Doctoral theses at NTNU, 2016:287

Heidi Mjelva Breivik

Dynamic relations between humans and environment in the earliest settlement phase of Norway (9500-8000 cal BC)

NTNU
Norwegian University of Science and Technology

Doctoral thesis

Heidi Mjelva Breivik

ISBN 978-82-326-1912-2 (printed ver.)
ISBN 978-82-326-1913-9 (electronic ver.)
ISSN 1503-8181

Doctoral theses at NTNU, 2016:287

NTNU
Norwegian University of Science and Technology
Thesis for the Degree of Philosophiae Doctor
Faculty of Humanities
Department of Historical Studies

NTNU
Norwegian University of Science and Technology

NTNU

Heidi Mjelva Breivik

Dynamic relations between humans and environment in the earliest settlement phase of Norway (9500-8000 cal BC)

Thesis for the Degree of Philosophiae Doctor

Trondheim, October 2016

Norwegian University of Science and Technology
Faculty of Humanities
Department of Historical Studies

NTNU
Norwegian University of
Science and Technology

NTNU
Norwegian University of Science and Technology

Thesis for the Degree of Philosophiae Doctor

Faculty of Humanities
Department of Historical Studies

ISBN 978-82-326-1912-2 (printed ver.)
ISBN 978-82-326-1913-9 (electronic ver.)
ISSN 1503-8181

Doctoral theses at NTNU, 2016:287

Printed by NTNU Grafisk senter

Preface

During some lonely hours at the office, I thought I would never get to the stage where I would be writing the preface of my PhD thesis. But here it is, at last!

Many people have contributed to make the PhD period such an interesting and educational experience. I want to start by thanking my main supervisor, Hein B. Bjerck, who has been an inexhaustible source of knowledge and inspiration from beginning to end. Thank you for steady guidance along the way. Thank you also for letting me pursue some of your dearest research topics, and for letting me take part of the Marine Ventures project including the three study trips to Argentina. Thanks to my co-supervisor, Hans Peter Blankholm whose fruitful comments have challenged me to reflect around my research and to rethink my arguments. Thank you also for letting me use your survey data and for helping me to complete my lists of Early Mesolithic sites in northern Norway. Thank you to Felix Riede who has read and commented on earlier versions of the manuscripts.

Thank you to my co-authors: Hein B. Bjerck, Martin Callanan, Ellen G. Ellingsen, Ernesto L. Piana, A. Francisco J. Zangrando. It was nice working with all of you.

I am very grateful towards the NTNU University Museum, Department of Archaeology and Cultural History, who has financed my PhD project and provided me with an office space during my work. Thanks to all my colleagues, fellow PhD students and friends at the NTNU Department of Archaeology and Cultural History, and Department of Historical Studies, for healthy discussions and social gatherings. I want to thank Martin Callanan and Jørgen Rosvold in particular, for giving me pep talks and fruitful comments on my manuscripts, and for providing me with relevant references and literature. Thank you also for helping me with last minute preparations. Thanks to my former roommate, Ingrid Ystgaard, whose cheerful countenance and structured nature laid the foundation for a good working environment. Thanks to Åge Hojem who has photographed several of the projectile points included in my studies. Thank you to Astrid B. Lorentzen who has made the distribution maps in the Appendix. Thank you also for lunches, dinners and trips, all of which have given me boosts along the way.

My project has also received funding from the Research Council of Norway, Latin America Program as being a part of the Marine Ventures project (Project no. 208828). I am very appreciative for this. Thanks to my Argentinean colleagues in the Marine Ventures network. First to my research partners, Ernesto L. Piana, A. Francisco J. Zangrando and Angélica Tivoli, who have generously accommodated me, taken care of me and shown me the pleasures of Argentinean cooking and drinking. I am grateful for your work upon providing me with ethnographic, archaeological and osteological data, and for always being ready to discuss mutual research interests. Thanks also to my other friends and colleagues in Argentina, especially Mentora Pili, las dos Marias and Daniela. You have all contributed to make the fieldwork in Cambaceres a great experience. I have especially appreciated your education in Argentinean culture, customs and language – I wouldn't have survived the Argentinean wilderness without you.

Thanks also to the Norwegian partners of the Marine Ventures network, which in addition to Hein B. Bjerck includes Birgitte Skar, Silje E. Fretheim, Karen Oftedal, Elisabeth Swensen and Magnhild Husøy. We have shared memorable times on field work in Norway and Argentina.

I am very thankful for all the help provided by the staff working with the archaeological collections at the NTNU University Museum: Ole Bjørn Pedersen and Torbjørn Åsvang have enabled and facilitated my material studies by spending hours bringing me boxes and boxes of lithics. Thanks to both of you. Jenny Kalseth and Grete I. Solvold have been great discussion partners during my material studies – their experienced eyes have seen things I have missed, and they have helped me to evaluate the artefacts according to my research questions. The staff at the Gunnerus library, especially Tore Moen, have been most helpful in my search for relevant literature.

I owe a great thanks to the colleagues in all corners of Norway who have helped me to complete the list of Early Mesolithic sites: Kristian Pettersen, Inger Marie Berg-Hansen, Lasse Jaksland, Håkon Glørstad, Steinar Solheim, Astrid J. Nyland, Knut F. Eskeland, Tor Arne Waraas, Leif I. Åstveit, Sveinung Bang-Andersen, Åsa Dahlin Hauken, Sigrid A. Dugstad, Bryan Hood, Anja R. Niemi, Ragnhild Myrstad and Jan Ingolf Kleppe.

Thanks also to colleagues in the "Forskning i fellesskap, pionergruppa" ("Joint research, pioneer group"), "INQUA project HaBCom-1404" and "Nordic Blade Technology Network/STINT" for taking interest in my research and for letting me present preliminary results.

I also want to thank Lou Schmitt for comments on my research and for useful information and literature tips.

Finally, thanks to my family who has both motivated me, supported me and pushed me into finishing my PhD. A special thanks to my mother who has taken care of my son Magnus in the final stages of my work. I couldn't have done it without your help. And finally, thanks to my spouse, Tommy, who has always given me room to follow my research interests.

Trondheim, March 2016

Heidi M. Breivik

Table of contents

List of tables and figures

List of appendices

1.0 Introduction

1.1 Background and introduction to the topic

The dissertation has its starting point in the following call for PhD proposals:

> **Dynamic relations between humans and environment among the earliest hunter-gatherer populations in central Norway**
>
> The scholarship is meant to improve the interdisciplinary collaboration between archaeology and natural history. The project should contribute to greater understanding of the dynamics surrounding the earliest settlement in Norway, and consider these in a national and international perspective.
>
> The theme includes the emergence and development of maritime foraging societies; landscape; logistics; settlement pattern and social organization; technological adaptations; and changes in climate, landscape and marine/terrestrial biotopes. An important aim is to gain expertise on the interaction between peoples and their resource base through analyses on how the humans have responded on challenges and possibilities in unfamiliar surroundings. The PhD project must have a clear interdisciplinary profile where interaction between nature and culture is emphasized, and opens for a wide specter of topics within cultural history, palaeo-ecology, new analytical tools, interdisciplinary theoretical perspectives, and more (PhD proposal).

The text thus strongly lay up to an ecological approach in the studies of the earliest settlement phase of Norway, and invited to formulate research questions where archaeological and palaeo-environmental data would be essential.

The PhD project also came to be incorporated in a research project with the title: "Marine ventures. Comparative perspectives on the dynamics of early human approaches to the seascapes of Tierra del Fuego and Norway".

This research project was coined on the basis of topographic, environmental and cultural similarities between two regions on opposite sides of the globe; as phrased in the project application:

> Not only do they constitute the "tops of the world" (cf. Blankholm *et al*. 2009) – they also are situated on different continents – thus excluding all kinds of cultural contacts prior to the European travellers in the Historical periods. The latter is one of the obvious scientific advantages – that allow us to study how human beings have adapted to their environmental, material and social surroundings in two different, yet similar settings.
>
> The glacial erosion of Patagonia and Norway produced a very characteristic coastal landscape with abundant skerries, islands, channels and fiords. This seascape constitutes highly productive marine

> habitats – and sheltered seas that are optimal to maritime foragers. [...] Also similar is the Holocene development of viable maritime foragers. [...] The triggers and trajectories in the dynamics of the human maritime venture are poorly understood. [...] Comparative studies of the archaeological and palaeo-ecological record of Norway and Patagonia are prone to produce important insight (Marine Ventures Project Application, pp. 2-3).

As this research project included study trips and close collaboration with Argentinean colleagues, it gave me the opportunity to collect data and information that could place my regional data and research questions in a wider geographical and temporal perspective. This enabled me to treat aspects of human-environment relations as phenomena, not only as single cultural historical cases.

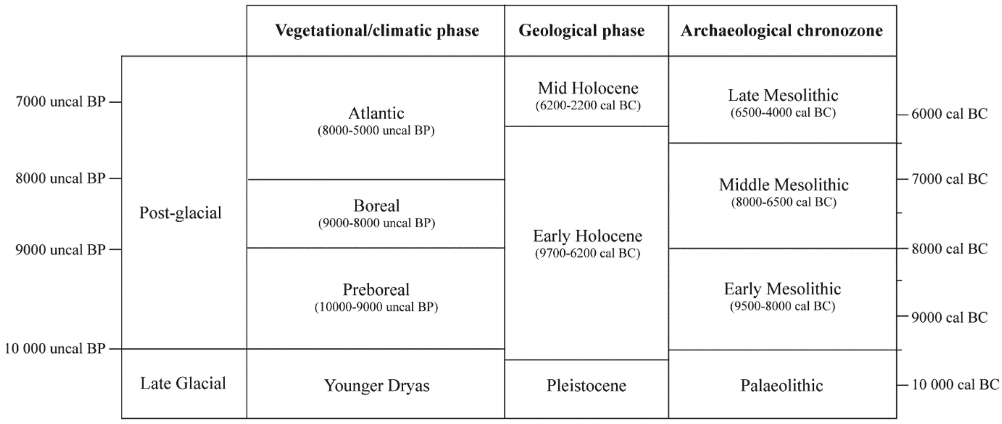
Before proceeding with the contextualization of the topic and papers, a few definitions is in order. My use of the term 'hunter-gatherer' refers to a mode of subsistence. I follow Lee and Daly's (1999:3) definition of hunter-gathering (or foraging) as a: "subsistence based on hunting of wild animals, gathering of wild plant foods, and fishing, with no domestication of plants, and no domesticated animals except the dog" (Lee and Daly 1999:3).

