (about one fifth of the material) that it would be methodologically wrong to disregard this group when dealing with the tradition of writing. On the whole inscriptions on textile tools are very common in the material (they make up about one third), and this is probably related to the fact that textile production was one of the most important occupations in Norse Greenland. The inscriptions on the textile tools are often Christian prayers or fragments of Christian prayers. A good example is a fragment of a mould for a spindle whorl (fig. 2), which has the

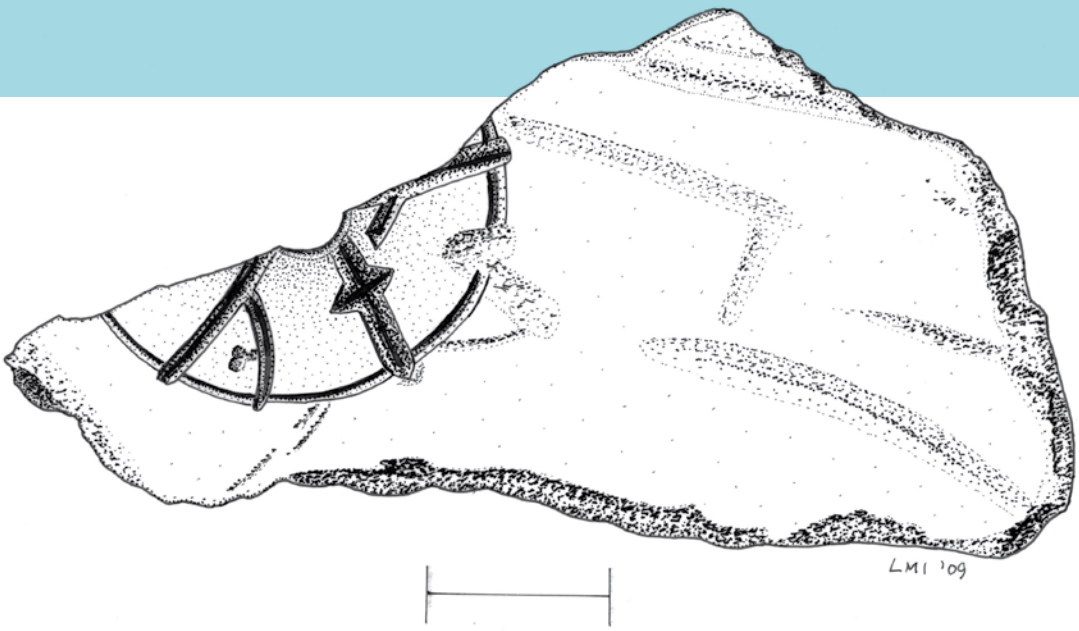
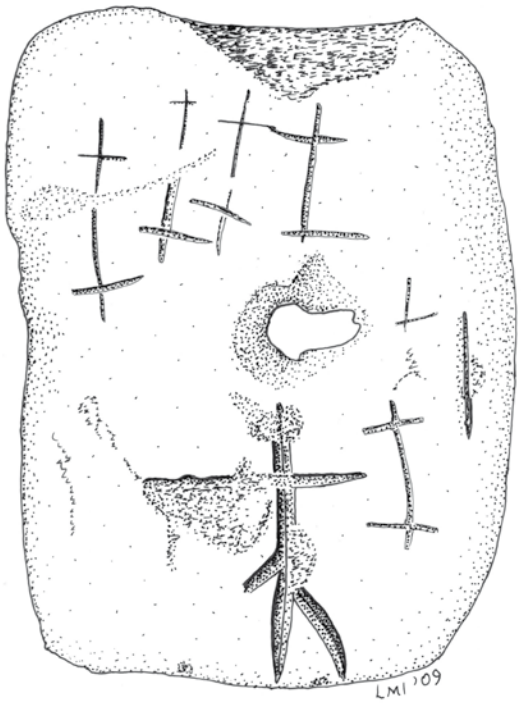


Fig. 2. Mould of soapstone from Gardar, half of which has been preserved. The inscription says ...ue (m)... and is c. half of *Ave Maria*. Scale 2 cm. Drawing: Lisbeth M. Imer.

characters ...ue (m)... It is clear that the object has just enough space for Ave Maria, that is 'Hail, Mary', the beginning of the Archangel Gabriel's greeting to the Virgin Mary at the Annunciation, which became one of the most frequently used prayers of the Middle Ages. 'Ave Maria', 'Maria' or abbreviations of this are found on the whole on many objects from Norse Greenland. One of the inscriptions to which attention had not earlier been given is on a warp weight from Gardar, where the inscription on one side is entwined with a cross in a kind of religious bind-rune +=a=u (fig. 3), while on the other side there is an m-rune. If we compare this to other abbreviated Ave Maria inscriptions, for example from Bryggen in Bergen, there is no doubt that we are dealing with an Ave Maria inscription in much abbreviated form. On many other warp weights and spindle whorls there are m-runes, sometimes in conjunction with a cross, and we cannot rule out the possibility that these single m-runes too have something to do with the Marian cult.

When one looks at the total number of inscriptions in Norse Greenland, it is quite clear that it was in divine worship that writing really found expression. Faith and superstition ere closely related, as it was thought that one could expel a disease – a sorceress – with a Christian prayer. The religious rural population used writing both in personal worship, on tombstones and in connection with their everyday work.

After a total of one year's work the Greenlandic inscriptions have been drawn, registered and collected in a catalogue, and work has begun on the description of the objects and the analytical method to be used in connection with the publication. In 2013 the manuscript will be finished.



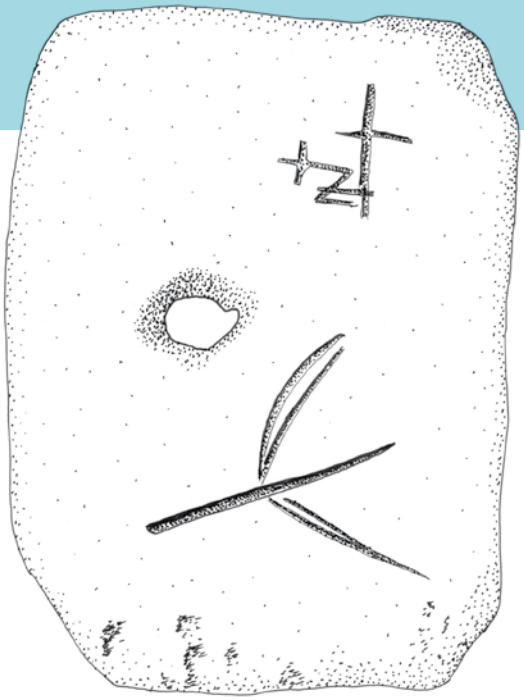


Fig. 3. Warp weight of soapstone with runes on both sides of the object. The runes on one side are entwined with a cross in a kind of religious bind-rune. On the other side one sees an 'm'. Scale 2 cm. Drawing: Lisbeth M. Imer.

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Skin Clothing from the North

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The project *Skin Clothing from the North studies* the Danish National Museum's unique historical collections of skin clothing from the Inuit, Aleut, Siberian and Sami peoples. The collection comprises approximately 2100 items of clothing made from different animal skins. In his thesis from 1914, *Arktiske Skinddragter i Eurasien og Amerika,* Gudmund Hatt indicated that circumpolar peoples from coastal areas and inland followed different skin clothing traditions according to their Asian origin. The aim of the project is to demonstrate which contexts can be identified among items of circumpolar peoples' clothing dating from approximately 1800 to 1950. The analysis deals with 1) the geographical use of skin materials, 2) the gender of the wearers, 3) manufacture, sewing and design, and 4) lifestyle, geographical alliances, interactions and trade (Schmidt & Petersen 2010).

In 2010-2011, all the items of clothing were registered by means of a new scientific documentation method. The individual items were documented in a database complete with high-resolution digital photos. The work was done at the Department of Conservation of the Danish National Museum. Additionally, approximately 100 items of clothing, representing a number of costumes for men and women, were selected from the collection and studied with regard to design, technique and material identification. In general, the costumes consist of clothing for the upper and lower part of the body as well as footwear. The items of clothing were grouped in terms of provenance, dating and gender.

The mounted costume was digitally photographed while it rotated 360° in front of the camera. The series of photographs makes it possible to study the costume from all sides – that is, to study every costume's characteristic individual silhouette. The technology also makes it possible to magnify every part of the costume. In addition, the elements of the clothing were measured, a pattern was drawn, the sewing techniques were analysed, and the animal species of the skins were identified. In this way, new documentation was obtained about the selected clothing and coordinated into

Fig. 1
Woman's sealskin parka from West Greenland, Aasiaat District, collected in 1918. Inv. no. L.7819. Photo: Roberto Fortuna.

complete costumes, representing as many circumpolar peoples as possible within the collection. Since the Inuit collection is predominates, most of the costumes chosen were from Greenland and Canada. The Siberian and Sami collection is less abundant. Items that could be matched into a complete costume were obviously chosen. To complete the study, it was sometimes necessary to select only clothing for the upper part of the body as representative of the Siberian and Sami peoples.

The automated pattern-drawing procedure was developed in collaboration with Aalborg University (Jensen et al., work in progress) in order to document the clothing design. The method is based upon three-dimensional measurements from which a corresponding two-dimensional sewing pattern is generated. The method is non-damaging, quickly performed and accurate. The production of the two-dimensional pattern depends on the current flatness of the measured clothing element; buckling and distortion in the skin may thus affect the accuracy of the pattern. The drawing also reveals information about the area of the individual parts of the item of clothing – for instance of the front, back, hood and sleeve of a parka.

Once one has added together the areas of the elements for the individual items of clothing that make up a whole costume, it becomes obvious that the amount of material consumed was generally small in the historical Inuit women's costumes in Greenland. One example is a woman's costume collected in West Greenland in 1918 (figs. 1 and 2). The costume consists of 1) a parka designed for carrying a baby at the back (a so-called amaat) made of furred sealskin, 2) trousers made of furred sealskin, 3) boots made of depilated sealskin without epidermis (so-called white skin), and 4) stockings of furred sealskin. For the parka,

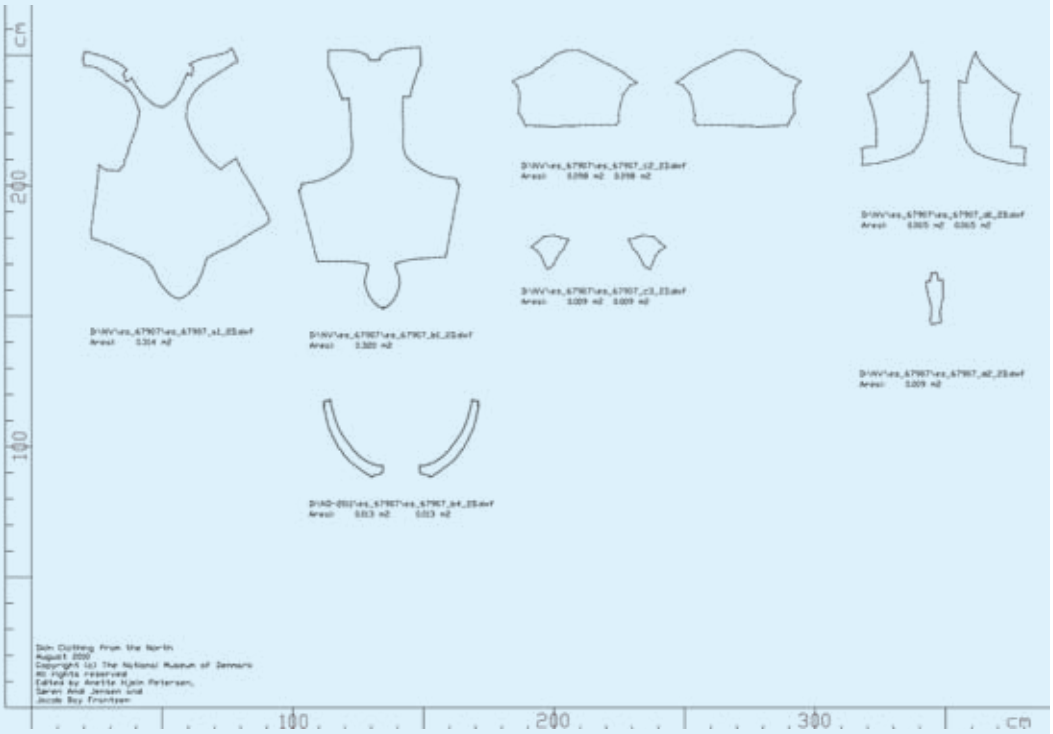

Fig. 2
Pattern of woman's parka, inv. no. L.7819. The direction of the pattern elements refers to the actual hair direction in the skin. Drawing: Anette Hjelm Petersen.

approximately 1.0 square metres of skin were used, for the trousers 0.3 square metres of skin, and for the boots 0.4 square metres of skin. For the three items of clothing, approximately 1.7 square metres of skin were required (fig. 3). For comparison, the human body is covered by an average of 1.6 square metres of skin.

Together with the pattern production, analyses and descriptions of the sewing techniques were noted on the measurement sheets and registered in the database. Joining and decorative seams were identified with regard to type of stitch, number of stitches per 10 cm, and type of thread. The most prevalent sewing technique in Inuit skin clothing is overcast stitching with 20-40 stitches, and the thread is made of sinew.

Subsequent investigations will compare the material consumption of all of the selected items of clothing and costumes and will include animal species identification. This study is being conducted in collaboration with the Danish Natural History Museum by means of DNA analyses (Schmidt et al. 2011). The analyses facilitate the mapping of animal skin usage in the circumpolar area.

Fig. 3 Approximately 1.7 square metres of furred and de-haired sealskin were used to make this West Greenlandic woman's costume. Photo: Roberto Fortuna.

The future perspective of the project is, in 2012, to present the registered clothing with photos on the Internet together with the old and newly-obtained documentation. By sharing knowledge, the Danish National Museum hopes to give all interested parties easy access to previously hidden information treasures and to encourage new studies in the field. Furthermore, it is the intention that external museums and institutions will be given the possibility of adding information about skin clothing from the circumpolar areas to the online database in order to supply the database with as much information as possible.

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Challenges of cultural and colonial encounters – European commodities in the Historical Thule Culture

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Ethnographic Collection

Introduction

Trade was the main motivation for the cultural encounter of European whalers, merchants and missionaries with the Inuit of the Historical Thule Culture. The aim of the PhD project "Trade as a meeting of cultures – European artefacts in the Historical Thule Culture" was to study the cultural reception of European commodities by the Inuit in order to illuminate the nature of the cultural encounters between Europeans and Inuit in 17th-19th century Greenland. The focal point is the Inuit use and transformation of European trade goods and the cultural contexts in which European objects were used and deposited. This analysis of archaeological and ethnographical collections in the Danish and Greenlandic National Museum from three Greenlandic regions was combined with studies of European trade records and trade goods in Inuit oral tradition. This article presents one of the challenges of the project: to study the cultural encounters from the local viewpoint of the Inuit. The challenge was met by applying the theoretical framework of cultural biographies and social histories to European commodities in Inuit context. How this anthropological model worked as a solution will be illustrated by three types of European commodities: iron hoops, bricks and glass beads, which form a large part of the 11,068 objects analysed in the thesis (Toft 2010). Prior to this, the arguments for the use of a local approach in comparative studies of cultural and colonial encounters, and the histories of the three Greenlandic regions included in the project, will be presented.