I also use the term 'forager' to denote groups who live from wild food resources. Forager is often used synonymously with hunter-gatherer (Panter-Brick, Layton and Rowly-Conwy 2001:2). More specifically, the use of the term forager refers to Binford's definition along the forager–collector axis. Here they are characterized as groups that apply a high degree of residential mobility, where the people are moved to the resources (Binford 1980:9). This mobility type is recognized both in Early Mesolithic Norway and among the Yámana population of the Beagle Channel in southern Patagonia (see Paper 6 (Breivik *et al*. in press)). I thus find it appropriate to apply foragers on the groups under study in this thesis.

The term 'ecozone' is in this dissertation used to describe a macro-topographical zone. Ecozone is usually applied to different parts of the environment with similar geography, vegetation and animal life. As the details of the distribution of Early Mesolithic fauna and vegetation is not known to us today, it is more convenient to divide the landscape in larger zones which are likely to be inhabited by the same animals and plants (see Paper 2 (Breivik and Bjerck in press), Paper 3 (Breivik 2014) and Paper 4 (Breivik and Callanan in press)).

As the thesis makes use of both archaeological and palaeo-environmental data, different labels are used to express time sequences with roughly the same dating. The dating of these periods can be read from Table 1 below.

Table 1: Chronological relations between the different time sequences used throughout the text. After Bjerck (2008i), Bjerck *et al*. (2008), Mangerud *et al*. (1974), Walker *et al*. (2012).



The dissertation is made up of six papers, each of which has their own aims and research questions. The main topic for the entire project is: Dynamic relations between humans and their environment in the earliest settlement phase of Norway, c. 9500–8000 cal BC (Early Mesolithic). It deals with human behaviour and adaptations to environments that were spatially diverse, and changed through time. The research is particularly directed towards the coastal and oceanic environments.

Considerable effort has been put into collecting, sorting and presenting published and unpublished archaeological and environmental data in order to make it easily accessible for fellow researchers; the majority of the papers are highly empirical. Moreover, it has been a premise that the acquisition of food and material resources is fundamental to any hunter-gatherer society and that many aspects of human behaviour are somehow connected to the character of the natural surroundings. That is not to say that tradition, religion and social relations are unimportant – I think these aspects certainly worked an influence on behaviour and choice of adaptive strategies. However, these sides to adaptation are but lightly touched upon in this dissertation.

Studies of human–environment relations have a long history in the Humanities, but particularly gained popularity in the 1960s and 1970s when the logic-positivistic trend had its golden age. In archaeology and anthropology, this direction was promoted by the “New

Archaeology" or "Processual Archaeology" (see Chapter 3). This paradigm has later been accused of being too focused on hard data and natural deterministic processes at the expense of cultural variations and social dynamics. Nevertheless, we now find ourselves embracing environmental data and material culture once again. The great accumulation of palaeo-environmental data achieved through better sampling and analytical methods has put us in the same optimistic position that the new material and methods offered in the 1960s; empirical and quantitative studies are most welcome. The increased knowledge and awareness of the environmental and climatic changes we are facing today, has also directed our research towards particular questions: The wish to predict and evaluate natural catastrophes and adapt to changing climates and environments have given a renewed interest in studying how prehistoric humans coped with the same problems.

In a recent attempt to conceptualize climate change archaeology, Van de Noort (2011) discusses the role of archaeology to studies of the current global climatic changes. It is not difficult to agree with him when he says that

> Climate and environmental change were never the only changes faced by communities in the past. [...] Societies also had to adapt to internal and external political, economic, social, technological and religious changes, many of them unconnected to climate or environmental change (Van de Noort 2011:1044).

Although acknowledging this complexity, climatic and environmental variations are major factors which humans had to cope with. To study how they resolved the challenges of fluctuating landscapes and resource situations (whether it led to cultural change or not) are one important aspect of archaeological and anthropological research. It comes from this that the thesis does not seek to explain the driving factors behind cultural change, but rather explores *if* cultural changes in fact happened. The dissertation does not only deal with responses to climatic and environmental changes through the Post-glacial Early Mesolithic period, but also with the approach and utilization of different environmental settings during the same time span. Moreover, it compares adaptive behaviour in similar environments but on different latitudes. The dissertation thus deals with dynamic human-environment relations along multiple transects: temporal, trans-regional/geographical, topographical and latitudinal.

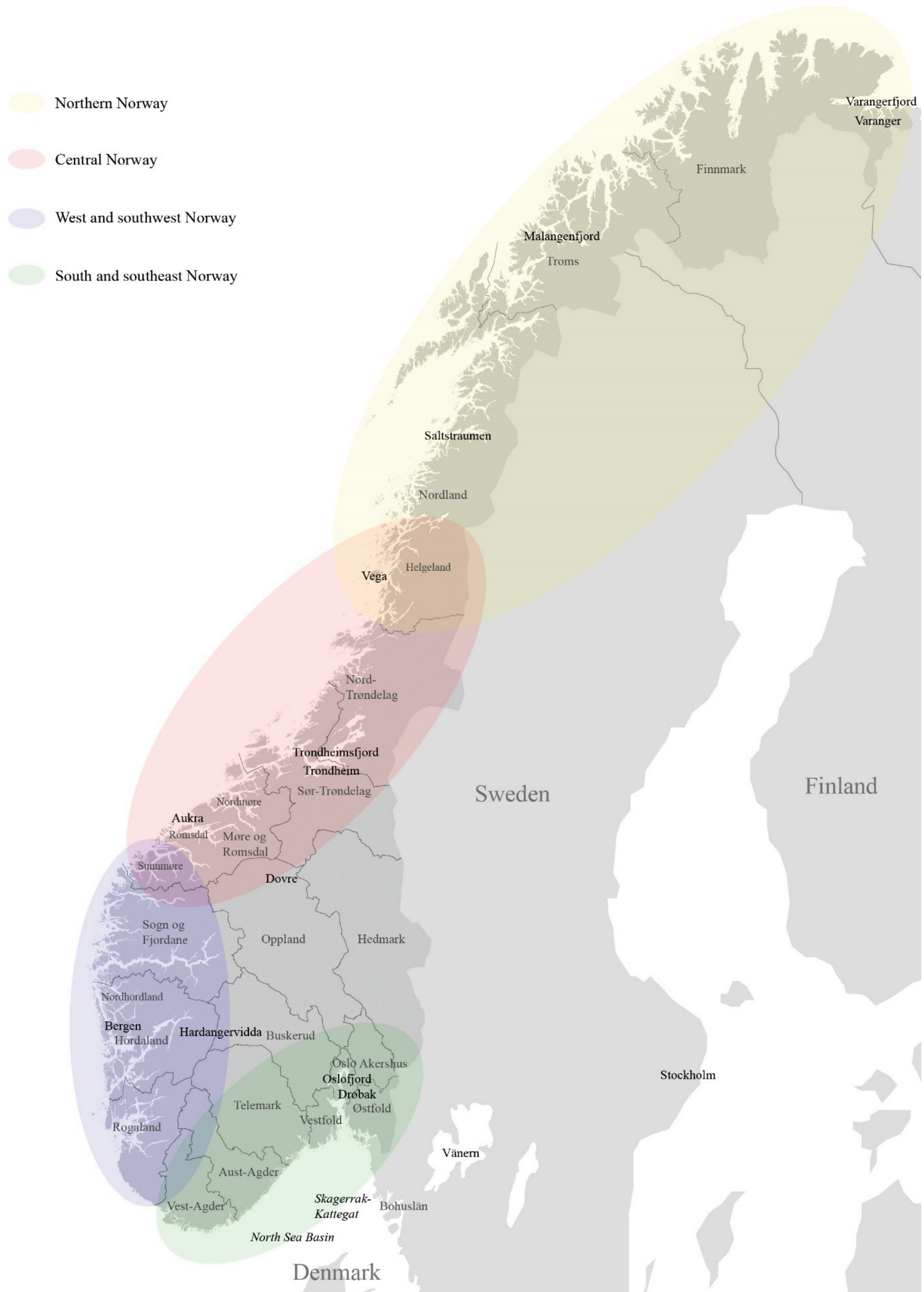


Figure 1: Map showing regions and place names mentioned in the text.

1.2 Research questions

Together the six papers present a range of new data and highlight the topic of human–environment relations and adaptive strategies from different angles. The thesis is structured around the following main topics and research questions:

- *Environmental trajectories in the Late Glacial/Post-glacial periods*: What kind of environmental and climatic changes did the terrestrial and marine environments undergo during the Early Mesolithic period?
- *Colonizing the Norwegian landscape*: How and when did people approach the new landscape, and how did they organize themselves and their technology and settlements in order to meet the challenges posed by the varied Early Mesolithic environment of Norway?
- *Adaptive strategies in different and shifting environments*: Do we find changes in adaptive strategies through time, or adaptive variations between different regions and/or ecozones in Norway?
- *Adaptive strategies in similar environments*: Did similar environments on opposite sides of the globe invite to similar mobility strategies, and does the environment structure human behaviour in a predictable way?

1.3 Structure of the thesis

The thesis is divided into seven chapters. A summary of each paper will follow this introduction, in Chapter 2. In Chapter 3, economic, ecological and environmental aspects of Norwegian Stone Age research history are briefly presented. In Chapter 4, I elaborate on premises, concepts and theoretical aspects that form the basis of my research questions and discussions, before presenting the procedures and issues connected to the acquisition of archaeological data in Chapter 5. The main results and discussion of the papers are found in Chapter 6, followed by Chapter 7 which deals with future perspectives.

2.0 The papers

The dissertation includes six individual papers:

Paper 1: Breivik, H.M. and Ellingsen, E.J.G. (2014). 'A Discovery of Quite Exceptional Proportions: Controversies in the Wake of Anders Nummedal's Discoveries of Norway's First Inhabitants. *Bulletin of the history of archaeology*, 24(9), pp. 1-13.

Paper 2: Breivik, H.M. and Bjerck, H.B. (in press). Early Mesolithic central Norway: A review of research history, settlements, and tool tradition. In: Blankholm, H.P. (ed.) *The early economy and settlement in Northern Europe: Pioneering, resource use, coping with change*, Vol. 3. Sheffield: Equinox Publishing.

Paper 3: Breivik, H.M. (2014). Palaeo-oceanographic development and human adaptive strategies in the Pleistocene–Holocene transition: A study from the Norwegian coast. *The Holocene*, 24(11), pp. 1478-1490.

Paper 4: Breivik, H.M. and Callanan, M. (in press). Hunting High and Low: Postglacial Colonization Strategies in Central Norway between 9500 and 8000 cal BC. *European Journal of Archaeology*.

Paper 5: Bjerck, H.B. and Breivik, H.M. (2012). Off shore pioneers: Scandinavian and Patagonian lifestyles compared in the Marine Ventures project. *Antiquity*, 086(333). [Online] available at http://antiquity.ac.uk/projgall/bjerck333/

Paper 6: Breivik, H.M., Bjerck, H.B., Zangrando, A.F.J. and Piana, E.L. (in press). On the applicability of environmental and ethnographic reference frames: An example from the high-latitude seascapes of Norway and Tierra del Fuego. In: Bjerck, H.B., Breivik, H., Fretheim, S., Piana, E., Skar, B., Tivoli, A. and Zangrando, A.F.J. (eds.) *Marine Ventures: Archaeological Perspectives on Human–Sea Relations*. Sheffield: Equinox Publishing.

The papers are attached in their published or submitted form (Paper 1–6).

2.1 Contextualizing the papers

In Norwegian archaeology human–environment relations have been a topic of interest since the first discoveries of Early Mesolithic sites around 1900. The geologist Anders Nummedal, central in these discoveries, was among the first to use knowledge about environment and landscape features in search for Stone Age sites. His surveys, excavations and studies greatly influenced later research on Stone Age and Early Mesolithic societies, and his work remains important today, especially with regards to site distribution and location analyses. Bringing in a wide range of archived documents, Paper 1 (Breivik and Ellingsen 2014) gives a review of the discussions in the wake of the discoveries of Early Mesolithic sites in central Norway, and provides insight into the early research history on pioneers and environmental conditions in Post-glacial Norway.

The efforts of Nummedal, which were especially directed towards the coast of central Norway, resulted in a large amount of Early Mesolithic sites and assemblages in this region. Large archaeological surveys and excavations conducted through the last 50 years have added to the collection, and at present central Norway appears to be the most site-abundant region in the country when it comes to the Early Mesolithic period. A review of research history, age, location patterns, settlement structure and lithic tools is given in Paper 2 (Breivik and Bjerck in press). A large amount of previously unpublished archaeological data is sorted and presented. The paper thus provides an updated overview from the region, which is discussed in light of trans-regional trends.

Due to the predominance of sites in the coastal zone, characterizations of the oceanic environment and reconstruction of the marine resource base have always been a pivotal part of Early Mesolithic research. The lack of osteological data from the period poses a challenge in this regard, forcing us to use climatic data and modern analogies for this purpose. This situation has not improved much, but the increasing amount of palaeo-oceanographic data from the Nordic Seas (the Norwegian Sea, the Iceland Sea and the Greenland Sea) during the past two decades has enabled us to explore the character and development of the marine conditions more closely. Paper 3 (Breivik 2014) compiles and presents such data and puts it into a cultural historical perspective with focus on spatial and temporal trends in adaptive strategies.

Despite the overwhelming amount of Early Mesolithic sites on the coast, sites have also begun to appear in mountain contexts during the last 50 years. The results of the surveys and excavations around the lakes of Store Myrvatnet and Fløyrli in Rogaland County in southwest Norway have been widely published and discussed in relation to colonization processes, mobility patterns and resource exploitation. Similarities and differences between the sites in these two ecozones have been emphasized but never systematically compared and analyzed with questions about colonization strategies in mind. In Paper 4 (Breivik and Callanan in press) we explore how the Early Mesolithic groups organized themselves when moving across the landscape, by analyzing well-documented sites in both coastal and mountain contexts in central Norway.

Most traces of early marine and coastal societies are lost or inundated due to the global transgressions of the world's coastlines. This has left us with few clues as to when and how peoples adapted to the diverse coastal environments around the world. The previously glaciated, rocky coastlines of Scandinavia, South and North America and New Zealand are among the few places where severe isostatic uplift has resulted in preserved Late Glacial and Post-glacial coastal sites on dry land. Paper 5 (Bjerck and Breivik 2012) gives an introduction to the Marine Ventures project which studies and compares two of these high-latitude early marine societies, namely the pioneer groups of Early Mesolithic Norway and the earliest, Holocene "canoe indians" (later known as Yámana) of southern Tierra del Fuego in Argentina.

The Early Mesolithic settlements of central Norway and shell midden sites from southern Tierra del Fuego are also the case studies in Paper 6 (Breivik *et al*. in press). Sharing a set of environmental and cultural traits, without having any contact in the past, these cases are appropriate to explore adaptive strategies as a phenomenon. Theoretical frameworks that predict behavioural patterns according to the environmental setting rarely consider hunter-gatherers with a distinct marine subsistence strategy. How these factors are interrelated for high-latitude boat-using foragers is equally less investigated. Using predictive models derived from environmental and ethnographic datasets as a starting point, we discuss this matter.

2.2 Paper summaries

Paper 1: 'A Discovery of Quite Exceptional Proportions': Controversies in the Wake of Anders Nummedal's Discoveries of Norway's First Inhabitants

Breivik, H.M. and Ellingsen, E.J.G. (2014). *Bulletin of the history of archaeology*, 24(9), pp. 1-13.

Around the beginning of the twentieth century archaeologists believed that Norway was not inhabited until the Late Stone Age. In 1909 two pieces of flint, found by the school-teacher Anders Nummedal, launched an extensive debate about the prehistory of Norway, which in time led to the acknowledgement that there was an Early Mesolithic (9500–8000 cal BC) settlement of the country. However, Nummedal's lack of archaeological education worked against him when he tried to date the many flint sites he found later on, and well-established researchers found his theories about Stone Age settlements unconvincing. He was regarded as an unskilled teacher who did not know the first thing about archaeological methods and terminology. Today, Nummedal is considered to be one of the most influential participants in Norwegian Stone Age research, and his discoveries are well known and widely recognized. This paper describes Nummedal's fight to transform his reputation from ridiculed amateur to respected professional. The resistance he met when presenting his sensational theories is detailed through an extensive review of letters, newspaper articles and eulogies written by his colleagues.

Paper 2: Early Mesolithic Central Norway: A review of research history, settlements, and tool tradition

Breivik, H.M. and Bjerck, H.B. (in press). In: Blankholm, H.P. (ed.) *The early economy and settlement in Northern Europe: Pioneering, resource use, coping with change,* Vol. 3. Sheffield: Equinox Publishing.

This paper sums up the vast record from the Early Mesolithic (EM) pioneer period (c. 10,000–9000 BP, 9500–8000 cal BC) in central Norway. This is where the first EM pioneer settlements were located by Anders Nummedal in 1909. It is also the region with the highest density of EM settlements in the present archaeological record of Norway. In recent years, several large-scale excavations have been conducted, revealing new and interesting details of EM dwellings, settlement structure and tool tradition. The quantitative analysis of 244 sites has the potential to put the former studies into perspective and investigate topics that have been sidelined in the past. Since the EM record from the coastal areas of Northern Europe are severely hampered by Post-glacial inundations, this archaeological information is of great importance. The nature of the isostatic uplift in central Norway has preserved these ancient shorelines, and does, unlike most other places, allow for detailed studies of early marine foragers. There is also a possibility that the high density of settlements is a result of a perfect correspondence between subsistence pattern and environmental characteristics, where fjords represent efficient communication routes between a highly productive marine biotope along the outer coast and the reindeer populations in the adjacent mountain plateaus. Thus, the EM record from central Norway constitutes an interesting case in the understanding of the social and economic conglomerate of Mesolithic Europe.

Paper 3: Palaeo-oceanographic development and human adaptive strategies in the Pleistocene–Holocene transition: A study from the Norwegian coast

Breivik, H.M. (2014). *The Holocene*, 24(11), pp. 1478-1490.

The human colonization of Norway occurred in the Pleistocene–Holocene transition – one of the most abrupt and severe climatic shifts in human history. For 1500 years (9500–8000 cal BC), the whole coast was occupied by mobile, marine-oriented hunter-gatherers. This paper explores dynamic relations between human adaptation and marine environmental variations in this period. An updated record of archaeological sites and palaeo-oceanographic data suggests a correlation between marine productivity and site distribution and density. The data further demonstrate spatial and temporal differences in the environment. A cooling pulse at 9300–9200 cal BC (the Preboreal Oscillation) with widespread ecological consequences must have been noticeable to humans occupying Norwegian landscapes. A more gradual shift occurred around 8800 cal BC when the arctic climate gave way to warmer conditions: The Norwegian Atlantic current stabilized, all fjord systems became ice-free, and animal diversity increased. In the northernmost region, the impact of Atlantic water was less severe, and Polar conditions with more sea ice seem to have lingered throughout the period. Variations in the site pattern may be related to these fluctuations in the resource situation. Variations in the lithic industry, on the other hand, seem to be connected to technological choices or local traditions, rather than environmental dissimilarities. The archaeological record indicates that the lifestyle, which developed under arctic conditions, was maintained through a flexible mobility pattern and a versatile tool technology, but the Norwegian coast also provided a good base to uphold such a lifestyle.

Paper 4: Hunting High and Low: Postglacial Colonization Strategies in Central Norway between 9500 and 8000 cal BC

Breivik, H.M. and Callanan, M. (in press). *European Journal of Archaeology*.

In this article, we examine aspects of the Postglacial colonization processes that took place in central Norway during the Early Mesolithic (c. 9500–8000 cal BC). The distribution of sites from this period shows that the colonizers approached and exploited two very different landscapes and resource situations—from archipelagic to alpine. Based on twelve artefact assemblages from central Norway we investigate how colonizing populations met the challenge posed by varying ecozones. Did they organize their settlements and technologies in similar ways or did they modify sites and activities in relation to the different locations? The aspects studied are site organization, artefact composition, projectile technology, and lithic raw material use. It appears that the sites are of a similar size and structure across ecozones. Apart from some variations in tool composition, there is no evidence in the lithic material for any technical adaptation towards specific ecozones. We conclude that using a standard, generalized lithic technology, combined with high mobility and small group size, enabled the colonizing groups to overcome the risks and difficulties associated with settling and seeking out resources in new and unknown landscapes.

Paper 5: Off shore pioneers: Scandinavian and Patagonian lifestyles compared in the Marine Ventures project

Bjerck, H.B. and Breivik, H.M. (2012). *Antiquity* 086(333).