Two concepts of colonialism in archaeology

In archaeology, models of colonialism as a special form of cultural encounter have been discussed since the 1980s and de-

veloped in two general directions, seeing colonialism either as a universal phenomenon or as varying independent local constructs. The discussion of colonialism is thus related to, and very similar to, the discussion of globalization in anthropology in the same period.

Some archaeologists characterize colonialism as a given universal result of long historical system-economic development – a structural phenomenon – which is a part of world systems (Wallerstein 1974, 1980) governing change on a macro-scale in core-periphery systems (Gosden 2004: 7f). In order to legitimize globalization as a universal phenomenon, it is often made historical by pushing its characteristics further back in time. The universal concept of colonialism is partly grounded in criticism of fragmentary and localized fieldwork, and of the traditional concept of culture in anthropology, which often ignored change on the macro-scale. However, studies of universal colonialism often go to the opposite extreme, explaining local change only as the result of external, global processes.

The second school views colonialism as multiple, independent colonial encounters observable only on the micro-scale, since different societies create their own versions of colonies and colonialisms in specific historical and geographical contexts. This approach is a critique of the use of the word colonialism by world-system theorists as one universal process without recognition of the local contributions to the individual colonial encounters. The use of the core-periphery model in world system theory was further criticized for having a Eurocentric viewpoint assuming asymmetrical knowledge of technology and power relations involving connotations of military force, epidemics and capitalism. This made the models inapplicable to non-western or pre-capitalistic cases of colonialism (Lightfoot 2005: 209f; Stein 2005: 24ff; van Dommelen 2005: 113). Inherent too in the world system thinking were acculturation models that made the adoption of culture unidirectional from colonizers to the colonized; a donor-recipient relationship (Stein 2005: 16; van Dommelen 2005: 116). This was countered by the argument that colonial encounters have at least three parties – the colonial homeland, colonizers and the colonized – all heterogeneous groups consisting of multiple subgroups and individuals who were active agents in the social networks of that particular historical context (Stein 2005: 25). Using the concept of colonial encounters, studying each case of colonialism(s) in its own spatial and temporal context, counters the artificial division into colonizers and natives on the macro-scale, or into the global and local in the discussion of globalization (Bubandt 2001: 42-51).

Furthermore, the varied nature and duration of cultural and colonial encounters makes the use of a local perspective inevitable, as is evident from the histories of Disko Bay, Nuuk Fjord and South East Greenland.

Local histories of cultural encounters

Disko Bay was a whaling destination for the Inuit themselves (fig. 1) and naturally attracted Dutch, Danish, German and British whalers from the late 17th century (Gulløv 2004: 91). To monopolize whaling and trade, the Danish Crown established colonies in the early 18th century in this region (Møbjerg & Canning 1986: 187) as well as in the rest of West Greenland. The region thus offers a unique opportunity not only to conduct a (first) cultural contact study in the Disko Bay area, but also to study the development of a colonial situation for which these contacts have often been mistaken (cf. Silliman 2005: 60). However, it was not possible to identify pre-colonial European objects with certainty among the archaeological and ethnographic material of the three regions.

The Nuuk Fjord was an important stop in the existing Inuit trade network even before the arrival of the Europeans because of the natural deposits of soapstone used for lamps and cooking vessels by the local population. The first

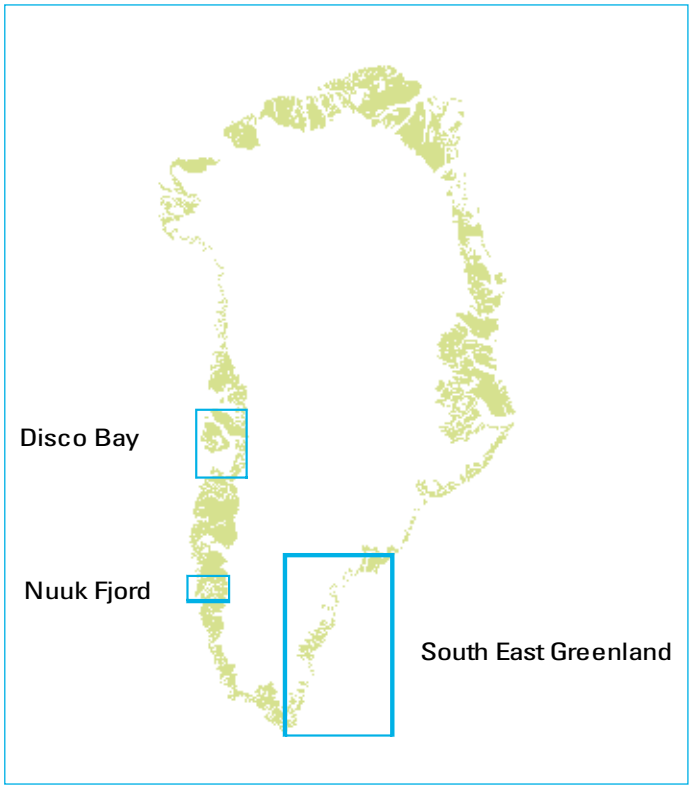


Fig. 1:
The regions of the study.

Europeans in the region were Danish missionaries who came in 1721, followed by Moravian Brethren in 1733. Most of the local population was part of the Danish mission, whereas large parties of southern Greenlanders gathered around the Moravian missions in their existing annual cycle of travel between southern Greenland and Disko Bay (Gulløv 1983: 247). After the smallpox epidemic in 1733-34 many southern Greenlanders settled permanently in the area and stopped travelling north (Gulløv 1997: 401ff). The interplay between two competing missions, two indigenous

populations and a Danish colony makes the area a very interesting case for studying the local reception of foreign cultures.

Although whaling and later commercial sealing were intense along the east coast of Greenland, European whalers were prevented from going ashore by the thick pack ice (Mikkelsen & Sveistrup 1944: 120; Fogsgaard 2003: 39-46). Thus for most of the period eastern Greenland only received European commodities indirectly through the hands of the southern Greenlanders. The inhabitants of southern Greenland played the role of middlemen, travelling from their home to Disko Bay and returning along the west coast to continue their voyage to East Greenland (Gulløv 2004: 340). South East Greenland was colonized as late as 1894 – a point in time which also marks the end of the Thule Culture.

The varied historical contexts of Greenland make it clear that it is not meaningful to study the impact of universal globalization. Both the local groups and the foreign groups involved in the trade are clearly heterogeneous, and the nature of contact and the groups involved changed over time and space. Instead this historical period is ideal for conducting studies of the varying Inuit reception of foreign peoples and artefacts in different regional contexts. This approach makes it possible to study the impact of the varied spatial and temporal nature of contact on the constitution of cultural encounters as part of local cosmologies. Central to this study is the analysis of the cultural biographies and social histories of European artefacts found in Inuit contexts.

Cultural biographies and social histories

In most previous research, European objects found in the Inuit contexts of Greenland were seen as simple evidence of contact and as means of dating house structures, middens and graves. But further steps must be taken to shed light on how these artefacts were used, redefined and perceived in a different cultural setting.

One way to study the cultural adoption of foreign artefacts and their effect on everyday and social life is through the concepts of cultural biographies and the social histories of things as described by the anthropologists Arjun Appadurai and Igor Kopytoff.

The construction of cultural biographies means the study of the life-history of single artefacts: their origin, who made them, their ideal use, their actual use, how the function of the things changes with age, and what happens when a thing is finally discarded (Kopytoff 2003: 66f).

Fig. 2:
Ulo made of a European saw-blade. From Illorpaat, Nuuk Fjord. Photo: Peter Andreas Toft.

An ulo from the site Illorpaat in the Nuuk Fjord region (fig. 2) is a good example of the usefulness of cultural biographies for understanding the cultural transformation of foreign artefacts. This ulo was originally a saw-blade made by a European smith, which was shipped to Greenland. When it came into the Historical Thule Culture it was used as raw material for making an ulo – a woman's knife for cutting up seal and cleaning the skin. During this process the object was not only transformed from a saw to a knife; its meaning also changed – from a man's tool to a woman's. A similar change from men's to women's tools happened to European sailmakers' knives, which because of their curved blades were commonly used as ulos (Gulløv & Kapel 1979: 125).

In other cases, commodities are taken out of trade circulation to be used as exotic raw materials marking status or in the religious sphere, a process called singularization or sacralization (Kopytoff 2003: 73ff). This process is frequent in cases with huge distances between producer and consumer and results in the construction of myths about the traders and their goods – a general cultural phenomenon suggested by Appadurai (2003: 48). One example is the use of European wood as amulets in the gunwale of an umiaq (Gulløv 1997: 433). What is significant is not that European artefacts are adopted, but the way they are redefined and put to use. Another aspect of the redefinition of European commodities is the social histories of artefact types, which demonstrate changes in the long-term perspective and the dynamics behind such changes (Appadurai 2003: 34).

Unravelling the social histories of the European artefacts in the Historical Thule Culture calls for contextual analy-

sis at three levels: context-type, the location of artefacts within the context, and deposition practice, including the state of the deposited artefacts. First of all it is important to determine whether some artefact types are repeatedly left in certain context types (tent rings, communal houses, aggregation sites and graves). For instance, a high frequency of European artefacts is already seen in some communal houses housing Inuit shamans (Gulløv 2004: 93), which could be interpreted as signs of singularization or even sacralization. Secondly, the plotting of artefacts in the individual context may link European artefacts with certain activities or even with gender differences as at the site Ikaasap Ittiva (Møbjerg & Robert-Lamblin 1989). Furthermore, systematic studies of the practice of deposition could reveal whether foreign artefacts were treated differently from local ones in principle.
The study of the cultural biographies and social histories of European artefacts offers opportunities not only to illustrate the reception of foreign artefacts at a local or even individual level, but also to discover cultural practices not described in the historical sources of the Europeans and the tales and myths of the Inuit.

Working with cultural biographies and social histories of the European objects in the Historical Thule Culture changes their meaning from simply expressing the adoption of European identity, as often portrayed in culture contact and colonial studies (Silliman 2005: 68) to things used, transformed, redefined or even resisted by active social agents in particular situations in a specific historical context. The objects probably also lost their 'European identity' in the minds of the Inuit in the early stages of this process. Consequently the analysis and interpretation avoid the loaded terms 'native' and 'European' known from historical archaeology and stays clear of the cultural adoption approach and donor-recipient relationship known from many studies of colonialism (Stein 2005: 16).

In the following, three of the 531 artefact types studied will be presented. The cases of iron hoops, bricks and glass beads exemplify the varied local use, transformation and reception of European commodities in the Historical Thule Culture of Greenland.

Iron hoops

In South East Greenland European commodities are transformed for new functions much more frequently than at the Nuuk Fjord and Disko Bay. The creative use of foreign things is greater not only in quantity but also in the range of functions that the individual European artefact type was reworked to accommo-

date. One of the best examples of this practice is the reworking of iron hoops from barrels. Iron hoops are 0.5-1.5 mm thick with a rectangular uniform cross-section and regularly spaced holes, which makes them ideal for making sharp edges by filing or grinding them and hafting them by tying string, sinew or baleen through the existing perforations. Consequently, iron hoops were reworked in South East Greenland into a multitude of new functions related to hunting and the processing of prey (fig. 3), for example blades for harpoons, knifes, saws, ulos and side prongs for bird darts. At the base of the harpoon heads, hoops could also be used as a plate for strengthening the shaft groove. Furthermore, one hoop became the blade of a kamiut stick, used for cleaning the ice off the soles of skin boots before going indoors. The most creative use of iron hoops is the reshaping of two pieces of hoop in Ammassalik using the natural curve to form the rim and bottom of a landing net for scraping mussels, taking advantage of the perforations for hafting and forming the basis of the sides with strings of skin.

The only case of a reworked hoop in the other two regions in this comparative study is a knife blade from Kangia in Disko Bay, which was collected in 1908, presumably from a grave. The knife blade may this have originated from the earliest contact with European whalers, when the supply of European commodities was unstable resulting in greater creativity in their use. Later in the 18th century at Disko Bay and the Nuuk Fjord, a wide range of metal tools could be bought by the Inuit in the Danish colonies, making the reworking of metal objects a rare phenomenon (Toft 2010: 52ff). In contrast, the reworking of hoops and other commodities such as iron plates, bar iron and cans in South East Greenland as late as the end of the 19th century reflects a situation with an unstable supply, necessitating a highly creative and opportunistic approach to metal objects (Toft 2010: 57-62). A knife blade from Nuuaalik consists of a hoop with an edge riveted to another piece of iron which functioned as the tang (fig. 3c). This object illustrates that metal was used intensively in this region. This is also evident from lance, harpoon, ulo and knife blades, which are generally narrower in South East Greenland than at Nuuk Fjord and Disko Bay. The differences in the widths of the harpoon blades could also be related to the different types of animals hunted in the three regions (Toft 2010: 81ff). Strong traces of grinding on the same artefact types are seen in the material from South East Greenland and Disko Bay. Whereas the hard grinding is visible even on tools from the 19th century in the former region, the intensive use of

(a)

(b)

(d)

(c)

(e)

Fig. 3: Kamiut-stick (a), mussel scraper (b), knife (c), ulo (d) and harpoon heads (e-f) from South East Greenland made of reworked iron hoops. Photos: Peter Andreas Toft.

tools in the Disko Bay material may have originated in the unstable supply of iron during early contacts with European whalers.

Bricks

Another case of the variation in the use and meaning of European artefacts is bricks. The majority of yellow and red brick fragments from Inuit contexts are found at Nuuk Fjord, where bricks are also known from the Colony of Hope, the first Danish colony in Greenland (1721-28) and from the subsequent colony and Moravian mission, Neu Herrnhut, established at Nuuk (Gulløv 1997: 258f). Most of the bricks are found at nearby sites and at a Moravian mission, Uummannaq, in the inner part of the fjord (Toft & Gulløv 2011: 38, 47), where bricks could be picked up during the construction of European houses or from their ru-

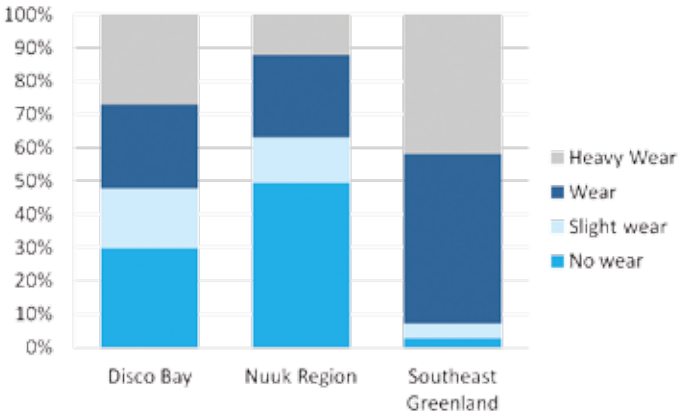
ins. Of these, only red bricks were used for new functions; as whetstones or for grinding bone or antler (fig. 4). From a strictly functional perspective the exclusive use of red bricks is a paradox, since the much harder yellow bricks would be more suited to many of the tasks in question. The use of bricks must be seen in another light. The Inuit preference for red bricks is related to the traditional use of red sandstone from Disko Bay and the Ivittut area in southern Greenland. Furthermore, the white and sand-coloured chamotte, sand and stones in the red bricks resemble the white-spotted red Igaliko sandstone from southern Greenland, which was used for similar purposes (Gulløv 1997: 163). At Nuuk Fjord red bricks were perceived and used by the Inuit as visually similar local raw materials.

Only one piece of brick is known from South East Greenland. This piece was used for making an amulet and was later left in a 17th-century house (fig. 5). The turning the brick into an object with sacral functions demonstrates how exotic this material must have been in this region. Whether the brick fragment reached South East Greenland through the hands of a South Greenlander or came from an ice-bound whaling ship in the pack ice off the coast remains obscure (Toft 2010: 78f).

Fig. 4: Red brick used as a grinding stone in the Nuuk Fjord. Photo: Peter Andreas Toft.

Fig. 5: Amulet made of a reworked brick found in an 17th-century house at Qimisaa, South East Greenland. Photo: Peter Andreas Toft.

Fig. 6: Regional variation in the degree of wear on glass beads. Drawing: Peter Andreas Toft.



Glass Beads

Glass beads are the most frequent European commodity in the ethnographic and archaeological collections from the three regions, making up 73% of the total sample. A limited study of the sales records of the Royal Greenlandic Trading Company shows that this amount is only the tip of the iceberg. In the years 1806, 1816 and 1826 the number of beads sold to the Inuit of the two southernmost colonies at Disko Bay, Egedesminde and Christianshaab, was at least 22 times higher than the total sample of beads from the three regions (Toft 2010: 215f). Most of the beads from archaeological contexts bear no trace of their use, but according to historical descriptions they were used on clothes and as jewellery in the hair or around the neck and wrists.

Glass beads were more frequently in South East Greenland than at Nuuk Fjord and Disko Bay (fig.6). At Disko Bay 30% of the beads discarded have no traces of wear. At Nuuk Fjord and in South East Greenland unworn beads make up 50% and 2% of the regional samples. The reverse pattern is true for the much-worn beads, which make up 92%, 52% and 37% of the bead material from South East Greenland, Disko Bay and the Nuuk Fjord respectively (Toft 2010: 90f). The different degree of access to glass beads in the three regions is also evident from

Fig. 7: Close-up of a string of beads on an amaut, a woman's jacket, combining large worn 18th-century glass beads with unworn seed beads produced in the 19th century. Photos: Peter Andreas Toft.

the contexts where the beads were finally discarded. At Disko Bay glass beads were often left in middens. Beads were also left in the middens of the Nuuk Fjord area, but are more frequently found in the large communal houses used during the long journeys along the west coast of Greenland for trading and whaling. In contrast, most beads from South East Greenland are found in graves and in communal houses, which were used in this region not only during travelling but also as winter houses. The deposition of unworn beads also follows these general patterns. Thus the beads left in the communal houses of the Nuuk Fjord have been interpreted as stocks gathered for later exchange. Generally the consumption patterns of the Nuuk Fjord and Disko Bay reflect a 'buy and discard' practice, as opposed to the long lives of beads in South East Greenland. One practice common to all three regions is the deposition of much worn glass beads in graves. Only beads and other artefact types with a long life span were suitable for accompanying the dead (Toft 2010: 114-123). The re-use of old beads is visible in the ethnographic skin clothing, on which large worn 18th-century glass beads are combined with unworn small seed beads produced in the 19th century (fig. 7). These beads may have had life histories or even myths of their own associated with previous owners and older times, as is evident from both their size and the degree of wear.

Glass beads were used on Inuit clothing according to tradition and were placed in the same zones as traditional beads of calcite and fish vertebrae, often in combination with these. However, glass beads were also used in unique ways in

South East Greenland and at Disko Bay. A case in point is the use of two beads from the Disko Bay area as tops for children (fig. 8). The wear patterns on their ends reveal that the beads were previously strung with other beads either on clothing or in jewellery. The re-use of the costly beads in toys of the 18th century not only shows affection for the children, but also reflects a regional context in which European commodities were easy to obtain. A further example is the incorporation of glass beads into amulet harnesses and headdresses used by men as protection against possession by spirits (fig. 9). In West Greenland only beads of local materials were used in amulet harnesses, and men's headdresses were exclusive to South East Greenland. This clearly demonstrates the

sacralization of foreign objects in areas distant from the Europeans and their commodities. Another regional use of glass beads is beads set in the hafts of two ulos in South East Greenland. Whether these functioned as amulets on tools related to hunting and the processing of prey, as on harpoons and kayaks or as ornaments or owners' marks, is impossible to tell (Toft 2010: 91-93). However, sacralization was not always a matter of distance from Europeans and their commodities; it can also be seen in historical contexts in which European commodities are either a new phenomenon or the supply is not stable. In some of the communal houses of the Nuuk Fjord used in the early decades of the Danish colonization, glass beads were deposited according to a special practice. Glass beads and iron objects were left in some phases at *kataq*, the threshold between the living area and the house passage (fig. 10). This area was in many Inuit myths the zone in which orphans, murderers and the spirits of forefathers or whales materialized (Whitridge 2005: 232). Objects left at kataq were probably gifts left for some of these mythical figures. European commodities are rare in the archaeological contexts of the region before 1750 (Gulløv 1997: 248) and foreign things may have been perceived as exotic even during the first decades of colonization.

Conclusion

The analysis of the regional histories and the archaeological and ethnographic objects shows the need for local studies in the field of cultural encounters and colonial history. Moreover, the results of the project demonstrate how the cultural biographies and social histories of objects are effective in giving cultural and colonial encounters a local perspective.

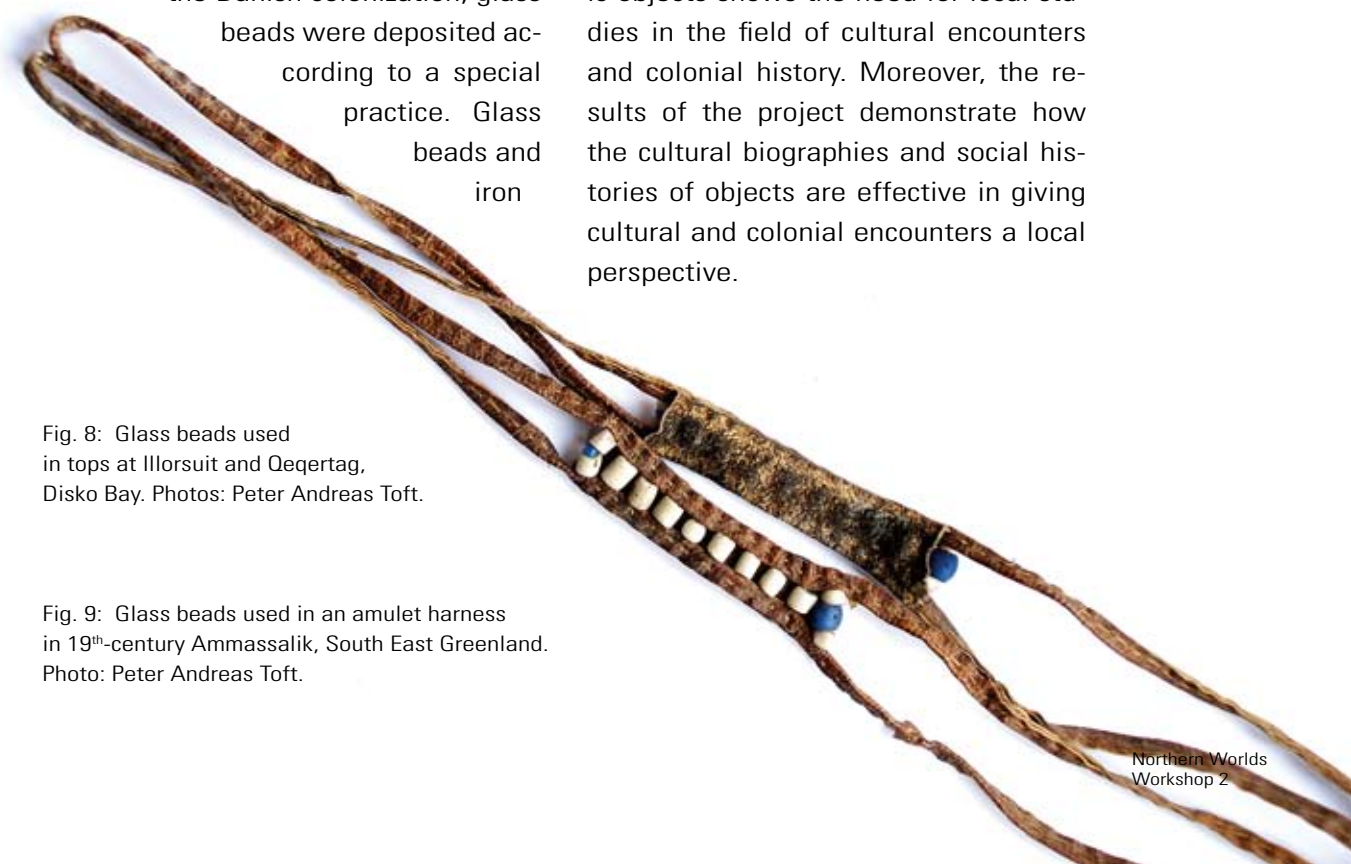


Fig. 8: Glass beads used in tops at Illorsuit and Qeqertag, Disko Bay. Photos: Peter Andreas Toft.

Fig. 9: Glass beads used in an amulet harness in 19th-century Ammassalik, South East Greenland. Photo: Peter Andreas Toft.

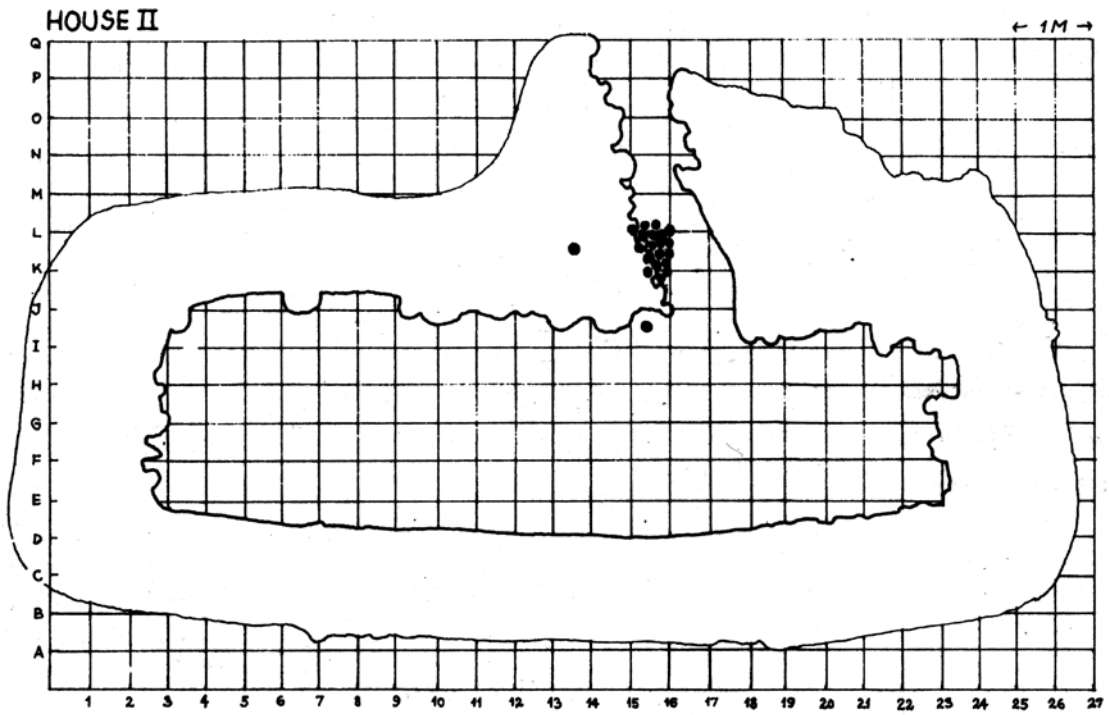


Fig. 10: Glass beads left at the threshold of a communal house in Illorpaat 1740-60 (Gulløv 1997: 102).

Objects can tell many stories of material and social practices not recorded in the written sources. Consequently, cultural biographies and social histories are a good solution to the challenge formulated at the start of the project. One particular aspect of the model which does not fit the case of Greenland is the definition of sacralization. In Kopytoff's definition commodities are sacralized by being pulled out of the commodity sphere and set aside to demonstrate status or for religious purposes. However, the latter function is not separate from everyday life in the Historical Thule Culture of Greenland. Certainly there were religious specialists – shamans – who owned certain things only used for spirit-travelling, but many 'sacralized' objects were also used by people in everyday life. This is true not only of European commodities, but also of local materials, as the Inuit believed that animals, plants, places and natural phenomena were inhabited by spirits called inua (Sonne 1994: 45f). One example is amulets, which could be used for protection against many things – from drowning accidents to spirit possession – or were incorporated in hunting equipment for luck. In this perspective, religious

practice was an integral part of Inuit life and things could have both sacral and ordinary functions depending on the situation. The separation of sacred and profane is not a universal cultural concept; the term sacralization must be contextualized in every historical case and cannot be uncritically transferred. Furthermore, distance between producer and consumer does not seem to be the sole factor in sacralization in the Greenlandic case. The novelty of foreign objects seems to have played its part even in regions with direct contact with the Europeans.

A good example of an object which in a western perspective had both practical and sacral functions is a lamp-stick with an iron blade collected in 1908 at Ammassalik. This was lent to Perkilak, a 4-year-old boy, by his parents, who told him to swing it through the air to fight off the disease when he was ill. At other times the lamp-stick, which in form and material resembles many others from the region, was simply used to adjust the flame of the family's lamp. This story shows how the purpose of things changes. It also illustrates that the social meaning of many things cannot be read directly from the object or its archaeological context. The many functional transformations and new meanings of European things in the historical Thule culture reflect only a part of what once existed.

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Timber houses in Greenland – diffusion and innovation

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When the first missionaries settled in Greenland in the 1720s, it was quickly apparent that they needed to find good housing. Traditional Greenlandic houses and lifestyles did not fit easily into the existing northern European norms, and being among the first permanent settlers posed challenges. Initially, the missionaries were organized via Bergen in Norway, and in 1723 the first timber house (log cabin) was sent to Greenland. This house will not be discussed here, but it is thought to have originated from 'West Norway', i.e. the region along the Atlantic coast of southern Norway. When one looks back at this pioneering period for Europeans in Greenland, it is clear that Hans Egede and the other pioneers received very little financial backing from 'the Company' in Bergen. 'The Company' was interested in making money.