Our project, “Marine Ventures, comparative perspectives on the dynamics of early human approaches to the seascapes of Tierra del Fuego and Norway”, follows a comparative approach. The raised shorelines are an important factor, offering unique possibilities to track the triggers and trajectories of the earliest development of off shore traditions. Some of the earliest evidence for foraging and sailing on open seas can be found among the Early Mesolithic (9500–8000 cal BC) hunter-gatherer communities of coastal Scandinavia. Although organic remains are scarce, hundreds of coastal sites bear witness to an elaborate marine lifestyle. Created by a series of glaciations, this seascape of shallows and deep channels, tidal currents, skerries, islands, headlands and fjords is ideal for foraging for the abundant marine and terrestrial fauna of the Late Glacial; this highly productive zone also has sheltered seas, which reduces the risk inherent in hunting, fishing and travelling off shore. Tierra del Fuego also underwent Pleistocene glaciations, and the natural history, seascapes and marine biotopes are similar to those of Scandinavia. This constitutes a common platform for the study of relations between humans and the marine environment.

Paper 6: On the applicability of environmental and ethnographic reference frames: An example from the high-latitude seascapes of Norway and Tierra del Fuego

Breivik, H.M., Bjerck, H.B., Zangrando, A.F.J. and Piana, E.L. (in press). In: Bjerck, H.B., Breivik, H., Fretheim, S., Piana, E., Skar, B., Tivoli, A. and Zangrando, A.F.J. (eds.) *Marine Ventures: Archaeological Perspectives on Human–Sea Relations*. Sheffield: Equinox Publishing.

Predictions about hunter-gatherer behavior are often derived from ethnographically documented cases and coupled with environmental data. Lewis Binford (2001) and Robert Kelly (1995) present large amount of data, and are among the most significant work on this matter. Although their cases ranges from equator to high-latitudes, and from inland to coast, his predictive models are largely based on pedestrian hunter-gatherers with a terrestrial subsistence strategy. We explore if these reference frames are applicable also to boat-using marine foragers in the high-latitude seascapes of central Norway and southern Tierra del Fuego by taking one aspect of adaptive behavior into consideration: mobility. By comparing the archaeological record in the two regions with James Chatters' (1987) archaeological measures of mobility type, range, frequency and stability, we find that the mobility practiced by our marine foragers stands in contrast to the predictive models. The study leads us conclude that the combination of the use of boats for transport and hunting, highly marine subsistence strategy, and the location in high-latitude seascapes calls for a different frame of reference.

3.0 Research history: Economy, ecology and environment in Norwegian Stone Age research

Archaeological research on the Norwegian Stone Age reaches far back in time. Topics of interest have changed over time, in line with trends within the Humanities and the society in general. Recent reviews of the history of Norwegian Stone Age research have been provided by several authors. Tor Arne Waraas (2001) gives a thorough review on the discussions about age, typology and terminology that evolved around the earliest discoveries of Mesolithic settlements in Norway. He also presents hypotheses, theoretical viewpoints and research questions that prevailed during the later phases of Mesolithic research in Norway. In her PhD dissertation, Ingrid Fuglestvedt (2005, 2009) focusses on archaeological material from south Norway and northern Europe, and provides an overview of the technological aspects of Late Glacial/Post-glacial inventories. The relationship between the Norwegian Fosna culture and the North European Ahrensburg culture is paid special attention. Hein Bjerck (2008i) chronologically summarizes the development in Mesolithic research in his review of Norwegian Mesolithic trends, and puts it in contexts of changing theoretical perspectives and concurrent societal trends. A review of research, archaeological excavations, Early Mesolithic features and technology is provided by Bjerck *et al*. (2008).

For the purpose of my thesis, I have chosen to focus on research that deals with economic, ecological and environmental aspects of the Norwegian Stone Age in the following review. Special attention will be given to the emergence of marine hunter-gatherers in archaeological research and literature. The intention of this chapter is to give a chronological overview of what I consider being the most important contributions to the topics outlined above, to give the reader a state of the art of conceptual frameworks, and to contextualize my own research methods and theories. Although my research centers on the very earliest phase of the Norwegian Stone Age, the term ‘Mesolithic’ and the subdivisions ‘Early’, ‘Middle’ and ‘Late’ Mesolithic were properly introduced only in the mid-twentieth century. The following review therefore includes larger parts of the Early Stone Age.

3.1 Early stage of research, c. 1850s–1950s

The incorporation of natural historical data has a long tradition within Norwegian and Scandinavian archaeology. We find environmental thinking, first and foremost by reconstructing the natural setting of the culture in study, already in the mid-19th century Denmark with the multidisciplinary "Kitchen midden commissions". This groundbreaking research produced knowledge about intra-site matters, seasonality, exploited resources, the surrounding vegetation and geological processes (Gutiérrez-Zugasti *et al*. 2011; Trigger 1996:68). Important fundamental environmental research was also conducted by biologists and geologist in the late 19th and early 20th century, which further contributed to the understanding of the natural preconditions in which humans acted in the past.

In Norway, two topics were of particular interest to archaeologists studying the earliest Stone Age cultures: the processes of isostatic rebound, and the deglaciation following the last Ice Age. Research on isostatic land uplift was conducted already around 1900 in Norway and Sweden (Brøgger 1901, 1905; De Geer 1888; Hansen 1904). The retreat of the Scandinavian ice sheet was especially investigated by De Geer (1884, 1910) at this early stage. For archaeologists, knowledge about the fluctuations in land uplift and sea-level could be used as a tool to date archaeological sites (see Chapter 5.1.5), and could consequently give an indication on when Norway was colonized. It was also interesting to document the Post-glacial position of the ice margin to get a picture of inhabitable landmasses in this early settlement phase.

Anders Nummedal was one of the first to actively incorporate these aspects into archaeological Stone Age research (Paper 1 (Breivik and Ellingsen 2014)). From the current knowledge about geological circumstances, he systematically searched for sites along elevated shorelines during the early 1900's. His archaeological mappings and observations revealed tendencies in macro- and micro-topographic location, and connections between landscape features and cultural settlement preferences in the Stone Age were made: The geographical distribution, which became more distinct in tandem with the growing number of sites, emphasized the early inhabitants' relation to the sea – they settled by the water margin, frequently on islands – supporting the notion of boat use and exploitation of marine resources.

Although Nummedal clearly found the natural conditions to be structuring for the lifestyle of Norway's early settlers, environmental factors rarely had a central place in his interpretations of past cultures. Palaeo-environmental data was rather used as a methodological tool in search for new Stone Age sites. This is in line with the descriptive tradition that prevailed in archaeology at that time; there was little focus on theoretical frameworks to explain how cultures evolved and developed. Nummedal's work is nevertheless very important and forms the basis for many later studies of Early Stone Age cultures in Norway.

During the subsequent decades, syntheses about the "first Norwegians" were basically built on Nummedal's results. Reviews were written by Håkon Shetelig (1922) and Gutorm Gjessing (1945). Shetelig gives a summary of the geological and natural preconditions for early settlements in Norway, before proceeding to artefact types, typological issues and questions about cultural contacts. Gjessing elaborates somewhat more on logistical issues and the use of resources, but also here questions about dating, immigration routes and cultural affinities are more central, in line with most archaeological publications within this time span (e.g. Bjørn 1931; Bøe and Nummedal 1936; Clark 1936; Freundt 1948).

An issue of particular environmental interest was the possibility for "over-wintering" populations in northern Norway. Nummedal's discoveries of the alleged Palaeolithic 'Komsa culture' in Finnmark (see Paper 1 (Breivik and Ellingsen 2014)) led to hypotheses about interglacial refugia before and during the last Ice Age (Weichsel). Rolf Nordhagen (1933) especially encouraged this idea and approached it by studying geological and botanical data. He concluded that during the Late Glacial maximum there were ice free refugi along the coast of Møre and north Norway, as well as in alpine areas, where plants and animals could live through the Late Glacial period (Nordhagen 1933:39). The impact of climatic deterioration on humans and their livelihood was also touched upon by Nordhagen, yet first and foremost in relation to pastoralists and agriculturalists in later stages of the prehistory. When it came to hunter-gatherer cultures, there basically seemed to be a question about existence or not, based on the natural conditions. This reflects the overall "static" perception of cultures: changes in cultures, or artefact inventories, were explained by migrations or diffusions – cultures were practically regarded as unable to change internally (Olsen 1997:125-130).

3.2 The "New Archaeology", c. 1960s–1990s

Typology was a much debated topic also during the following decades. However, from the 1950s onwards, new data, methods and theoretical frameworks influenced archaeological Stone Age research in Norway.

Novel ideas were introduced through the "New Archaeology" that emerged within the circles of American anthropology, decisively defined by Lewis Binford (Binford 1962, 1965). The new paradigm criticized the static perception of cultures that permeated the archaeology of the early 20th century. According to Binford, archaeologists should be able to engage themselves in the same issues that anthropologists were studying – just over a much longer timespan (Binford 1962). Bjørnar Olsen (1997:45) describes the new direction, which was labeled "processual archaeology" and particularly manifested itself in the 70ies and 80ies in Norway, as focused on questions about dynamic processes within cultures. With it, we can see an increasing interest for studying the relation between humans and their surroundings.

At the same time, the concept of ecology was introduced into archaeology from the biological sciences. The American anthropologist Julian H. Steward drew up a framework for cultural ecology, which involved seeing humans and their culture as part of an ecosystem (1955:30-31). This view was also adopted by Norwegian Stone Age archaeologists. Anders Hagen phrases it like this in his paper *Man and nature. Reflections on culture and ecology*:

> Man is an important part of the ecosystem. All cultural activity interferes with the ecological balance of the local environment, and every human society is more or less dependent on natural conditions and resources. The study of how mankind has adapted itself through its cultural forms in order to exist in its environment, and the study of reciprocity between nature and culture, can be defined as cultural ecology (Hagen 1972:1).

With this definition lies the will to see people as domesticators of nature: How human with their special culture have managed to adapt nature to their special needs (Hagen 1972:10-11). The new conceptual directions laid the foundation for eco-functionalism in archaeology, meaning that human culture was seen as an adaptation to the environment, and that culture is a means of maintaining humans and the environment in balance.

Of great significance to archaeology in general, was also the development and application of radiocarbon dating. For Stone Age archaeologists in Norway, this was one more step towards dating the earliest cultures and sorting out chronological issues. The method also made its impact on environmental research, as events now could be dated more precisely. Research on geological conditions, sea-level fluctuations, glacial meltdown and vegetation patterns were also increasingly conducted on local and regional levels (e.g. Anundsen 1985; Hafsten 1963, 1983; Kjemperud 1981; Mangerud 1970, 1977; Nesje and Dahl 1993; Reite, Seines and Sveian 1982; Svendsen and Mangerud 1987). New archaeological data was collected: Stone Age sites were located, mapped and made available through national survey projects, and the development of hydro-electrical power initiated large surveys in the interior (for a thorough review of this survey activity, see Indrelid 2009).