The oldest preserved house from these colonial times is dated 1734 and was built for Poul Egede's new mission at Christianshåb in the Disko Bay. The house-building style is strongly influenced by Norwegian traditions and it has been suggested that this house was originally a Norwegian timber house which was bought, dismantled and then transported to Greenland. The house wasn't sent from Bergen, though, but from Copenhagen, since by this time the mission's main contacts with Europe and its trading network went through Denmark's capital. The house has since had a rather varied history in the small community, both as a shop and a storehouse between 1806 and 1990. Today it is a museum.

When the house was being refurbished in connection with its new role as a museum in the 1990s, it was possible to take a slice (cross-section) through some of its timber posts. This slice was analysed using dendrochronology and revealed a secret. The construction date was confirmed, but the pattern of tree rings showed that the trees that were used for the

"It smells Norwegian". Sampling produces a lot of smoke and Helge Paulsen thought that he could determine where the timber came from just from the smell of the smoke. Photo: Thomas Bartholin.

timber posts had not grown in Norway but somewhere in the Baltic area, most probably somewhere in present-day Poland.

So we had a Norwegian timber house made from Polish trees!

In the summer of 2010, dendrochronological cores were taken from 15 historical buildings in Ilulisat/Jakobshavn, Ilimanaq/Claushavn and Sissimiut/Holsteinsborg. The samples were taken by Thomas Bartholin (dendrochronologist) and Helge

Paulsen (building conservation consultant) using a specially designed corer for use on standing structures. This is work which requires great care and not least strong biceps.

The laboratory analysis quickly revealed that the timbers used in the extant houses in Greenland derived from a wide area, especially from Poland but also from Sweden and perhaps Finland, with only a little from Norway. This is a totally different picture from the traditional idea, which assumed that the area that was closest, i.e. Norway, would be the major supplier of timber. In this case it was not – other forces and trends were important.

Our Norwegian building expert could quickly see that most of the buildings didn't follow traditional Norwegian building styles, and that many details pointed in quite different directions. There is virtually nothing 'Norwegian' in these buildings, but they do have similarities to the log cabins of eastern and central Europe. The indications are that, at the end of the 18th century, a standard house type had been developed which may have been inspired by the building traditions of the region that supplied the timber for the houses. These new 'type-houses' could easily have been sent to Greenland as a package solution and did not need extensive expertise to erect.

'Holmen' (the naval base with shipyard in Copenhagen) probably played a significant role in the story. At Holmen there were highly trained 'masters' who were most likely the equivalent of modern-day engineers, carpenters with experience of both house construction and shipbuilding, and not least contacts with most of northern Europe. Ideas flowed along the trade routes, and in this melting-pot new ideas and inspirations were formed.

One of the advantages of dendrochronological dating is that it is rooted in a biological context. This means that it is totally independent of all other dating methods, historical, archaeological or geological, for example radiocarbon dating. The results can therefore be used as an independent contribution to the study of Greenland's old buildings (cf. Bartholin 2011; Paulsen 2011).

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Tunit and the birds — echoes of another world

Martin Appelt & Mari Hardenberg
Ethnographic Collection

With a point of departure in only a small number of artefacts assembled from a Late Dorset site in the eastern Arctic, it is suggested that historical trajectories sometimes move in highly asynchronous ways. It is also suggested that processes of cultural change, as reflected in archaeological records in the eastern Arctic, are mostly driven by cultural encounters.

Among the numerous artefacts from prehistoric sites in Arctic and sub-Arctic Canada and Greenland, the miniature carvings of the Tunit people (i.e. the Dorset culture) speak directly to our imagination. When studying this particular aspect, one feels almost able to understand the worldview that led to the very specific way this group of prehistoric carvers portrayed the beings that inhabited their world. The attention of both researchers and the public has mainly been directed to the relationships among humans, human-like beings (perhaps deceased humans), and polar bears as reflected in the carvings. Fewer scholars, however, have discussed the Tunit miniature portrayals of birds that are sometimes found in the archaeological assemblages. The following text will cast some flickering light on the Tunit and their relationship with birds as viewed from a single aspect of their material culture.

Background

In 1939, the Oxford archaeologist Graham Rowley completed the first systematic excavation of a settlement of the Tunit culture. The site is known as Abverdjar, and it is located in the northwestern part of Foxe Basin, Nunavut.

Fourteen years earlier, in 1925, Diamond Jenness had already suggested that the eastern Arctic was inhabited prior to its settlement by the Inuit population during the 11-12th century AD. Jenness based his suggestion on observations of archaeological specimens from a collection that had come to the Canadian National Museum from Cape Dorset. Significantly, some of the objects looked stylistically different from and older than those of the familiar Inuit culture. The artefacts were depos-

ited in a single wooden box in which Jenness placed a little note citing the term "Tunit culture", referring to the stories told by the Inuit in Nunavut to Franz Boas and Knud Rasmussen during their journeys. These stories were about a people who inhabited the country before and for some time after the Inuit arrived in the eastern Arctic. One can only guess at why Jenness then went on to follow the normal archaeological practice of naming cultures after the places where they are first recognized as independent phenomena, in this case the "Dorset culture".

In the following, we will adopt Jenness' first suggestion and use the term "Tunit culture", although in a slightly different way from the common use of "Dorset culture" by archaeologists. In this context, "Tunit" refers directly to the people with whom the Inuit made contact when they first settled in the eastern Arctic, and not only to the specific composition of objects and their stylistic traits that generally constitute the archaeological "Dorset Culture".

At the beginning of the Second World War, Graham Rowley joined the Canadian military, which is why his excavations at Abverdjar were only sporadically described in a brief article (1940). This may be one of the reasons why it was to take more than ten years before the wider archaeological world accepted the existence of a group of settlements older than, and different from, the earliest Inuit settlements. A number of researchers have since studied the artefacts from Abverdjar; however, the finds have never been fully published. The Danish archaeologist Jørgen Meldgaard examined the artefacts from Abverdjar in connection with his fieldwork in Nunavut in the 1950s and 1960s, and produced a number of excellent photos and drawings of these exceptional objects. Moreover, he conducted minor additional excavations at Abverdjar in 1965 and produced the only existing archaeological site maps of Abverdjar. Despite the lack of published information on the site, it is famous for its varied and extensive occurrences of organic artefacts (fig. 1).

The Abverdjar site covers an area of 1,800 m^2 and houses a small mission station and eleven houses, most of which probably date from 1930 and 1940. The objects made by the Tunit people were obtained from two disturbed semi-subterranean dwelling floors and the associated thick midden layers. This part of the settlement is now 10-12 metres above sea level and is situated at the northern, highest part of the settlement. According to Rowley's preliminary description, the excavations included a number of bones of such animals as walrus, bearded seal, ringed seal, polar bear and arctic hare. He noted that catching foxes seems to

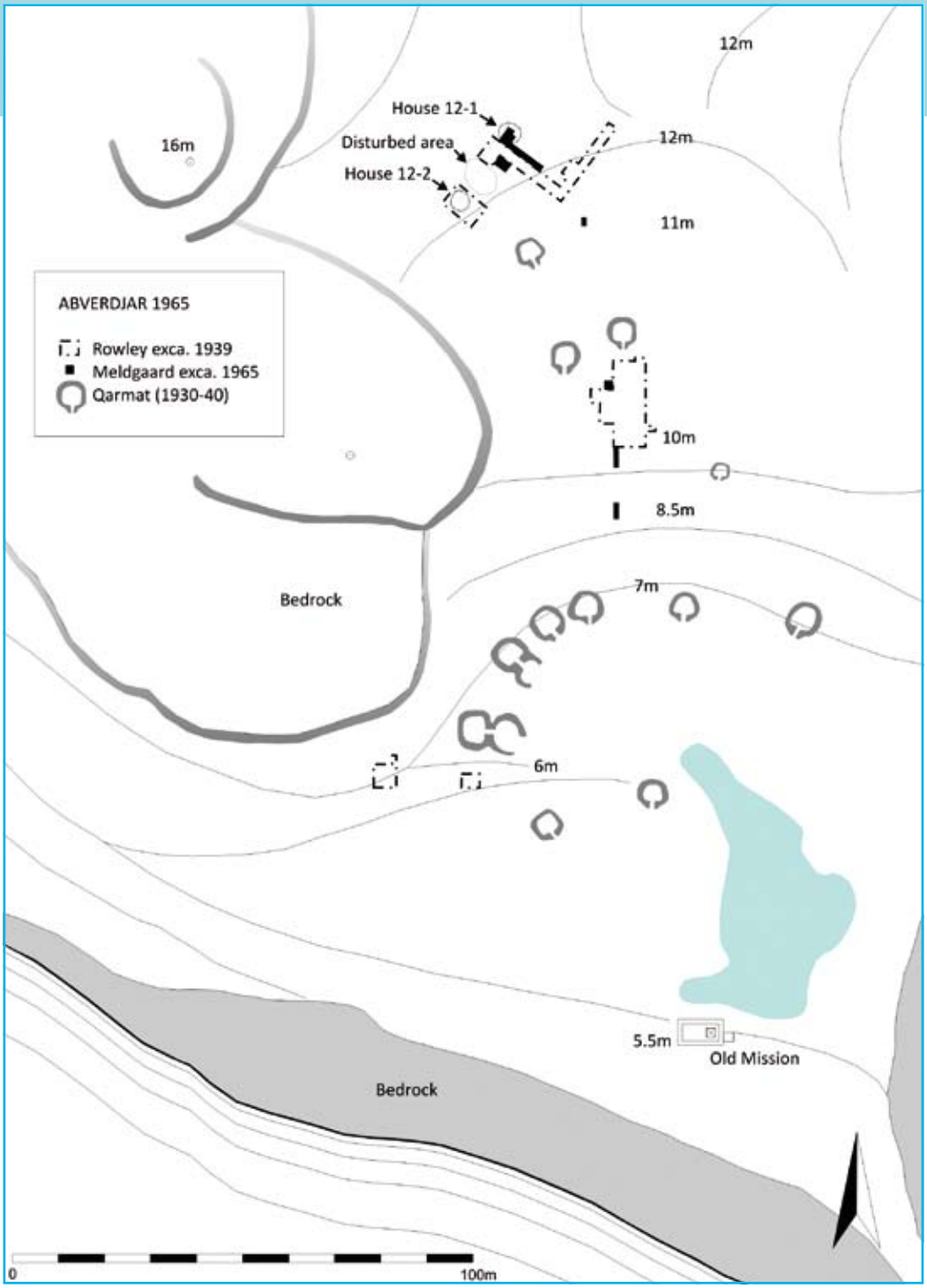


Figure 1: Plan view of the Abverdjar site, Igloolik Region, Nunavut. Drawing by Jørgen Meldgaard, 1965.

have been of particular importance (Rowley 1940: 492), indicating that the settlement had also been inhabited during the winter months when fox furs are in prime condition. A wintertime use of the site is further indicated by the large number of fragments of snow knives and the so-called ice-creepers. The latter objects are

Figure 2: Needles obtained from Abverdjar. Museum of Archaeology and Anthropology, University of Cambridge. Photo by Martin Appelt.

halved, flat pieces of walrus tusk where one surface is smooth while the opposite surface has a series of pointed buds. The pieces would have been bound under the kamiks with the buds facing downwards, thus making it possible to move on icy surfaces.

The birds

As was the case at Abverdjar, birds were an important part of the Tunit people's food resources wherever they resided. At some settlements, bird bones make up nearly one third of the bone material found in archaeological excavations. This

applies particularly to settlements that had been inhabited during the summer when there would have been significant numbers of birds in the immediate vicinity. Often, one will find the remains of Tunit settlements at the so-called polynyas – that is, places where strong currents and local winds help to keep the sea open in winter or to break the ice earlier. Sea mammals gather in the polynyas in order to breath and feed, thus creating ample opportunity for hunters to find prey. Polynyas are also ideal locations for many of the Arctic migratory birds to find their food; in some places, such as Cape York Peninsula in the Thule district, the biologically productive North Water polynya are the basis for 20-30 million breeding auks. According to Knud Rasmussen, the flocks are so large that they block out the sun when they take off. In other High Arctic areas, geese and gulls are particularly common in the archaeological assemblages (Darwent 2001).

There is no doubt that most bird species were caught for subsistence purposes. But it is also likely that the skins of some bird species functioned as clothing among Tunit groups. We know, for instance, from the Inughuit in the Thule area in historical times that dovekie were especially prized for inner clothing. While the Tunit people's clothing is only known from indications on a small number of carvings of human figures, we imagine that their clothing included bird skins, as it is difficult to imagine that the warm skins would just be discarded. Many of the Tunit people's needles are also so delicate that they must have been particularly suitable for sewing thin, soft leather such as fox and bird skins. These needles were almost exclusively made of split bird bones (fig. 2).

Tunit carvings

Today, the total carvings known from the Tunit and their predecessors number more than 1000 individual pieces (e.g. Sutherland 2001), both complete and fragmented. The majority of the carvings were produced during the period around the beginning of our era until the 13-14th century, peaking in the period from the fifth century onwards.

The carvings are primarily in ivory, antler, bone and wood, but soapstone had also been used in Newfoundland and Labrador. They range from what appear to be naturalistic portraits of individual people and animals to completely abstract forms apparently depicting creatures which in many cases (whether humans, animals or spirits) are only indicated by simple, characteristic incisions. For example, the abstract representations of the bear may be as simple as five short lines repeated twice, representing the bear's claws. In other cases, a simple incision along the axial spine of an animal carving repre-

sents what seems to be the act of breathing and/or digestion.

For the Tunit people the skeleton appears to have played a distinct role, and carvings of both humans and non-humans often have a number of skeletal elements indicated (fig. 3). This kind of skeleton motif, as it is called, is commonly found in a number of communities across the Arctic, but also among hunter-gatherers in the far southern regions and even back in some of the oldest human societies in Africa and Europe. In the course of time researchers from various disciplines have discussed the meaning and importance of the skeletal motif, and the interpretations are numerous. There is some consensus that the use of skeletal motif ornamentation is associated with a particular worldview that suggests a particular relationship among humans, animals and spirits. In this special perspective, everything in the world has energy and a will, and is closely linked both in this and in other worlds; for several spirit worlds exists parallel to our own. In the same vein, a number of 'crosses' and in small and large versions are incised to mark the body's joints. In later Inuit and Yupik societies, these images marked the so-called 'joint-souls', but it is not known whether they were understood in the same way among the prehistoric Tunit people.

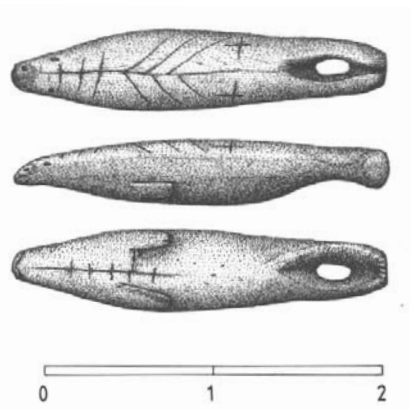


Figure 3: Miniature seal carving with incised skeletal motif carved from walrus ivory. Obtained from a Tunit dwelling in the Thule region, Greenland. Drawing: Niels Levinsen.