The new data enabled more detailed studies on environmental and cultural trajectories in the earliest settlement phase in Norway, and more holistic observations around the use of resources and landscape. The available information invited to systematic investigations on a regional level, and the research questions generally had a more local character than earlier. The theoretical framework of the eco-functionalist direction provided a new set of ideas about how culture and nature interacted, and how cultural differences were to be interpreted.

The increasing number of Stone Age sites in mountain environs created a new focus on inland environments and terrestrial resources (Hagen 1963; Indrelid 1973, 1975; Johansen 1969, 1975; Martens and Hagen 1961; Odner 1965). Several of the radiocarbon dated sites turned out to be quite old and they consequently achieved a central place in the colonization debate. A view that was particularly promoted by Anders Hagen (1963) and Svein Indrelid (1975) was that reindeer followed the retreating glacier at the end of the Pleistocene, and that the hunters, which originated from the continent, chased them into Sweden and Norway. But while Hagen suggested that these groups may have been more or less permanently stationed there, Indrelid pictured a seasonal migration pattern between coast and highland.

Several other studies have also focused on seasonal patterns and relations between inland and coastal sites. An early example is Knut Odner's (1964) study from Finnmark County in north Norway. He points out the fact that economic issues have been more or less absent in debates about the 'Komsa culture'. In his paper he seeks to reconstruct subsistence and settlement patterns along the Varanger fjord. Comparing sites in the inner fjord with sites on the outer coast, he points to differences in terms of size, structure and location. From environmental reconstructions he suggests seasonal migrations between the inner fjord and outer coast, where the fjord areas were used most of the year while the outer coast was used only during spring/early summer. Models of seasonal migration patterns were developed also by others, on the basis of coastal and inland camps that were detected in north Norway (Gaustad 1973; Helskog 1974) and south Norway (Bang-Andersen 1988a, 1988b, 1996a; Gustafson 1986; Indrelid 1975). Egil Mikkelsen's (1978) thorough review of Mesolithic sites speaks for an overall seasonal pattern with exploitation of marine resources in spring and summer, and use of terrestrial resources in late summer, autumn and winter. He does, in addition, trace different systems of adaptation and social organization across the regions.

The chronological refinement of the Mesolithic period, following meticulous typological studies and improved dating methods, gave the opportunity to study temporal changes in human–environment relations. A major part of the archaeological surveys and studies from the 1970s, 1980s and 1990s addresses issues such as settlement patterns and approaches to landscapes and resource through time. Indrelid (1978) has worked on relations between cultural and environmental changes during the Mesolithic. He points to regional variations in economy and settlement patterns, and attributes them to the great environmental varieties found in different parts of the country. Climatic fluctuations, he argues, were not sufficient to cause dramatic cultural adaptive changes – only gradual modifications in the course of time. Inge Lindblom (1978, 1984) draws on anthropological research and ecological adaptation models to investigate seasonal exploitation patterns through the Mesolithic in Østfold. He argues for seasonal movements between the archipelago and fringes of the mainland coast during the Preboreal phase, with a gradual implementation of the interior zones taking place during later Mesolithic phases. Surveys and excavations of Stone Age sites in Hordaland County on the west coast forms the basis for Knut Andreas Bergsvik's (1991, 1995) and Atle Bruen Olsen's (1992) analyses of location preferences and resource exploitation. Bergsvik regards "bottlenecks", a limited space within which resources accumulate, as a decisive localization factor. The Early Mesolithic camps, he finds, are mainly localized along the Fosnstraum current, and is thought to reflect short-term activity related to the procurement of specific resources. The Late Mesolithic sites, he continues, are characterized by larger variation in size and location. A change from a residentially/highly mobile pattern to a logistical/more sedentary mobility pattern during the Mesolithic, and Neolithic, periods is suggested. Olsen's synthesis, which builds on the excavation of the multi-phased Kotedalen site, largely supports Bergsvik's theories (Olsen 1992:235-241). Further north, Hein B. Bjerck (1989, 1990) has investigated location preferences and settlement systems based on his survey project on the island of Vega, Nordland County. He pictures a network of one residential base and several stations for the Boreal period. During early Atlantic times, on the other hand, no residential bases are found. Stine Barlindhaug (1996, 1997) has analyzed the topographic and geographical locations of Preboreal and Boreal sites in the Troms region. She finds that good harbour conditions and prospect of the surroundings were important localization factors, and discusses possible underlying factors for the choice of location. Kjersti Schanche (1988) looks at the sites in Varanger in a long-term perspective, focusing on changes in technology, settlement patterns, resource exploitation and social relations. She pictures mobile groups of hunters and fishers moving between coast and inland in the Early Stone Age. More permanent house structures and a wider spectrum of terrestrial resources, she argues, are found in Late

Stone Age. Several extensive excavations conducted during the last 15 years (see below) have provided more information on economy, location patterns and settlement structure in the Mesolithic.

Although all these studies focus on environmental and economic issues, we can see a shift from eco-functional explanations of cultural change and choices, towards a more socially-founded explanation regime around 1990. This is in line with the general trends in the field of archaeology. In his analysis of research trends, as manifested through publications in the journal *Norwegian Archaeological Review*, Bjerck (2008h) observes a decline in the topics of economy and adaptation in Norwegian archaeology from the 90s. He observes that:

> The reluctance to study this issue is related to research ideals that have steadily been moving away from functionality and economical rationality, resource optimizing strategies, driven by some nature deterministic monster (Bjerck 2008h:12).

For the next couple of decades, the discipline was more focused towards individuals and societies, and theoretical frameworks were adopted from social rather than natural sciences.

3.3 Recent trends, c. 2000 and onwards

During the last 15 years, there has been an increased interest in ecological and environmental approaches in Norwegian archaeology. The international awareness around global warming has nourished the ground for research related to ecosystems and human responses to climatic changes, among other things. At the same time we see a renewed emphasis on material culture and tangible empirical data after the "post-processual" focus on social relations and theoretical approaches. Methodologically, great advances have been made within the natural sciences (e.g. isotope analysis and aDNA, sediment analyses and micromorphology, geological provenience studies) of which much has been found applicable and useful to the archaeological discipline. A growing interest in branches like environmental archaeology, geoarchaeology, osteoarchaeology, zooarchaeology, and archaeobotany, which have developed particularly strongly within the British archaeology, underlines these trends. In Norwegian Stone Age archaeology, the methodological developments and improved sampling methods within the natural sciences have given rise to comprehensive, on-site palaeo-ecological reconstructions. On large excavation projects, multiple disciplines have been engaged in order to achieve this goal. The Melkøya project 2001–2002 (Hesjedal, Ramstad and Niemi 2009), the Ormen Lange project 2003–2004 (Bjerck *et al*. 2008), the E18 Brunlanes project 2007–2008 (Jaksland 2012a, 2012b, Jaksland and Persson 2014), and the Vestfoldbane project 2010–2013 (Melvold and Persson 2014) are examples such excavation projects in recent years.

With this, the production and accessibility of high-resolution environmental data have greatly improved; with the general interest for oceanic and bathymetric conditions due to research on climate change, and development of fisheries and petroleum and gas plants, this goes not the least for the marine environment.

3.4 The emergence of marine hunter-gatherers in archaeological research and literature

Archaeological and anthropological research on hunter-gatherers' relation to their natural surroundings (in Europe and the Americas) has traditionally been focused on terrestrial data and case studies. Also theoretical and methodological frameworks have mainly been built on these datasets. George P. Murdock's ethnographic atlas from 1969 [1967] is illustrative in this regard: fewer than 4 % of his 862 included societies have a subsistence economy largely based on shellfish-gathering, fishing, and pursuit of large aquatic animals (Murdock 1969:46-125). Moreover, the societies presented in the atlas are mainly from tropic, sub-tropic and temperate zones. Despite more balanced selections of case studies and more elaborate discussions on coastal environments and aquatic resources, this trend is also visible in Robert Kelly's *Foraging spectrum* from 1995 and Lewis Binford's *Constructing frames of reference* from 2001. Although many theories and predictive models derived from this research are applicable to marine societies in general terms, there has been a lack of theories developed in order to understand these societies on their own, somewhat different, premises.

In addition to an early ethnographic interest in tropic, sub-tropic and temperate and zones (regions with relatively low marine productivity), at least two reasons for the lacking interest in marine hunter-gatherers and environments may be lifted forward. The first is the apparently late evidence for marine exploitation in most parts of the world. In his review of archaeological evidence for early use of marine resources, Alan J. Osborn shows that very few places in the world have marine adaptation prior to the Holocene period – Spain and the south coast of Africa are mentioned as exceptions (Osborn 1977:159). David Yesner adds

Palaeolithic sites with shellfish and other types of seafood from southern France, Gibraltar and Libya to Osborn's list over exceptions. He further points to finds of Upper Palaeolithic fishing and sea-hunting equipment on a worldwide basis, along with early appearance of shell mounds and other coastal sites in Europe, North Africa and Japan, and slightly later (10,000–8000 BP) in Oceania, the Pacific Northwest and Brazil (Yesner 1980:734). Yet, he argues, it is not until around 5000 BP that maritime sites appear in significant numbers. As coastal areas in most part of the world experienced eustatic sea-level rise that slowed markedly at this time, he suspects that this trajectory is not related to prehistoric cultural processes (Yesner 1980:734). This matter has been elaborated by Geoff Bailey and John Parkington (Bailey 1978; Bailey and Parkington 1988) who find it likely that evidence for earlier marine exploitation is under-represented. On the other hand, they point to the fact that on some coastlines there is a time-lag of many millennia in the Holocene before the appearance of earliest coastal shell middens, despite availability of marine resources and favorable preservation conditions (Bailey and Parkington 1988:5-7). This evidence underlines that the emergence of marine economies is not simply a question about the presence or not of aquatic resources.

The second reason for a lacking interest in marine lifestyles is a theoretical focus on the net energy intake and high ranked resources. Bailey and Parkington emphasize that optimal foraging theory, which evaluates the costs and benefits of various resources (see Chapter 4), places marine resources – mollusks in particular – low on the scales of preferred foods. This is partly due to the high risks or costs of exploitation, with the implication that these resources would have been avoided until more attractive options became depleted (Bailey and Parkington 1988:6). The great interest in shell mounds and shell middens in studies of coastal hunter-gatherers (these structures are highly visible, offer good preservation for organic material and mapped and excavated in great numbers in Europe, North and South America, Africa, Japan and Oceania; see e.g. Gutiérrez-Zugasti *et al*. 2011) may have exaggerated the role of mollusks in prehistory (Bailey and Parkington 1988:2-4), building up under this hypothesis. Additionally comes a notion about oceans as less productive than the continental landmasses, and marine ecosystems as "second-rate" compared to terrestrial ecosystems (Osborn 1977). The neglect of the dietary importance of marine resources has led several researchers to explain the emergence of an aquatic economy by push-factors: e.g. as response to environmental stress (e.g. Glassow, Wilcoxon and Erlandson 1988; Yesner 1988) or ideological changes (Osborn 1977).

Although not a new thought (see e.g. Bailey and Parkington 1988; Bowdler 1977; Perlman 1980; Yesner 1980), there has been increased focus on the coast as an attractive environment for human foragers during the last decades of archaeological research. The role of marine resources and coastlines in human evolution and migration (see Bailey 2004; Bailey and Milner 2002; Cohen *et al*. 2012; Dixon 2001; Erlandson and Fitzpatrick 2006; Erlandson *et al*. 2007) and the emergence and dynamics of seafaring and marine adaptations (Ames 2002; Bjerck 2008i; Erlandson 2001, 2010; Glørstad *et al*. 2013, Glørstad 2014; Schmitt *et al*. 2009) have been studied. Efforts have also been made to characterize the variations in hydrodynamics, oceanographic conditions and coastal biotopes in relation to early utilization (Bjerck 2007, 2009a, 2009b; Blankholm 2008; Graham, Dayton and Erlandson 2003; Schmitt *et al*. 2006; Westley and Dix 2006). The oceans are now highlighted as rich ecosystems – especially in high-latitudes (Huston and Wolverton 2009).

The increasing knowledge of palaeo-oceanographic conditions, and the steadily growing number of sites recorded in the varying coastal environments of the world, seem to have triggered research on categories and classifications on different coastal environments and levels of marine adaptation. One example is the focus on kelp forests of the North Pacific by Jon Erlandson *et al*. (2007). These ecosystems are among the most productive ecosystems on earth, with high primary productivity and magnified secondary productivity, and are introduced as a highway for maritime peoples colonizing the New World. Another example is Hein Bjerck's studies of fjord–skerry seascapes of the earlier deglaciated regions of the world, with particular emphasis on Scandinavia and Patagonia (Bjerck 2007, 2008i, 2009a, 2009b; Bjerck and Zangrando 2013). The mixing of water with different salinity and temperature, in combination with changing water depths, promotes productivity in these seascapes. Archipelagos also offer sheltered waterways for safe travel for marine hunter-gatherers.

Due to the predominance of sites in the coastal zone, there has always been an interest in marine environments and resources in Norwegian Mesolithic research (see above). Nevertheless, when it comes to discussing the dynamic relationship between humans and their surroundings within this timespan, there has been a tendency towards focusing on palaeo-terrestrial data (fluctuations in ice-cover, air temperature, and vegetation). Some exceptions can be mentioned (Bergsvik 1991, 1995, 2001; Bjerck 2007, 2008i, 2009a, 2009b; Bjerck and Zangrando 2013; Bjerck *et al*. 2008; Blankholm 2008; Nygaard 1987; Svendsen 2007b), all of which focus on topographical features and marine productivity in the understanding of past settlement patterns, subsistence strategies and social organization within different regions of Norway.

During the last decade there has been a renewed interest in colonization processes and the motivating factors and preconditions for early settlement in Norway (Bang-Andersen 2012; Bjerck 2008i; Fuglestvedt 2005, 2009, 2012 Glørstad *et al*. 2013, Glørstad 2014). Except for Fuglestvedt's dissertation (2005, 2009) (which emphasizes the role of reindeer hunting – not merely as dietary source, but also as an incorporated part of the cultural tradition – as motivating factor) coastal landscapes, marine environments and technological specializations are now central in discussions about the colonization of Norway. Bjerck (2008i) draws attention to the sheltered and bountiful seascapes of the Swedish west coast, which he finds optimal for the development of a specialized marine adaptation that includes seaworthy vessels. He also finds it likely that seal hunting may have played an important role in the colonization process: a dependency on its raw materials may have been a motivation towards open sea hunting and specialized marine adaptation. Bang-Andersen (2012) also stresses the importance of skilled navigators with well-adapted sea crafts and hunting methods for an efficient adaptation to the Norwegian coast. He argues for a subsistence focus related to the coast and ocean in the initial colonization phase, shortly followed by a seasonal utilization of inland areas, including high mountains that could be reached via fjord systems. Glørstad (2014) connects the colonization of Norway to the deglaciation of the Oslofjord. He argues that the earliest sites only can be dated back to c. 9300 cal BC, an age which coincides with the deglaciation of the Oslofjord and emergence of sheltered passages between Norway and Sweden. He thus finds it likely that the ice barrier in this area that prevented human occupation at an earlier stage.

4.0 Premises, concepts and theoretical aspects

The dissertation deals with early hunter-gatherer groups' relation to their surroundings. The work is highly empirical in nature, and the theoretical frameworks presented in this chapter are not applied directly in my papers, but rather form a basis for my research questions, discussions and conclusions.

With its ecological and environmental approach, my research is inspired by directions and concepts that were adopted from biological sciences – especially ecology – into the humanistic and social sciences, and evolved from the 1960s and onwards. Ecological theories and frameworks have had varying popularity within the archaeological discipline (see Chapter 3). The theories came with the "New Archaeology" (processual archaeology), and were in particular promoted by Binford, who accused the "traditional" archaeology's descriptive and culture chronological approach of contributing little to the understanding of cultural processes. The spokesmen for the New Archaeology argued that for a social science, archaeology was unacceptably undisciplined and unscientific. Analytical frameworks, built around the development and testing of law-like propositions regarding the regularities of human behaviour, were proposed as the solution (Bettinger 1991:51). Binford applied such frameworks in a series of studies and papers that are still widely cited today (e.g. Binford 1978a, 1978b, 1979, 1980, 1982). In this logic positivistic epoch, several predictive models based on quantitative data coupled with mathematical formulae were produced as tools to understand variations in hunter-gatherer behaviour. These models, collectively termed 'foraging theories', have later (during the post-processual paradigm) been dismissed as too deterministic and unrealistic. However, the ideas have been further developed into frameworks that are widely employed in archaeological and anthropological research today; e.g. niche construction theory and complex systems modelling. Equally important, the foraging theories carry a mindset that is the foundation of interpretations in many studies that concern human-environment relations – including my own. These aspects will be elaborated in the following.

Two main issues are addressed in my papers. The first relates to questions about *subsistence strategies*: the choice of diet and preferred habitats for acquiring these food resources. A premise for all my papers is that the Early Mesolithic foragers of Norway had a dietary focus on marine resources. This is based on previous research (see Chapter 3), and is also supported and strengthened through my present research (Paper 2 (Breivik and Bjerck in press), Paper 3 (Breivik 2014), and Paper 4 (Breivik and Callanan in press)). In Paper 3, the relation between Early Mesolithic site distribution and marine productivity was investigated in detail. It was also considered whether locational preferences varied geographically and temporally according to variations in the food resource situation. The premises for these research questions are influenced by the ideas on which the foraging theories build.

The other main issue relates to *adaptive behaviour*. Subsistence strategies are indisputably a form of adaptive behavior. But what is meant here, are the social and technological sides to adaptation: group organization, mobility patterns, settlement structure, and tool technology. These aspects were treated in Paper 3 (Breivik 2014), Paper 4 (Breivik and Callanan in press) and Paper 6 (Breivik *et al*. in press). Paper 3 (Breivik 2014) investigated whether the Early Mesolithic lithic tool inventory of central Norway changed according to the temporal changes in climate and environment. Paper 6 (Breivik *et al*. in press) focused on the mobility patterns of the early marine foragers in the comparable seascapes of central Norway and southern Tierra del Fuego, Argentina. Here, we asked whether the choice of mobility strategies could be predicted from the climatic and environmental setting of the cultures in study. In Paper 4 (Breivik and Callanan in press), Early Mesolithic mountain and coastal sites from central Norway were compared in order to see whether site organization, tool assemblages, projectiles and the use of raw materials varied across the ecozones. For these research questions, the dichotomies that lies within the concepts of forager vs. collector (Binford 1980), nomadic vs. sedentary (Murdock 1969) and immediate vs. delayed return (Woodburn 1980) have been found useful.

Before turning to these theoretical frameworks in Chapter 4.2 and 4.3, I will elaborate on the concept of ecology on which the overall topic of the dissertation builds.

4.1 Ecology – a conceptual framework for human–environment studies

Ecology can be defined as the study of the interrelations between living organisms and their environment (Odum 1971:3). The ecological field of research was developed within the biological sciences, and has later been widely adopted as a conceptual framework into anthropological and archaeological research (see Jochim 1979 for a thorough review on applications of ecological thought in anthropology and archaeology). I follow Michael Jochim's definition of ecological anthropology (as applied in anthropological and archaeological research): "the study of cultural behavior in its natural and social environment, in terms of its relationship to this environment" (Jochim 1979:77-78). In a later paper he states that "an ecological approach to cultural behaviour requires that any particular aspect of behaviour be examined within its cultural and natural context, keeping in mind that this context may be varying in space and time" (Jochim 1990:75). He emphasizes that ecological archaeology thus introduces spatio-temporal variability and complex interrelationships as important elements of the problems investigated (Jochim 1990:77). This is the very essence of my research questions.

Early applications of ecology have tended to incorporate elements of the 'ecosystem concept', articulated by the biologist Arthur Tansley (Moran 1990:4 with reference to Tansley 1935; Winterhalder 1984:301; see also Bettinger 1991:48-60 about the 'ecological model' and 'neofunctionalism'). The ecosystem concept focused on interactions within systems, claiming it was their nature to develop toward dynamic equilibrium. A system would consequently remain unchanged as long as it was in balance. In case of external pressure, the components would respond with the necessary alterations to regain equilibrium. According to Bruce P. Winterhalder (1984) there was a widespread application of the ecosystem concept in American anthropology starting in the late 1960s and early 1970s. Measures like structure, function and equilibrium were already well-known in social studies, making the concept easy to adopt (Winterhalder 1984:301-302).

In anthropology and archaeology the ecosystem approach has later been subject to criticism, because of too much emphasis on energy flow, too heavy a reliance on functionalist analysis, neglect of historical and evolutionary factors and neglect of the role of individual decision-making, among other things (Winterhalder 1984:303). It has also been argued that humans are not like other components of the ecosystem – they have values, histories, intentions, and consciousness that enter into decisions (Hastorf 1990:132); and that people make decisions not only in response to the physical environment, but also in relation to social conditions, such as kinship, ideology, and perceptions of threat and scarcity (as exemplified by e.g. Bollig and Schulte 1999). It has therefore been claimed that the concept is useful primarily as a heuristic device, encouraging us to think in terms of the systemic interrelationships among cultural and natural factors (Jochim 1990:75-76).