Among both prehistoric and historic Inuit groups, there has been a tradition of carving two-dimensional 'sceneries' on pieces of walrus tusk and antler. In contrast, we only know of a few pieces carved by Tunit. We shall later present some of the few ornamental exceptions that exist among the Tunit people's objects.

The total assemblage of carvings most likely represents many different meanings and uses. A large number of carvings are probably personal amulets, while others, such as some of the miniature versions of harpoon heads, may have functioned as toys. A third group of carvings may have been tools for particular collective ceremonies directed by religious specialists. It seems likely for example that the dramatic full-size wooden masks known from a single place in Canada, like bear teeth carved from walrus tusk, were used in large gathering ceremonies. A number of Canadian sites have

also revealed pieces of caribou antler with a large number of carved faces, seeming to show denizens of this and possibly other worlds. Of these types, 14 pieces have been found with up to 60 carved faces. These varied representations of faces, known by some scholars as shamans' wands, may well have been used for collective ceremonial events (fig. 4).

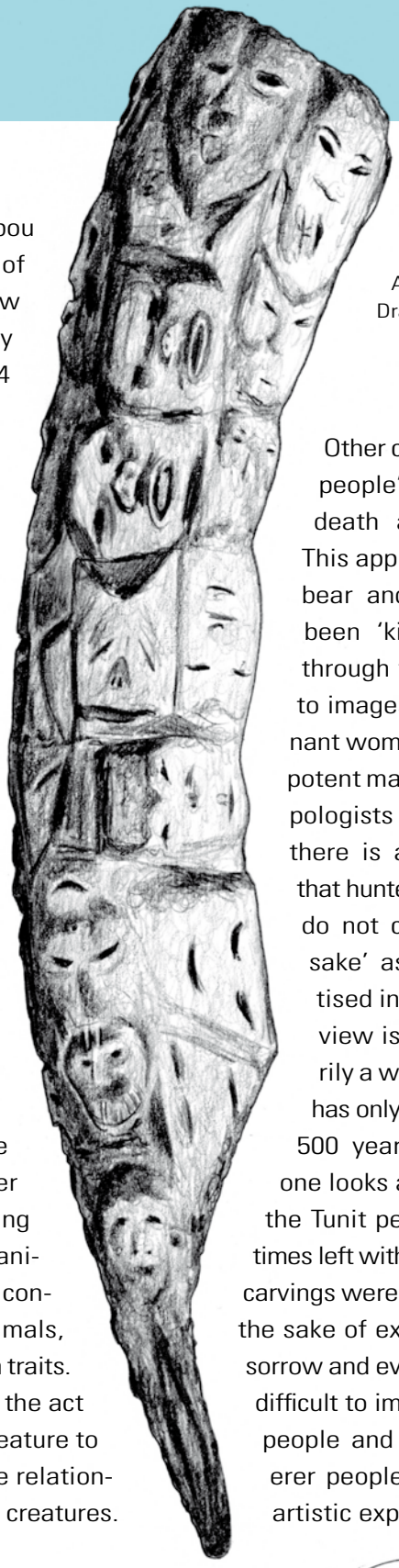


Figure 4: Multi-facial carving ("Shaman's wand") in caribou antler. Obtained from Abverdjar site, Igloolik region, Nunavut. Drawing: Nuka K. Godtfredsen.

As earlier mentioned, there are a number of figurines that may have been used as personal amulets. As is the case among historical Inuit, among the Tunit they may have had the function of protecting the wearer against evil and of transferring the distinctive powers of the animals reproduced. For example, a carving representing a caribou leg could have functioned as an amulet either for attracting caribou or for giving the owner the speed of the animal. Other types of figurines contain elements from several animals, in each case mixed with human traits. These figures likely represent the act of transformation from one creature to another, or perhaps simply the relationship between the represented creatures.

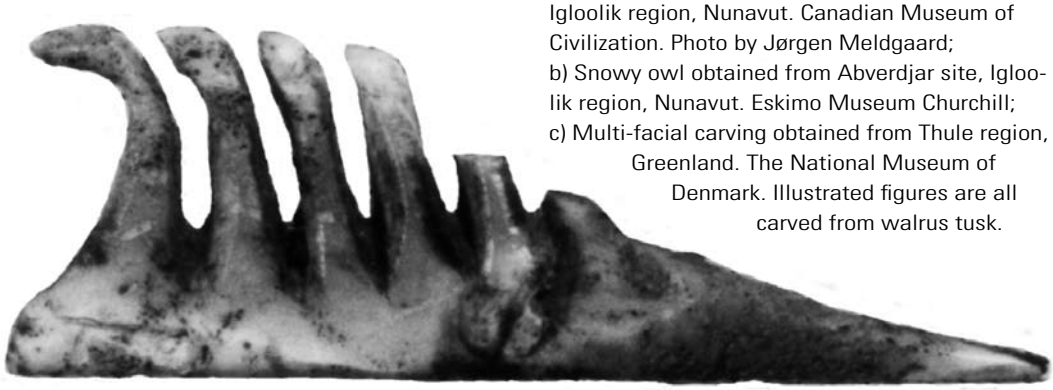
Other carvings on the Tunit people's objects illustrate death and birth themes. This applies to carvings of a bear and a man who has been 'killed' with a stick through the heart, and also to images of a heavily pregnant woman, or a particularly potent man. Amongst anthropologists and archaeologists there is a broad consensus that hunter-gatherer societies do not create 'art for art's sake' as known and practised in modern times. The view is that 'art' is primarily a western concept that has only arisen over the past 500 years. However, when one looks at some carvings of the Tunit people, one is sometimes left with a feeling that some carvings were actually created for the sake of expressing creativity, sorrow and even amusement. It is difficult to imagine that the Tunit people and other hunter-gatherer peoples had no sense of artistic expression.

According to an examination of more than 800 Tunit carvings conducted in the 1980s, human and bear representations are by far the largest groups represented. Man and bear have both been reproduced in countless variations, from abstract and sometimes hardly recognizable forms to fully naturalistic forms, represented by simple body elements or complete individuals. The many carvings express variations that are still recognizable today as ranging from happy and pleasant to highly caricatured and upsetting characters.

Creatures with beaks

Among the many artefacts from Abverdjar there are three or four representations of birds or bird-like creatures (fig. 5). One of the bird portraits is a perching falcon, but the legs are oversized and appear to belong to a large mammal. In other words, the figure is 'more than' a falcon. On the whole, the falcon in particular seems to have been viewed as a very particular creature, and is frequently found carved with skeleton decoration on the body surface, just as there are examples of the breast pieces being 'cut out' so that the sternum is visible. In some instances, the falcon, or rather its wings, are found in combination with other creatures or things, such as a bear or a harpoon. It is probable that the wings of the falcon were represented to transfer its exceptional abilities as a killer to the owner of the carving. In contrast, we also find examples of Tunit carvings from Greenland and Nunavut depicting what appear to be vulnerable falcon chicks (many of the figures mentioned are reproduced in Carpenter 1973).

The bird figures from Abverdjar are part of the group of more than 50 three-dimensional bird carvings found at Tunit settlement sites dated to the period from the sixth to the twelfth century.



(a)

Figure 5:
a) A flock of loons? Obtained from Abverdjar site, Igloolik region, Nunavut. Canadian Museum of Civilization. Photo by Jørgen Meldgaard;
b) Snowy owl obtained from Abverdjar site, Igloolik region, Nunavut. Eskimo Museum Churchill;
c) Multi-facial carving obtained from Thule region, Greenland. The National Museum of Denmark. Illustrated figures are all carved from walrus tusk.

(c)

(b)

These figures include one of the most graceful of Tunit carvings – a pair of swans with necks and heads stretched out in flight. The figure is from Mansel Island (a small island on the west side of Ungava Peninsula, Nunavik), and in the same place two more swan carvings were found that seem to illustrate a male swan in a courtship display. Another group of figures includes small, compact, naturalistic representations of the grouse, carved in wood or soapstone. We also know of three or four carvings that probably show small flocks of geese swimming in lines with their heads stretched out. The interpretation of the species represented on the carvings is particularly subjective, but the group of birds represented seems at all events to include snowy owl, diver and ivory gull, possibly a crane, and the other species already mentioned. The crane is a very rare visitor to the Arctic; but a bone has been identified from one of the Tunit settlements near Abverdjar which may well be from a crane (diary from 1957 by Jørgen Meldgaard).

Returning to the approximately 2000 unearthed artefact assemblages from Abverdjar site, the needles in particular represent a very large group of assemblages. If one adds the number of whole needles to the number of intact rear ends of needles, at least 101 needles are represented. Along with these a large quantity of sides and bottoms of what may have functioned as small boxes for storage and transport of the long, slender needles have been found (fig. 6). The containers are approximately five to ten centimetres long and are made of two or three pieces of caribou bone/antler, tied together through small oval holes on the sides of the pieces. Some of the side pieces have visible marks suggesting lashing/coils that functioned to keep the container together. The inside surfaces of the sides typically have a narrow groove at the top and bottom running across the piece breadth-wise. In this groove a bottom and a top disc head have been added. Some of the side pieces end in a narrow peak with a small cut hole which probably served as a suspension hole, so the container could be hung on a cord around the neck, on a belt, or in some similar way. The oval or circular top and bottom pieces are made of millimetre-thin slices of caribou shoulder blade; each piece has small holes for tying-on the sides. In some of these top and bottom pieces there is one hole in the middle, which may well have served as the hole through which one moved the needles in and out of the container (almost as in contemporary toothpick holders).

Some of the container side pieces and top/bottom pieces have ornamental engravings which in some instances have

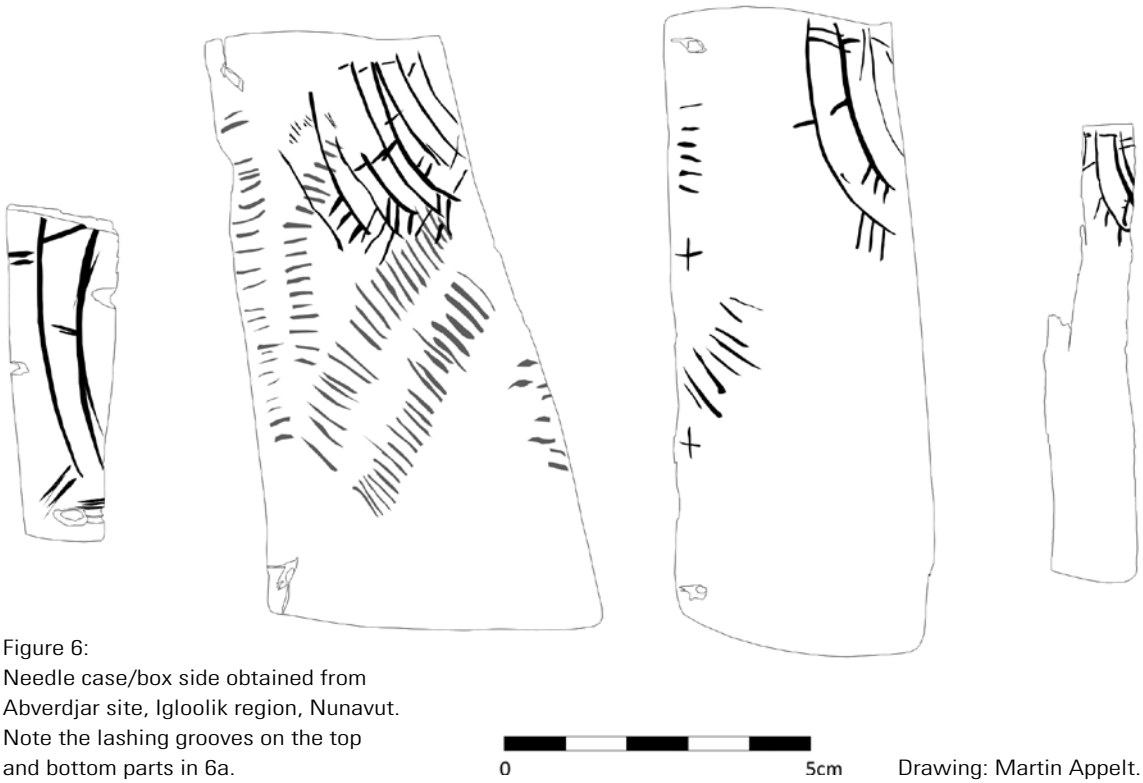


Figure 6:
Needle case/box side obtained from Abverdjar site, Igloolik region, Nunavut. Note the lashing grooves on the top and bottom parts in 6a.

Drawing: Martin Appelt.

immediately recognizable images. In several cases it is rather difficult to determine whether the many highlights are abstractions of concrete objects or merely served as ornamentation. If one studies the pieces for a long time, one slowly starts to recognize elements of small herds of caribou. Immediately after this recognition, however, it begins to look as if an entirely different creature is represented, or perhaps even the sun, making the small strokes that first appeared to be caribou legs the rays of the sun. Any previous clarity thus gradually starts to fade for the observer. However, there is little doubt that the people who carved this ornamentation assigned a concrete meaning to it and that their contemporaries were well aware of the meaning.

The carvings on some of the top and bottom pieces contain elements that are more accessible. This applies to carvings of figures that share the common feature that they have two wings and two three-toed feet (see figure 7 a, b, c and

figure 8 a, b). Figure 7 comprises a 'spine' formed only by a thin line to which the different body parts are connected. However, the torsos in figure 8 are trapezoid. Both types have clear markings of the ribs (skeletal ornamentation) and feathers, while the heads are quite varied. In figure 7a the head is lanceolate and has six short lines along its edges. In figure 7b the head is somewhat uneven pointed oval with clear markings of the eyes and mouth, while the head is missing from figure 7c. Figures 8a and 8b both have triangular heads. While figure 8b has individual dots inside the head, figure 8a again has six short lines along the sides of the head. Figure 7d has an oval head with seven dots, as known from other contexts, constituting facial orifices: ear, eye, nose and mouth. Finally, figure 8c differs from the others mentioned. This figure seems to have four legs, two of which end in three toes, while one leg has only two toes.

The engraved figures from Abverdjar only have a few parallels in the material excavated from other Tunit settlements, although most of the individual elements on the carvings are known from other places. First and foremost, the skeletal ornamentation is a recurrent feature in many of the three-dimensional renderings of mammals, like the seven dots depicting facial openings, and the carved figures reproduce features of several creatures. The dominant figure is the bird, but the figures in 7b and 7d appear to have human-like faces. In figures 8a and 8b, one of the wings is apparently folded across the body and is thus more similar to a human arm than an actual wing. The figure in 8c is a four-legged creature with bird feet, and the head has been formed with birdlike features.