The general understanding of ecology and its application to archaeology, as articulated by Jochim, forms the conceptual framework of my dissertation, and is the foundation for my research questions, data presentation and discussions.

4.2 Theories about subsistence strategies

Issues related to choice of diet and acquisition of food resources must be the most well-researched in hunter-gatherer studies – the importance is stressed by the fact that the group under study commonly is categorized after such activities. 'Optimal foraging theory' (OFT) is a theoretical framework for studying economic issues, and is one of the directions that have gained large popularity among anthropologists. It includes a wide array of literature, mostly American, of which some will be presented here.

4.2.1 Optimal foraging theory

OFT has been applied ethnographically since the late 1970s, and was adopted by the Humanities from biology (Bettinger 1991:83). The theoretical paradigm consists of several models addressing resource selection, time allocation, and habitat movement. The models are built on the basic assumption that human decisions are made to maximize the net rate of energy gain (Bettinger 1991:84; Winterhalder and Smith 2000:54). The most frequently applied models seem to be the diet breadth model, the patch choice model and the marginal value theorem.

The diet breadth model concerns decisions on which items are to be foraged. Foragers confront an array of items that may vary with respect to their abundance; amount of energy produced per item; amount of energy needed to acquire the energy from each; and amount of time needed to acquire that energy once the item is selected. The economy-minded forager is likely to choose the combination of food types that maximizes his net energy intake per unit of foraging time (Bettinger 1991:84). This includes an evaluation on costs vs. benefits in terms of energy use and intake, and it is thus assumed that high-ranked resources (with low handling costs relative to energetic yield) are selected (Bird and O'Connell 2006:155-156). *The patch choice model* concerns decisions in which places to forage. Foragers confront an array of patches that differ with respect to the energy they contain and the time needed to extract that energy. The patches are ranked, where the most optimal will produce the best return rate per unit of foraging time (Bettinger 1991:88-89). *The marginal value theorem* concerns decisions on how long to stay in a place. It predicts that an optimal forager abandons a patch when its declining marginal rate of return equals the net acquisition rate of foraging averaged over visits to many patches (Bettinger 1991:92; Winterhalder 2001:17).

There are many problems related to the strict application of these models in archaeology. As they are based on mathematical algorithms that include ranking of resources and patches, they require accurate information on environmental factors, as well as the actual choice of diet. Winterhalder and Smith (2000) point out that they also require data on individual decisions, taken in behavioural time. In contrast, the recoverable archaeological record consists of material remains that aggregate over multiple foragers and foraging episodes. As a consequence, ethnoarchaeological applications have been devised to serve as a bridge between the short time-frame of foraging models and the extended time-frame of prehistorians (Winterhalder and Smith 2000:57). Nevertheless, the foundation on which the models build – that people tend to act in a rational, economic way according to their surroundings, that hunter-gatherers tend to depend on high ranked resources and to seek out the most productive patches according to their subsistence focus – is applied as a premise for numerous archaeological studies, including my own. The archaeological record of Early Mesolithic Norway includes very few traces of organic material, and it is not possible to reconstruct neither the exact fauna nor the actual chosen food resources. In my work I have instead focused on *productive habitats* and *subsistence focus*. My pre-assumption (especially articulated in Paper 3 (Breivik 2014)), that there is a relation between productive habitats and archaeological site density, builds on the OFT notion that the most rewarding patches (according to the chosen subsistence focus) were sought out. One can always ask why hunter-gatherers should seek the most productive areas if they could acquire sufficient food and other resources on other places. Still, it is difficult to envisage human groups not taking advantage of possibilities that would facilitate or increase the food intake. That being said, I find the OFT emphasis on energetic yield one-sided. There may be other reasons behind the choice of a particular patch or prey than merely the net rate of energy gain: it may for instance also be a matter of extracting useful raw materials from the animal (bones, sinew, skin etc.). Cultural traditions are also likely to affect and limit prey choice. Likewise, the choice of patch may not be exclusively about resource abundance, but also about predictability. Another objection may be that OFT seems to favor push-factors above pull-factors – that it is the depletion of resources or population pressure that forces human groups to take action and find solutions to their changed resource situation. In my work I have argued that pull-factors were important – that the human groups took advantage of the new opportunities that came with a changing environment, e.g. newly exposed land and increasingly stable and predictable marine conditions.

According to Robert L. Bettinger (1991:105), OFT has overall been accused of being too deterministic and unrealistic; it treats foraging behaviour as resulting from straightforward choices made by optimizing individuals, and the cost and consequence of each available alternative are treated as though they were perfectly known. The want for more dynamic models gave rise to a new direction within ecological archaeology, namely 'human behavioural ecology'.

4.2.2 Human behavioural ecology

Human behavioural ecology (HBE) began in the mid-1970s with the application of optimal foraging models to hunter-gatherer decisions concerning resource selection and land use. The field has since developed, and adapted evolutionary ecology theory and methods to a wide range of topics important to archaeology and anthropology (Winterhalder and Smith 2000:51). Human behavioural ecologists are interested in how human behaviour is influenced by the environment, and how the alternative behavioral strategies produce cultural differences. The aim is to determine how ecological and social factors affect behavioral variability within and between populations (Laland and Brown 2010:75). Like OFT, behavioural ecology is based on an optimization premise. Winterhalder and Kennett (2006:11) prefer to call it 'constrained optimization', and by this emphasize that it does not entail the belief that behaviour is routinely optimal, only that there be a tendency towards optimal forms of behaviour. According to Kelly (1995), behavioural ecology makes explicit use of evolutionary theory, as opposed to OFT. 'Fitness' and 'natural selection' are central concepts here. Fitness can be described as an organism's propensity to survive and reproduce in a particularly specified environment and populations, and natural selection favours behaviour that maximize an individual's fitness (Kelly 1995:50-53). Within this concept, fitness and optimization are not always connected to the acquisition of resources with high-energy yield. Currency could be any kind of resource value: protein capture, material need, prestige – anything that can be converted into reproductive success (Winterhalder and Smith

2000:54). Moreover, investment in social relations may be just as important as maximizing net rate energy yield within this perspective. Other factors that are included in behavioural ecology are risk and discounting (to delay the reward in order to make it greater) (see Winterhalder and Kennett 2006:17-20).

HBE therefore holds that the relation between humans and their environment is not static and not merely controlled by the premises offered by nature, but also by cultural development and human initiatives. As it is recognized that both habitats and cultures changes over time, questions about dynamic relations over time becomes relevant within the frames of behavioural ecology. Winterhalder's encounter-contingent model exemplifies this: As patches become richer, or as harvest costs within the patch diminish, residence time also decreases (Winterhalder 2001:17). Behavioural ecology may thus be described as more flexible than basic foraging theories, as it encompasses elements such as social interaction, reproduction, and risk management. It also takes varying and changing cultural and environmental conditions into account. The latter perspectives have been of particular interest for my research (see Paper 3 (Breivik 2014) and Paper 4 (Breivik and Callanan in press)).

4.3 Adaptation, adaptive behaviour and adaptive strategies

Adaptation is a concept adopted from evolutionary biology, and may be defined as: "a process whereby the members of a population become suited over the generations to survive and reproduce" (Futuyma 1979:308). That an organism is adapted to certain environments means that it can survive and reproduce in these environments. In archaeological literature, terms such as 'adaptive behaviour' and 'adaptive strategies' are used to express decisions made in order to succeed and reproduce in a given environment (see e.g. Chatters 1987). The decisions include e.g actions, social systems and technology. In the following sections I will elaborate on the social and technological aspects of adaptation addressed in Paper 4 (Breivik and Callanan in press) and Paper 6 (Breivik *et al*. in press).

4.3.1 Generalized vs. specialized adaptive strategies

Adaptive strategies are made up by a range of choices that cover different aspects of a lifestyle. I have already commented upon some of the economical sides of adaptive behaviour (resource and habitat selection). In my papers I have especially focused on two other main aspects of adaptation: mobility strategies and tool technology.

Mobility strategy here refers to the way in which the system of movements and occupations was organized. In Paper 6 (Breivik *et al*. in press) we have especially treated these aspects of mobility: mobility type, mobility range and frequency, stability of mobility pattern (after Chatters 1987). *Mobility type* refers to Binford's (1980) division into residential and logistical mobility. Residential mobility is associated with foragers, who "maps onto" resources through residential moves and range out gathering food on an "encounter" basis, returning to their bases each afternoon or evening. Logistical mobility is associated with collectors, who supply themselves with specific resources through specially organized task groups. The task groups may leave a residential location and establish a field camp or a station from which food-procurement operations may be planned and executed (Binford 1980:5, 10). *Mobility range* refers to the area a group habitually utilizes through the year, or the distance moved between residential locations. *Mobility frequency* incorporates both the number of annual moves and the duration of residency between the moves. *Stability of mobility pattern* refers to the geographic constancy in settlement locations from year to year (Chatters 1987; Kelly 1995). Mobility patterns are often discussed in relation to the dispersion of resources: based on ethnographic cases and environmental data, the average distance per residential move increases as food resources become more spatially aggregated. Likewise, the number of residential moves per year should increase as overall food density decreases. The reuse of identical places are usually associated with critical resources that are fixed to a few specific locations (Kelly 1995:122-128).

Tool technology here refers to the production and composition of the tool assemblage. Binford (1977) classifies tool technology from completely 'expedient' manufacture, use and abandonment to 'curated' and maintained technology. Expedient tools can be produced relatively quickly, and are less sophisticated than curated tools. Curated tool technology is depending on recycling and long use of an item, and tools are produced in anticipation of use. These two types of tool technology reflect different ways of scheduling the time spent on manufacturing contra food acquisition. The former requires little labour investment in the production of each tool, but more time on the procurement of food resources. The latter requires more labour investment in tool manufacture and maintenance, but less time on food acquisition.

Torrence (1983:13) characterizes the structure of a tool assemblage by composition (the functional categories of tools present), diversity of tools within a functional class (the number of tool types present), and complexity (the average number of parts per tool) (see also Oswalt 1976). A specialized toolkit includes artefacts designed to be used in a small number of functions, and creates a very diverse assemblage. General-purpose assemblages exhibit a low level of diversity as they include tools that are used in many different tasks. Highly specialized tools are regarded as more time efficient in the execution of subsistence activities than general purpose equipment. According to Torrence, therefore, the diversity of toolkits should be negatively correlated with the amount of time available to complete a food acquisition job: with small quantities of time, the diversity of tool use will be large. Likewise, she predicts the complexity of tools to be inversely related to the availability of time: The investment of additional time used to manufacture a complex tool is time saved as a result of using that tool rather than a simpler tool (Torrence 1983:13-14).