As previously mentioned, several of the Tunit people's carvings include features or rather properties of various creatures, such as a harpoon head with marks of bear claws, which also has a human face or the face of a bird. In a number of places we also find cylinder-shaped boxes made of one piece of the lower part of a walrus tusk. These types are known among specialists as amulet boxes or 'blowing tubes'. The latter name refers to their possible use as tube-shaped objects for healing sessions as known from Inuit *angakkut* or shamans. The ornamentation on a number of these pieces contains elements from several creatures simultaneously: bear, human, seal, and walrus, like the well-known example of wolf and caribou combined.

The juxtaposition of elements from different creatures has been interpreted as an expression of the animistic worldview that must underlie the Tunit people's lifestyle. In this cosmology, everything has energy and an intention to

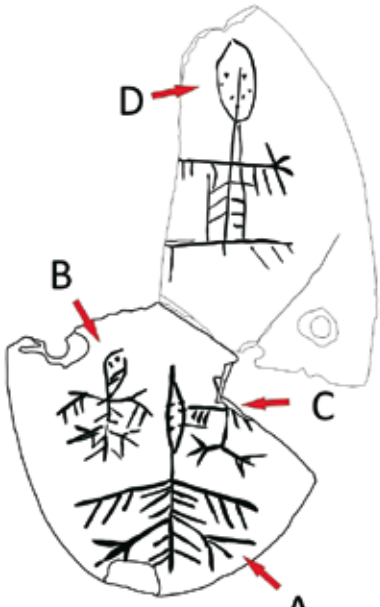


Fig. 7

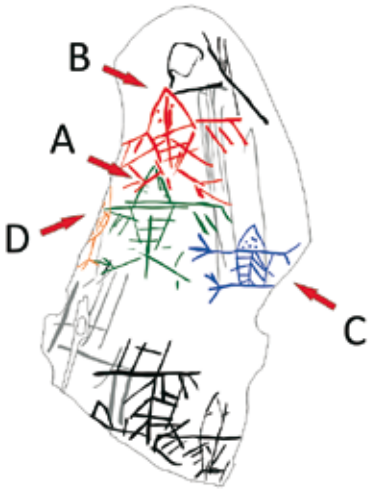


Fig. 8

Figures 7 & 8: Decorated top and bottom pieces of needle cases/boxes both obtained from Abverdjar site, Igloolik region, Nunavut. Drawing: Martin Appelt.

interact with the outside world that human beings must deal with. However, some things are more important than others. Judging from the many carvings, humans, humanoids (spirits and/or people who live in other, parallel worlds) and animals played a particularly important role. Tunit people apparently believed, like many other hunter-gatherer groups in the Arctic, that humans and animals could give themselves one another's appearance; that is, for long or short periods humans and animals could become other beings and possess their properties. One good example of this is the composition of the predator (probably polar bear or wolf) denture sets carved from walrus tusk known from several Tunit sites. These must once have had a use, and one can imagine that the person who put them in his mouth not only 'dressed up' as the bear/wolf, but for a time became the predator. It is within the scope of this worldview that we must understand the special carvings from Abverdjar.

We suggest that there are two possible interpretations of the engraved bird/human figures from Abverdjar, i.e. that the figures depicts humans that have become (or that are in the process of becoming) a bird or a being with bird-like features. Thus, as mentioned above, humans seeing the world from the viewpoint of the bird, whether that would have been the

view of the predatory falcon, trickster birds like the raven, or the caring ptarmigan. It could also be depictions of humans having borrowed the "skin" of their helping-spirits.

In a second interpretation, the figures could have been much more literally meant depicting people dressed in tangible human-made bird clothing. Quite simply, bird-skin clothing is both warm and light, even if it is also very fragile. This seems unlikely, however, as the engraved figures also appear with birdlike, three-toed feet.

We suggest a combination of the two explanations, i.e. that the figures depict people in bird-skin costumes that has become birds. Whether you accept one or the other interpretation, we argue that the engravings indicate that the Tunit felt that important spiritual connections existed between humans and birds.

The different shapes engraved on the two box bottoms seem to relate to each other and probably illustrate a storytelling sequence ('scenery'). It is striking that the characters do not overlap, and that their style and the way they are engraved are very similar. Whether the engraved figures reflect actual events or are part of purely mythical narratives (or both simultaneously), it is unlikely that we will get any closer to understanding their content.

If one assumes that gender roles among the Tunit were anything like what we find in most historically described Inuit societies, sewing belonged to the women's domain. The material from Abverdjar thus indicates an interesting correlation between women and birds, since almost all needles are made of bird bones. The figures carved on the needle cases, for example, are bird-like figures or people in bird skin (who could then be women).

The bird/human figures in a wider context

The unusual Tunit bird-people figures call to mind some of the oral stories from much later times (17-19th century) which were recorded among various Inuit and Indian groups across the Arctic and sub-Arctic. These stories relate that birds were associated with various, sometimes powerful symbolic meanings. Among some historical groups, birds played a crucial role in both the maintenance of and changes in the order of the universe. The many decorative objects and shapes left by the Tunit people may have referred to a similar role, albeit with variations in symbolic meaning and traditions through the ages.

In Graham Rowley's short report from Abverdjar (1940), he suggested the possibility that the Tunit may have been in contact with and/or inspired by southern Indian groups. So far, this possibility has not been verified by archaeological evi-

dence, but on the basis of the carved birds and human figures, it will be interesting to investigate this possibility in the future. Jørgen Meldgaard too had an eye for the possible link between the Tunit and Native American groups when he wrote his famous statement that the Dorset culture had "a smell of the forest" (Meldgaard 1962).

In the light of the striking overlap between the historically known role of birds (and religious specialists in bird-costumes) and depictions of the Tunit, it becomes important to consider whether this overlap is to be understood within the framework of general circumpolar phenomenon amongst pre-modern populations, like the use skeletal ornamentation. Or it may imply a direct historical link between Tunit and other Native American groups found across the sub-Arctic.

For more than five decades archaeologists have debated whether there is direct continuity between the various early and late pre-Inuit groups (traditionally designated by the term palaeo-Eskimos) and their material manifestations in the eastern Arctic.

It presently seems that a number of important traits predominantly signal continuity. These traits include styles of dwelling architecture, the orientation towards subsistence resources, some aspects of regional mobility, the preparation of organic substances (e.g. walrus tusk, antler, bones and wood) for tool production, the styles of some hunting implements, and the style of ornamentation. Particular harpoon-head styles and styles of dwellings for example, seem to suggest 4000 years of continuity, within the eastern Arctic. Other traits seem to be more universal – like the use of skeletal ornamentation.

In other elements we see very distinct discontinuities and changes in the archaeological record from the early and to the late pre-Inuit groups respectively. The changes include the introduction or disappearance of particular key implements; for example, the use of bow-and-arrow technology, dogs, snow knives and snow houses, of a particular style of gathering-site architecture, various hunting implement styles, various inorganic raw materials, and not least in the production of two- and three-dimensional carvings.

With regard to most of the above-mentioned traits/elements, the observed dimensions of continuity seem to be dependent on the temporal and spatial scales we decide to employ in our analyses. The style (i.e. the skeletal ornamentation) of the engraved figures from Abverdjar is on the one hand part of a long human history spanning all parts of the world

and related to a universal animistic worldview. On the other hand the particular style of the late Dorset bird/human figures is known only from a few sites dating to the later part of the 3800-year pre-Inuit occupation of the eastern Arctic (i.e. the late Dorset period). The carvings/ornamentation stand out, and seem to be part of storytelling sequences that are otherwise only known from carvings among later Inuit groups.

In conclusion, we suggest that the history of the Tunit has to be understood by employing multiple, and sometimes asynchronous, scales of time and geography. We've further indicate that the history of the Tunit includes encounters with other groups, including Native American groups from more southerly regions. The mythology reflected in the Tunit human/bird figures seems furthermore echoed among subsequent Inuit and Native American groups several centuries later (Appelt & Gulløv 2009).

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Memory of a myth – a unique Late Dorset ritual structure

Ulla Odgaard
Ethnographic Collection

In 1954 the Danish archaeologist Jørgen Meldgaard from the National Museum of Denmark discovered a unique structure from the Late Dorset culture (c. 500-1200 AD) at the Alarnerk site in the Igloolik area, Foxe Basin, northeastern Canada. The structure contained human bones, and Meldgaard interpreted it as a grave. This paper, however, argues that the structure is the material relic of another type of ritual than a burial.

Alarnerk is a large Palaeo-Eskimo settlement on the northeastern corner of the Melville Peninsula in the Igloolik area, Foxe Basin, northeastern Canada (fig. 1). It was Jørgen Meldgaard, from the National Museum of Denmark, who was the first archaeologist to survey and excavate this site in 1954. He had already discovered that the marine beach ridges in the Igloolik area had been elevated continuously into higher and higher terraces since the first pre-Dorset settlers. Consequently the sites could now be 'read' as a chronological open-air museum, from the earliest traces at the high levels to the youngest down by the sea.

On the terraces at Alernerk, Meldgaard found more than two hundred Palaeo-Eskimo dwellings, at heights from the Early Dorset phase, at 22 m above sea level, down to the Late Dorset phase at 8 m above sea level. But Meldgaard also found other types of Palaeo-Eskimo structures that had not previously been discovered. In the barren, rocky terrain he registered several structures that he

Fig. 1. Igloolik area, with Alarnerk. Original drawing: Jørgen Meldgaard.

Fig. 2.
Ritual mound during excavation.
Photo: Jørgen Meldgaard.

interpreted as graves, although they only contained human bones in two instances. These structures included low, oblong gravel mound.

"Rituals are behavioural acts that often entail material culture and therefore can be represented in the archaeological record" (Kelly and Thomas 2010: 297). But even though some archaeological finds are clearly remains of ritual activity, it can be difficult to interpret the meaning – or semantics – of a particular prehistoric ritual. In some cases, however, as with the subject of this paper – a gravel mound from a Palaeo-Eskimo, Late Dorset (500-1200 AD) context – it is possible to recognize the different phases and possibly even the semantics of the ritual.

The ritual mound

The most spectacular and best documented of the so called graves is the one Meldgaard named the "Ochre Grave",

but which I prefer to call a 'ritual mound'. It was located on a terrace 15 m a.s.l., but the mound contained a type of harpoon head that dated this find to the Late Dorset phase, i.e. later than the Middle Dorset dwellings found at the same level.

The structure is described as an approximately 9 m long, 4 m wide and 0.80 m high gravel mound (fig. 2). There was no vegetation on the mound, except some moss and lichens in a shallow 2 x 2 m wide, 0.30 m deep concavity on the north side. An excavation here showed that three episodes had taken place (fig. 3).

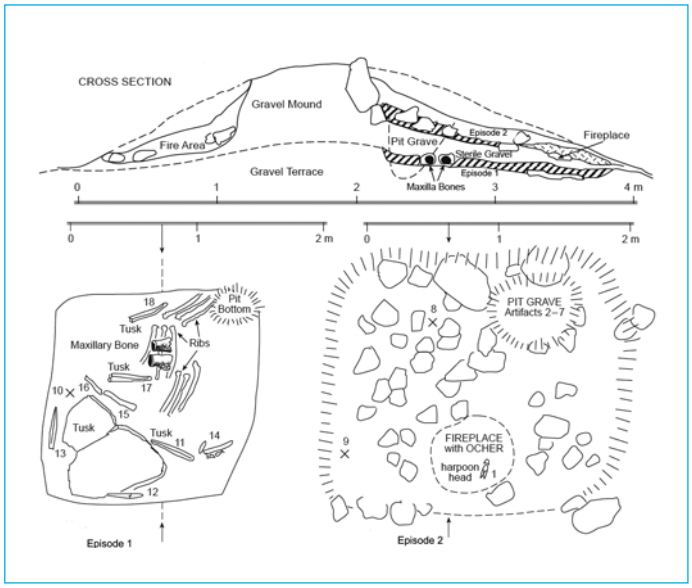


Fig. 3. Excavation of ritual mound. Cross-section and plan. Original drawing: Jørgen Meldgaard.

Episode 1): A square area was dug down 10-20 cm into the original terrace surface. Here artefacts and bones were carefully placed, with parts of a walrus in a central position: The maxillary bones (upper jaw) were split, but the sockets were placed close together on top of three walrus ribs. On each side of this arrangement, two halves of walrus tusk, split lengthwise, were placed together with two groups of three ribs, resembling a skeleton design. In one corner a couple of flat limestone slabs covered with black soil had probably contained a fireplace. Around the fireplace were some flint tools, a human femur, and another two halves of split walrus tusk. Furthermore, some artefacts including microblades, a harpoon foreshaft, a knife or lance head composed of a wooden shaft, two microblades as side blades and one end blade, and two parts of a foreshaft of notched bone pieces, were placed near the fireplace (fig. 4). Along with these finds there was a human long bone, probably a femur. Across the whole area there was a thin layer mainly of walrus ribs and vertebrae (backbones). None of these bones had been split for the marrow. A c. 20-30 cm thick layer of sterile gravel had concluded the first episode.

Episode 2): On top of the applied layer of gravel a second episode took place. Here a fire had burned, and the place was afterwards covered with a thin layer of ochre. An ivory harpoon head for walrus hunting with a carved human face

Fig. 4. Episode 1, the fireplace is in the foreground. Photo: Jørgen Meldgaard.

Fig. 5. Episode 2, an ivory harpoon head for walrus hunting with a carved human face was placed on top of a fireplace. An ivory miniature harpoon head and foreshaft were also found at this level. Photo: Jørgen Meldgaard.

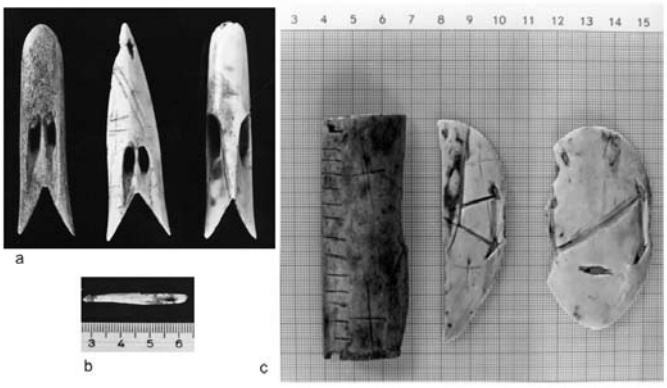


Fig. 6. Among other finds in the pit in episode 2 were: a. 3 ivory harpoon heads; b. one ivory miniature harpoon-head foreshaft; c. parts of an 'amulet box'. Photo: Jørgen Meldgaard.

was placed on top of this fireplace. Furthermore, an ivory miniature harpoon head (fig. 5) and four microblades were found at this level. In one corner a c. 60 cm deep pit was dug down through the sterile gravel layer, through the episode 1 layer and down into the gravel terrace. The pit was filled with black soil, the top layer of which contained fat. Near the bottom of this pit, the mandible (lower jaw) of an infant child was found together with three ivory harpoon heads, one ivory miniature harpoon head foreshaft, one walrus ulna 'bone knife' and parts of an 'amulet box' (fig. 6). The harpoon head with the carved human face and one of the others are typologically type G (Park and Stenton 1998: 36). These harpoon heads date the structure to Late Dorset, while the other types of harpoon heads were also produced in the Middle Dorset.

Episode 3): Above this layer, an approximately 20-30 cm thick layer of fist- to head-sized stones, many of which were blackened and cracked by fire, was found. Bones of walrus, seal and caribou (some crushed for the marrow) were scattered among the stones, but were mainly concentrated around the fireplace.

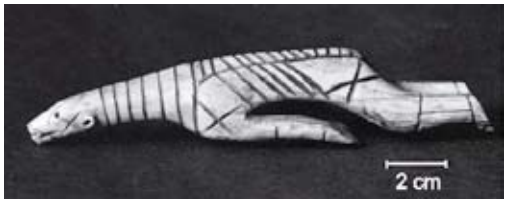
On the other side of the mound, a similar, rectangular, 1.1 x 0.65 m, dug-down floor was found 0.15-0.25 beneath the surface. There were also traces of fire here, but no finds.

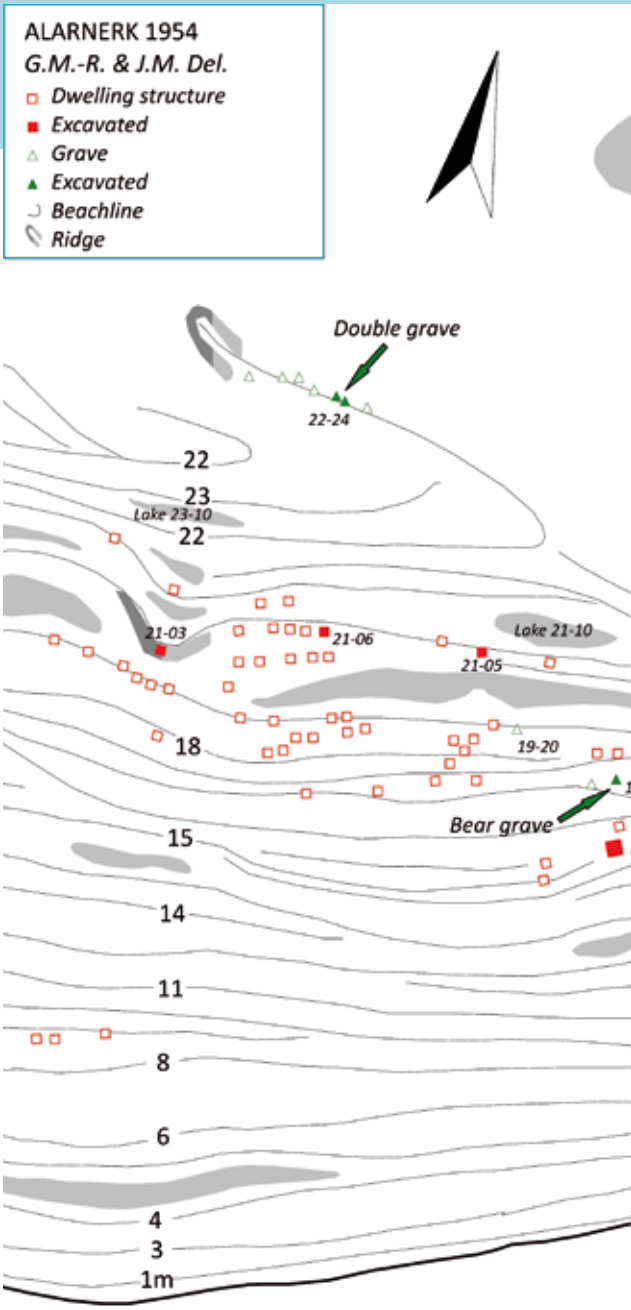
The context

At the Palaeo-Eskimo settlement Alarnerk, where the 'ritual mound' is located, there are also other archaeological structures, the function of which cannot be rationally explained.

Four other gravel mounds were observed at heights of 15-19 m a.s.l. Their general description is a rounded and flattened heap of gravel (2-9 m in diameter, with a maximum height of 0.8 m) piled up on the ridge of the terrace. On the top of one of these, at a distance of 600 m from the ritual mound, on a terrace 17 a.s.l., a carving of a polar bear was found, partly buried, with the head and front paws sticking out of the gravel. The bear, made from walrus tusk, is a beautifully carved example of Late Dorset art (fig. 7). An excavation revealed that 0.9 m west of the find spot, 0.2 m below the surface, a fireplace set with flat-stone paving was found. The fireplace contained ashes and traces of burned bones, and the ashes and blackened gravel continued 0.45 m down in a grave-like depression. The only

Fig. 7. The polar bear made from walrus tooth, is a beautifully carved example of the Late Dorset art. Photo: Jørgen Meldgaard.





artefact found in the depression was a notched slate blade. No further documentation of this interesting structure is available.

Additionally, a total of 16 chamber-like stone structures were mapped at the highest levels 21-22 m above sea level. A few artefacts, all of Late Dorset origin, were found scattered around and inside several of these. Several of the structures, too small to be used as caches for walrus meat, had been rebuilt later as meat caches. Some, however, had not been destroyed and their description fits the local tradition stating that 'Tunit graves' were short and built with large stones (Lynnerup et al. 2003: 351). In one of the structures, consisting of two small stone chambers (called the 'double grave'), Meldgaard found three human leg bones.

On terraces from 15 to 19 m a.s.l. one or two protruding stones, a slight depression – or both – marked twelve rounded pits, 70-100 cm in diameter, dug 30-60 cm down in the gravel and lined with smaller stones and with flat stone slabs at the bottom. In these pits too a few artefacts, all of Late Dorset origin, were found.

All of these probably 'non-rational' structures are found at heights between 15-22 m a.s.l., and at distances between 300 and 600 m from the dwellings at the shore (today between 8 and 14 m a.s.l.) where the people from the Late Dorset lived (fig. 8). Only two of the structures are located close to the dwellings of previous Palaeo-Eskimo occupation, while the rest are found in small isolated clusters.

Meldgaard described most of the possible grave structures as having been

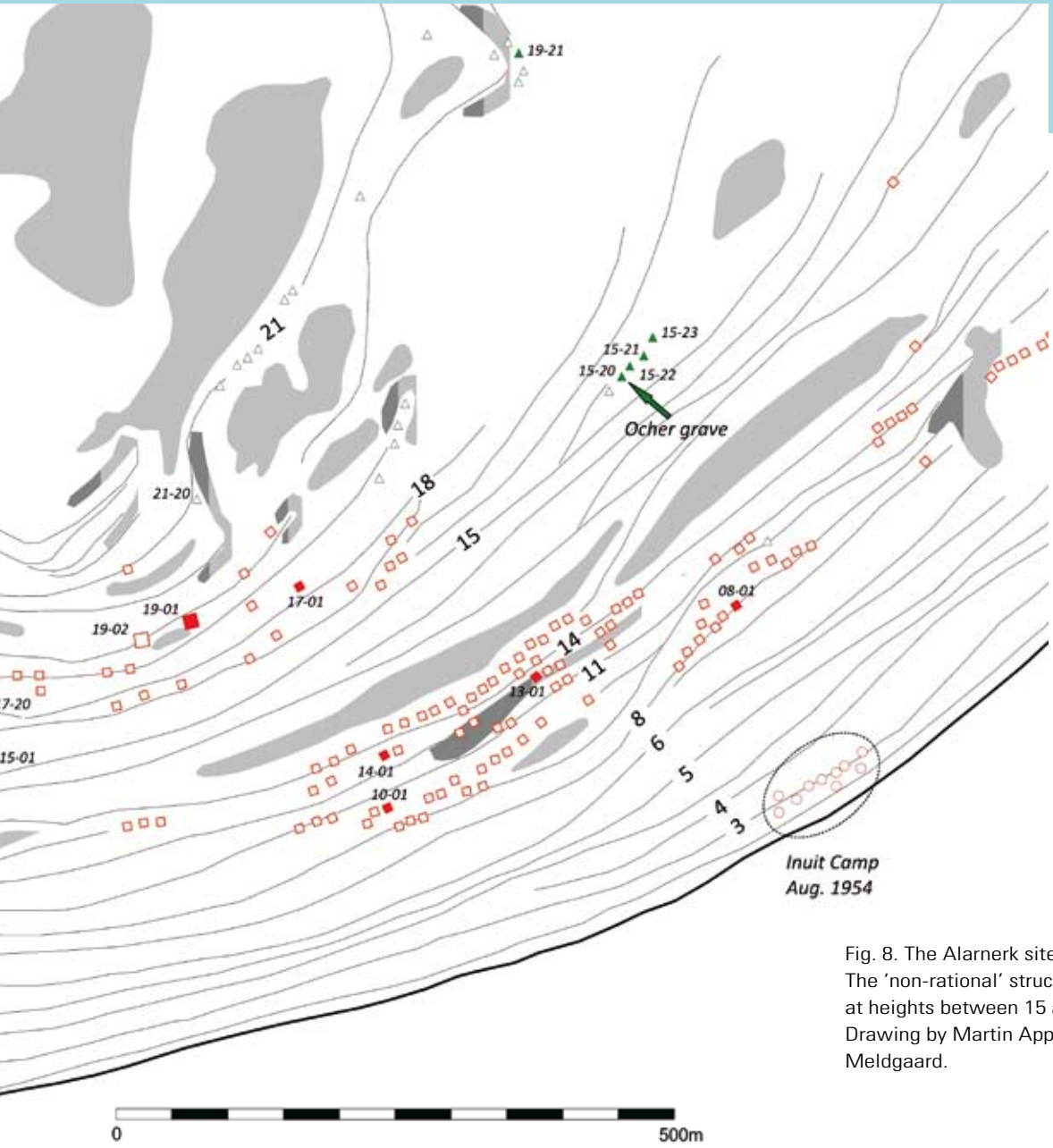


Fig. 8. The Alarnerk site.
The 'non-rational' structures are found at heights between 15 and 22 m a.s.l. Drawing by Martin Appelt after Jørgen Meldgaard.

robbed and re-used as meat caches, and it seems that only the gravel mounds were still intact, making his detailed description of the ritual mound possible. But was this structure, as supposed by Meldgaard, really a grave? Well – it definitely contained human bones. The human mandible was from an infant approximately nine months old at death (Lynnerup et al. 2003). The human femur has not been examined, since it was probably left at the site after excavation, like the other three human leg bones found by Meldgaard in the 'double grave'.

Human graves are not common in the Palaeo-Eskimo culture. A small number

of Dorset graves have been found, most of them in caves and crevices, close to the Port-aux-Choix site 2500 km south of the Igloolik area (Brown 2011). Apart from this southern phenomenon there is only one example of a pre-Dorset skeleton of a premature child from a tent ring at Devon Island in northern Canada (Helmer and Kennedy 1986) and a few human bones found in a Saqqaq midden in western Greenland (Grønnow 2004: 107f) and in Dorset middens at Alernerk (Lynnerup et al. 2003).

Most probably, the common mortuary practice was similar to the Mongolian 'casting-out' (Haslund-Christensen 1949), where the dead bodies were placed in open-air burials in an uninhabited area, and left there to be devoured by predatory animals. Revisits to an area like this could explain why a few bones are found at the settlements, detached from the rest of the corpse and in secondary contexts. If the present structure is a grave, it is therefore not an expression of the common funerary ritual practice. Rather, it is a trace of another kind of ritual than a burial.

Non-human persons

We can suggest that the careful placement of the walrus bones in the 'skeleton design' in episode 1 points to a practice of treating the bones of the game animal with respect, as described in many historical circumpolar cultures. For example the Yupik people of Alaska and Siberia believed that the animals would reward a hunter if he took proper care of the bones of his catch (Fienup-Riordan 1994: 107). The Yupik hunters did not view themselves as dominant over animals. Nor did they see themselves as dependent on or subordinate to animals. On the contrary, they viewed the relationship between humans and animals as a collaborative reciprocity in which the animals gave themselves to the hunter in response to the hunter's respectful treatment of them as 'non-human persons' (op. cit. p. 50).

Furthermore, the compilation of human and animal bones in episodes 1 and 2, where parts of the human skeleton complement animal bones (animal maxillary / human mandible – animal ribs and vertebrae / human long bone) suggests that the animal bones should not be understood as the remnants of a meal in honour of a dead person. Rather, it reflects a ritual that emphasizes a symbolic animal / human relationship. Turning again to the Yupiit, they considered humans and animals similar in a number of important respects. They extended personhood beyond the human domain and saw it as an attribute of animals too (op. cit.).

Ritual and myth

In this case, however, we might go a step further than generally attributing the mound to a – not surprisingly – ani-

mistic hunting society. Because of the structural sequence – the three episodes described above – an obvious step is to look at the structure with the three phases of the ritual analysis in mind. Van Gennep defined "rites of passage" as "rites which accompany every change of place, state, social position and age". "I propose to call the rites of separation from a previous world, preliminal rites, those executed during the transitional stage liminal (or threshold) rites, and the ceremonies of incorporation into the new world postliminal rites" (Van Gennep 1960: 21).

This very useful approach to understanding rituals can be summarized like as follows:

1) Separation phase – where preparations for the encounter with the 'sacred' or numinous take place, sometimes through a ritual death.
2) Liminal phase, where boundaries between time and space – and worlds – don't exist. This is the important phase, and everything happening here must follow the ritual prescriptions with great care.
3) Incorporation phase, where normal life is restored and strengthened.

The ritual object may be a person, but can also be a thing, a piece of land or anything else on which a ritual can focus (Sørensen 2004: 5).

Episode 1 in the archaeological structure can thus be interpreted as the pre-liminal separation, which in this case is symbolized by the walrus. This animal, which can be hunted both on land and in the sea, can function as a mediator between these two levels.

In episode 2, the liminal phase, the elements are child mandible, harpoon heads and a box found together, and another harpoon head with a face (in the fireplace).

Episode 3 could be the remains of the common meal that confirmed the restoration of normal life and a celebration of the new.

The meaning – or semantics – of rituals is embedded in mythic narratives. The "myth and ritual" school claimed that there is always a connection between myth and ritual, and the core theme is always death and rebirth (Schjødt 2000: 455).

In this case I will compare the archaeological structure to a historical myth from western Alaska comprising the same elements as episode 2. This well-known Yupik-Eskimo myth is about a boy whose parents wanted him to become a great hunter. They therefore allowed the shaman to send the boy down into the sea (child mandible in pit), where he lived, reborn as a seal, with the seals

and learned about the hunt (harpoon heads), as seen from the animals' perspective. The next year, after he had been speared by one of the human hunters (harpoon head with face), he again turned into a human being. He subsequently became a skilled hunter, who taught the other hunters about what the animals required to let the hunters kill them. Because of this insight the animals became easier to hunt for humans. The full version of the myth is found in Swann (1994: 57-74).

In episode 2 the child's mandible has been placed in a pit along with harpoon heads, but also with pieces of the so called 'amulet-box' (see fig. 6), whose function, however, we do not know. It is interesting in this context that a box is included as an element in a similar Chinook Indian myth about a boy who leaves his parents and people to live with the seals. The boy disappears from a camp on the riverbank, but he is captured years later while swimming with a group of seals. When he lived with the seals they had taught him how to build canoes and make beautiful carvings – skills he can pass on to the humans. But he does not thrive among men, so he ends up going back to the seals. He tells his parents not to mourn, and they throw his box of carving tools in the river after him. In return, he will continue to create beautiful carving work for mankind.

Both myths exist in multiple versions (the Chinook legend is told today as a tale for children), but the central theme is a boy who dies and is reborn as a seal, is in turn killed and is then reborn again as a human. And the other theme is the seals who teach the boy something that benefits mankind. Because the themes are similar, we suggest that they originally derive from the same myth. This myth, which deals with death and rebirth, and describes the intimate relationship between animals and humans, has survived in the version that fits best respectively in a coastal-oriented, Arctic hunting society, and among a hunting/fishing people who lived in historical times along the Columbia River in southwestern Canada.

The historian of religion Jørgen Podemann Sørensen has argued that when studying rituals we should look for the "situating" and the "productive" elements. The "situating elements" positions the ritual in a situation or a position from which it can work. "Any ritual is claimed implicitly or explicitly to take place at such a focal point" (Sørensen 2004: 4). The "productive elements" communicate the effect or the products of the ritual (ibid.).

Following these definitions, the object of the ritual in the mound was probably not the human being – the child. Rather,

the child mandible, together with harpoon heads and the box, served as situating elements, placing the liminal phase of the ritual in a mythological time. The walrus and other animal bones can be interpreted as the productive elements that the ritual aimed at effecting. Regeneration of the game animals may also have been the purpose of the other mound, the one with the bear carving, also examined by Meldgaard (Odgaard 2011).

The element of learning – in the myth a seal mentor teaches the boy – could also point to a kind of initiation ritual. Even though this ritual was only performed once, the mound could have served as a place where the memory of the insights gained by the boy could be communicated to young hunters. It is possible that the area with traces of fire on the other side of the mound reflects this kind of later ceremony.

Late Dorset – Thule contact?

There seems to be a remarkable correspondence between the elements of episode 2 and the elements in the Yupik myth of the boy who went to live with the seals. But is there any connection?

When we try to understand the 'meaning' or semantics of non-rational finds from societies like the Late Dorset, from which no written sources exist, it is necessary to apply what would earlier have been described as the "phenomenology of religion" (Schjødt 1989: 21) but is now termed the "comparative history of religion" (Sørensen 2001). As in all human science there are two types of comparison: the typological and the genetic. The typological method compares similarities between phenomena in different cultures. Obviously the typological method has limitations when it comes to demonstrating a certain meaning content behind the material form – or morphology – of rituals. The genetic method, on the other hand, compares elements in cultures that are historically related or which had contacts at some point (Schjødt 1989: 24).

In this case there may have been a historical connection between the Late Dorset and the later Thule culture, who were the ancestors of the Yupiit in Siberia/Alaska and the Inuit in Canada/Greenland. The end and disappearance of the Late Dorset coincides with the arrival of the Thule culture in the same areas and often at the same sites in the eastern Arctic around 1200 AD. Although it is very plausible that at least some people from the two groups could have met at some point, this has been strongly questioned. According to Park (1993) there is no evidence for the transfer of Thule knowledge to the Dorset or vice versa (op. cit. p. 225). The ritual mound at Alarnerk, however, could be an argu-

ment for a meeting between these two cultures. And probably this was a friendly meeting.

There are many examples of ceremonies being mimicked, borrowed or even stolen (ritual artefacts) among different tribes in historical times in North America. Furthermore: "The fact of diffusion must, then, be regarded as established; and the very great extent to which ceremonials have travelled from tribe to tribe, coupled with undoubted diffusion of other cultural elements in North America, indicates that, while the process has been greatly accelerated by improved methods of transportation and other circumstances promoting intertribal intercourse, it must have been active prior to these modern conditions due to white influence" (Lowie 1914: 614).

Ceremonial regalia were often carried in war, and might readily be imitated, or snatched away from the enemy, and thus become a ceremonial feature of a new tribe. During meetings of friendly tribes, dances were sometimes performed for the entertainment of the visitors, who might thus learn a new ceremony. Wherever (as frequently happened) a ceremony was considered a form of property, the right to perform it was naturally transferable to an alien who paid the customary price in goods.

Transmission of external features, such as ceremonial paraphernalia, is possible on the basis of superficial, possibly even hostile, meetings; friendly intertribal gatherings render possible the borrowing of ceremonial routine, songs, and the like – in short, of the exoteric phases of the complex; while initiation into the inner meaning of a ceremony becomes feasible only through the closest form of personal contact (op. cit. p. 616).

The communication and comprehension of the ritual in the mound required knowledge of 'hidden' meaning. And when there is esoteric ceremonial knowledge, the process of transmission implies intimate contact. The borrowing individuals or groups must be treated, for purposes of initiation, as though they belonged to the tribe from which the knowledge is obtained (ibid.).

Conclusion

In conclusion, we can suggest that the ritual at Alarnerk communicated and re-enacted a specific myth which 'worked' for the participants in the sense that it strengthened memory and renewed the kinship with the game animals on which it was supposed to have an effect. At the same time a ritual structure was created which could serve as a 'focal point' or an 'axis mundi', where exchanges with the numinous world could take place.

In historical times, a myth that incorporates the same elements as were found in the mound has been told by Yupik Eskimos and Chinook Indians living on the west coast of Alaska and Canada. For the Yupiit the myth was extremely important for the fundamental understanding of the reciprocal relationship between animals and humans. Furthermore, the myth provided a set of rules and "metaphors to live by" (Fienup-Riordan 1994).

The ritual adds to an otherwise rich picture of Late Dorset ritual life. But this structure still stands out as unique today, and no one except Jørgen Meldgaard in 1954 has ever been able to find 'mounds' from the Late Dorset culture. We can question whether it is really the case that structures like this were only created at this site. Was Alarnerk at one point a special place, or are there more mounds to be found on the terraces above other Late Dorset sites?

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Pre-Christian Cult Sites – archaeological investigations

Josefine Franck Bican, Anna Severine Beck and Susanne Klingenberg

Danish Prehistory

The research project Pre-Christian Cult Sites, led by Lars Jørgensen, has as its main objectives to research and investigate the background, identity and practices of the pre-Christian religion. This is illustrated by four prehistoric sites with magnates' residences, which all have potential for research into the pre-Christian religion: Tissø and Toftegård on Zealand, Gudme on Funen and Hoby on Lolland. Together the sites cover the whole period of the first millennium after Christ (Jørgensen and Drotner 2011). As part of the project archaeological excavations have been carried out at three of the sites in 2011. These have been funded respectively by the Heritage Agency of Denmark, the foundation Aage og Johanne Louis-Hansens Fond and the cooperating museums: the National Museum, the Museum Lolland-Falster, Vordingborg Museums and Køge Museum, together with Kalundborg Museum.

The archaeological excavations at Hoby, Lolland

Susanne Klingenberg, The National Museum

The 2011 excavations of the settlement area at Hoby took place between 10 June and 8 July and were undertaken by the Museum Lolland-Falster and the National Museum. The investigations were carried out as a student excavation, with the excavators coming from the Saxo Institute of the University of Copenhagen. The work was financed by the Museum Lolland-Falster, the National Museum and the Heritage Agency of Denmark.

In 2001 four house sites and a dump layer/culture layer were investigated. One of the house sites has not yet been dated, whilst the others can be placed in the Late Pre-Roman Iron Age and the Early Roman Iron Age, making them contemporary with the two richly-furnished graves from the location. Three of the house sites were identified in the subsoil; two of these were three-aisled longhouses (fig. 1), whilst an undated house site featured two sets of roof-bearing posts. This building may, however, continue outside the area of the 2011 investigation. The best preserved house site, however, was located in an up to 60 cm thick culture layer. Traces of this building consisted of large preserved areas of clay floor and fills containing patches of clay. The house site is a three-aisled longhouse orientated west/north west – east/south east, which has two different phases, respectively with five and four sets of roof-bearing posts. In both phases a clay floor extended over the entire area of the house. Two large pits were revealed in the middle of the house, which displayed traces of severe burning. In the eastern part of the building an oven structure was uncovered. Outside

Fig. 1: The southwestern part of the well-preserved house site area after removal of the culture layer. Traces of another house site appeared in the subsoil. This house site's roof-bearing posts are marked with poles. Photo: Katrine Kølle Hansen, Museum Lolland-Falster.

Fig. 2: Part of culture layer/dump layer containing bones and ceramics found outside the well-preserved house site. Photo: Jannick Hansen.

the north east of the house site a dump layer containing large quantities of ceramics and animal bones was excavated (fig. 2). The layer is contemporary with the house site. The substantial quantities of zoological material from the investigation have been taken to the Centre for Baltic and Scandinavian Archaeology at Schloss Gottorp. A provisional examination of the material has been carried out by Ulrich Schmölcke. This shows that it will be possible to analyse c. 3000 pieces of animal bone and samples can be taken for DNA analysis. The ceramic material from the excavations is being worked upon at present by Anders Nielsen of the University of Copenhagen for his dissertation project. The soil samples from the post-holes of the roof-bearing posts have been processed in the flotation apparatus. However, an examination of this material is still required to identify the environmental remains. In addition, AMS dating of the material from the undated house site is yet to be carried out.

The archaeological excavations at Toftegård, Stevns

Anna Severine Beck, Køge Museum

The excavation took place between 3 October and 12 October, 2011 and was carried out by Vordingborg Museums and Køge Museum. The work was funded by the Heritage Agency of Denmark, Vordingborg Museums and Køge Museum.

In October 2011 the excavation of the Viking Age settlement of Toftegård in the district of Stevns began again after a break of more than ten years (fig. 3). The aim of the investigation was to establish the western boundary of the high-status Viking Age settlement and thus gain better insight into the size of the original settlement.

In the opened-up area, evidence of settlement was seen in the subsoil. Traces of

Figure 3 Topsoil is removed with the machine in several stages and is investigated with a metal detector. Photo: Køge Museum.

at least three houses were found, two of which probably date to the Viking period. In addition, what may be the remains of two ploughed-out pit houses were found. A number of pits containing ceramics and bones were also excavated. Soil samples were taken for environmental analysis from a number of selected pits to establish, amongst other things, their function. The analysis is being carried out by agronomics graduate Peter Steen Henriksen of the National Museum's Natural Sciences Research Unit. A large depression was also identified in the two easternmost trenches. It is likely that there was a series of dug-out areas resulting from the excavation of clay for house construction, measuring over 40 metres in length and 15 metres in width, which subsequently filled up with cultural material.

The significant finds from the year's excavations include two trefoil (three-lobed) and one equal-armed clothes brooch, together with part of a sword hilt. One of the three-lobed brooches has obviously been damaged by heating. These objects match the other finds from the site in terms of dating, and collectively they point to a date for the settlement in the late Iron Age and the earlier part of the Viking period.

The distribution of the finds and structures indicates that the high-status Viking settlement continues a significant distance west of the previously investigated parts of the settlement. The investigations have thus provided evidence that the settlement area was originally larger than previously thought.

The archaeological excavations at Tissø, West Zealand, autumn 2011

Josefine Franck Bican, the National Museum

The excavation at Tissø was carried out by the National Museum with support from Kalundborg Museum and with the help of Kalundborg Arkæologiforening (the Kalundborg Archaeological Society) between 5 October and 3 November. Fugledegård Formidlingscenter generously made their premises and facilities available for our use. The investigations were funded with the support of the foundation Aage og Johanne Louis-Hansens Fond.

The aim of the excavation was to investigate the supposed area of ritual activities or the so-called open cult site dating to the 8th-9th century. The activity area is located at the edge of a wet hollow on the highest hilltop of the settlement area, west of Tissø at Fugledegård. The excavations of 1995 showed that a dark soil containing deposits of animal bones and special objects was deposited here at some time in the course of the 8th-9th

century. Later a silver hoard was deposited at the same location, which has been dated to the end of the 9th-10th century. In 1995 these deposits were interpreted as waste dumping, but subsequently this interpretation changed, as it was not thought to be appropriate to place such material at the highest point of the area. Comparable deposits have been found at sites of this period in central Sweden. As is often the case on archaeological excavations, a surprising and exciting observation was also made when it was established that the wet hollow had been made by human activity.

The deposits of dark soil were preserved in a c. 4 m broad belt on the southern edge of the wet area (fig. 4). The finds from here have included fragmented animal bones, glass beads, sherds of pottery vessels and whetstones. The material from the dark fill is currently being

Figure 4 The dark layer was located on the southern edge of the wet hollow. The fill was investigated in squares and wet-sieved. Photo: Josefine Franck Bican, the National Museum.

Figure 5
An unimpres- sive piece of bronze with a holed drilled into it displayed a scratched-in picture of a horse. The piece is dated to the Viking Age and strengthens the supposition of ritual activities on the edge of the wet hollow. Photo: Pia Brejnholdt, the National Museum.

worked upon and analysed. The animal bones are being

examined and investigated by Anne Birgitte Gotfredsen, ZM. The many soil samples will be analysed for environmental remains by agronomics graduate Peter Steen Henriksen of the National Museum's Environmental Archaeology Unit. Two metal finds, which should be highlighted, came from the southern part of the wet hollow. One of these is a small piece of silver, which must originate from a silver hoard. The other is an unimpressive piece of bronze measuring 2-3 x 4 cm, which has had a small hole drilled into it. A horse has been scratched into this piece of bronze sheet (fig. 5).

The hollow itself proved upon closer investigation to have been created by human activity, just before the dark layers from the supposed ritual activities were deposited. The area had dimensions of c. 22 x 23 m and people dug here in the past in order to get access to good clay, which is found at a depth of 1 metre (fig. 6). The topsoil was first dug through in order to dig out the clay. Estimates indicate that around 1400 tons of topsoil was dug out in order to remove the same amount of clay. So, considerable quantities of clay must have been used to daub the walls of the great hall a few hundred metres to the east, near the lake. This is the first time that it has been possible to estimate the amount of clay used for such a purpose.

Figure 6 Here the wet hollow can be seen with Tissø in the background. The hollow has been created by human activity and consists of a large group of associated clay extraction pits. Photo: Josefine Franck Bican, the National Museum.

Conclusion

The archaeological Investigations and scientific analyses will continue in the coming years at all three sites. Hoby is the earliest and least investigated of the sites. Here there is still much that needs to be excavated and to fall into place. The results so far are impressive and they provide new material for scholars. Toftegård is relatively well investigated, but its boundaries are yet to be properly identified, a problem that the coming excavations should be able to re-address. Tissø is probably the most thoroughly investigated magnate's residence in Northern Europe. The excavations here will concentrate on selected locations, which will give us greater insight into the society, religion and ritual activities of the time.

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Challenges and solutions

Back cover illustration:
View of modern sheep farm and hayfields in the central Vatnahverfi region, South Greenland.
Photo: Christian Koch Madsen.

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Challenges and solutions

Report from workshop 2
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