Other main aspects of adaptive behavior are social organization (such as group size and group composition), dwelling type (permanent vs. temporary; portable vs. fixed), the employment of food storage/caching. All these choices tend to be interrelated, and together they form two main adaptive strategies: *generalized adaptation* and *specialized adaptation*. Generalized adaptation is associated with a broad resource base which tends to be approached opportunistically. The strategy encourages high mobility with a flexible settlement pattern. Group sizes tend to be small, and residential mobility, where the whole basic social unit moves, is executed. The toolkit is expedient and generalized with a range of forms that are ready to perform a wide set of tasks related to different resources and materials. Specialized adaptation is applied where there is a focus on one or more specific resources, often decided by the season. This form for adaptation invites to systematic movements between particular locations, often with a more sedentary lifestyle. Group sizes tend to be larger, but smaller social units perform logistical mobility connected to the execution of specific tasks. As the success of this strategy depends on the acquisition of a few selected resources, more time and labour is invested in technology (specialized tools, sophisticated and stationary capturing devices, more permanent dwellings). There is also a propensity towards the use of storage facilities.

This coarse division can be recognized in many varieties. The most well-known is Binford's (1980) forager–collector continuum, where foragers must be regarded as generalists while collectors are specialists. Woodburn's (1980) distinction between immediate-return vs. delayed-return hunting and gathering (immediate consumption vs. storage systems), as well as oppositions like nomadic vs. sedentary (Murdock 1969) or mobile vs. sedentary (e.g. Kelly 1992) assimilate these main adaptive strategies, and it is also found in Gamble's (1997; Gamble *et al*. 2004) technological paradigms: ecological generalists and ecological specialists.

The models, which appear as dichotomies and as quite separate behavioural or organizational dimensions, are descriptive and categorizing, and it is emphasized by most authors that they are extremes on a range, which includes numerous varieties and combinations of adaptive strategies. The various dimensions overlap, crosscut each other and can be made to work in many different combinations. Likewise, it is recognized that although general predictions can be made, there is no absolute relation between certain environmental factors and the chosen strategy: There are several ways to overcome obstacles and manage risks in a given environment, and several ways to exploit the opportunities. Different societies in similar environments may therefore choose different adaptive strategies. The chosen strategy may have different advantages and disadvantages; however the general outcome (i.e. good food supply) may be similar. It may also be salubrious to remember that these models are based on the relatively limited database provided by the present-biased ethnographic record. To what degree such models hold for primary colonizing hunter-gatherers is not entirely clear. This issue was addressed in Paper 6 (Breivik *et al*. in press). Here it was explored whether similar mobility strategies were chosen in similar environmental settings on opposite sides of the globe. The two case studies were then compared to predictive models, based on ethnographic and environmental datasets, constructed by Binford (2001) and Kelly (1995).

4.3.2 Adaptation as dynamic processes

Adaptive strategies are dynamic processes and are prone to change over time, according to external or internal causes. The strategies chosen by colonizers who move into pristine and unoccupied land are likely to be different from the strategies of people that have lived and adapted to a place through many generations. It is not, however, a matter of an evolution from one extreme (i.e. generalized) to the other (i.e. specialized) (see e.g. Ames 1991:109 about 'sedentism'; Bailey and Parkington 1988:9 about 'mobility'). The case of the "canoe indians", or Yámana population, of southern Tierra del Fuego, Argentina (presented in Paper 5 (Bjerck and Breivik 2012) and Paper 6 (Breivik *et al*. in press)) demonstrates these points very well. A gradual shift through time in their subsistence strategy – from a strong dependency on pinnipeds to a broader resource base which include numerous fish species, birds and also terrestrial mammals; from a settlement pattern largely based on “mainland” areas to occupation of the archipelagic zone) – and tool technology/material culture is recognized in the archaeological record. Social organization, mobility and settlement pattern, as well as facilities and dwellings, in contrast, remained more or less unchanged until the population was absorbed into the modern European lifestyle during the 19th and 20th centuries.

In his research among the same population groups, Jordi Estévez (2009) concludes that the social system of the Yámana was less adaptive than their subsistence strategies. The flexibility of the technology is demonstrated by the rapid adaptation to the new European raw materials and techniques. On the other hand, the heavy population losses, mainly caused by illness, violence and the European industrial exploitation of resources, were not compensated for by reorganization and liberalization of the strategies of social reproduction. On this basis he argues that in hunter-gatherer societies, adaptation was not simple, stable and successful, but a dynamic attempt to maintain a social system in order to deal with the oscillations of resource availability and the natural tendency towards population growth. Therefore, changes in resource procurement and subsistence activities were more rapid than social system changes (Estévez 2009:141).

A different example, taken from the Yukaghir of Siberia, shows that hunting strategies that were coined for reindeer, maintained despite the switch to a different prey – namely elk. Here, it was argued that the symbolic value was the most important aspect of the hunting tradition (Willerslev 2009). This case underlines the resilience of social systems.

On the basis of these observations, I investigated adaptive alterations in subsistence strategies, technology and material culture rather than in social organization in my studies. In Norway, several researchers have identified changes in economy, technology and settlement patterns during the Mesolithic phase (see Chapter 3.2). In my work, I searched for similar changes within the Early Mesolithic phase.

Adaptive strategies and adaptation processes within the earliest settlement phase of Norway must be studied in light of pristine landscapes, varied environments and fluctuating resource situations. The motives for moving into a new region and a new environment may be complex. Ethnographic studies suggest that the reasons for colonization are more often anchored in positive pull-factors, social or political strategies or personal reasons like the urge to explore, than in negative push-factors (Anthony 1997:23-25).

Rockman (2003) describes two major forms of colonization: the 'advancing front' colonization pattern and the 'streaming' colonization pattern. The advancing front pattern represents regular movement over short distances into areas directly adjacent to previously known ranges. The process of an advancing front involves that the new area is explored and learned through a combination of short-distance wayfinding and substantial infilling before the next move is made. The streaming colonization pattern implies migration from known areas to new ones, leaving the areas in between unpopulated (Rockman 2003:10-11). Essential to this pattern is the knowledge of one or more pull-factors at the destination point. This can be the safety of a social network or the abundance of specific resources.

Moving into unknown landscapes may involve great risks, and colonization strategies thus include risk-reduction techniques. By keeping a high residential mobility, colonizers can learn as much as possible as quickly as possible (Meltzer 2009:235). Moving around in small groups, but still remaining in close contact with other groups, would have put less strain on local foraging, as well as helping to create a shareable knowledge base about the landscape that in turn would buffer environmental uncertainty or risk on an unknown landscape (Kelly 2003:52; Meltzer 2009:235). Producing and utilizing a generalized toolkit, ready to be pressed into service for a variety of tasks and contingencies, is another risk-reducing strategy (Beaton 1991; Meltzer 2009:235-236), as is pursuing high-ranked resources (i.e. large game), naïve prey or the most productive habitats (Meltzer 2009:218).

Yet finding and killing animal prey requires knowledge of how they behave in the landscape and how they respond to stalking or attack. To be able to read and learn the new landscape and resource situations may thus be one of the most essential components in a successful colonizing strategy. Meltzer (2009:219) claims that the first Americans made it in the new environment partly because they possessed a general knowledge of animal behaviour, a broad familiarity with plants and geological prospecting skills. Kelly (2003:50) also stresses the importance of a generalized and transferrable system of knowledge that could be extrapolated from one area to another. Yet, there are very few colonizers that unexpectedly find themselves in a completely unknown environment without no recognizable features or resources. To follow a particular 'megapatch' (Beaton 1991) or a range of resources may thus be the best way to approach a landscape; in short, searching for familiar traits in unfamiliar environments.

Although the strategies outlined above are discussed in a colonization perspective, they seem to be just as applicable when discussing adaptation to varied environments or fluctuating resource situations. Early Mesolithic Norway offered both highly different ecozones within short geographical distances, severe environmental changes through time, and different environmental trajectories in different geographical regions. These issues, which were pursued in Paper 3 (Breivik 2014) and Paper 4 (Breivik and Callanan in press), will be elaborated in Chapter 6.

5.0 Data collection and methods

5.1 Early Mesolithic sites and artefacts in central Norway

Considerable work was put into identifying and mapping Early Mesolithic sites in Norway, with particular emphasis on central Norway. In my papers, central Norway encompasses the counties of Møre og Romsdal, Sør-Trøndelag and Nord-Trøndelag (Fig.1). In the process of identifying and mapping sites, the artefact assemblages from the geographical district that lies under the authority of the NTNU University Museum in Trondheim was investigated. The consequence of this is that assemblages from the southern part of Møre og Romsdal (Sunnmøre) was left out, and assemblages from the southern part of Nordland (Helgeland) was included. The following description of my mappings of Early Mesolithic sites and artefacts in central Norway thus include assemblages from Romsdal, Nordmøre, Sør-Trøndelag, Nord-Trøndelag, Nordland (Helgeland).

My mapping of Early Mesolithic sites and artefacts in central Norway is a continuation of work conducted by Møllenhus (1977), Bjerck (1983) and Svendsen (2007b). Møllenhus presents Mesolithic coastal sites in Romsdal, Nordmøre and Trøndelag in his thesis. His 62 sites include artefacts that typologically can be dated to the "Pre-Neolithic" period. Bjerck goes through Mesolithic material from west and central Norway and presents typological artefacts from selected sites. He also gives a complete overview of 119 sites with Early Mesolithic flake- and core-adzes in Hordaland, Møre og Romsdal and Trøndelag. Through an examination of Early Mesolithic elements in Nordmøre, Romsdal and Sør-Trøndelag, Svendsen presents 86 sites, and by this increases the number of sites in the region. The large selection of Early Mesolithic sites presented in these three publications is included in my database (see below and Appendix C). However, the issues and research questions posed in my PhD project required a more complete review of sites in central Norway with equally good data from all the counties in the study region. In order to achieve this goal, an extensive search for Early Mesolithic artefacts in the archaeological collections of the NTNU University Museum in Trondheim was performed.

5.1.1 The archaeological collections at the NTNU University Museum

The NTNU University Museum have systematically been collecting, managing and keeping records of archaeological objects since the early 1870s. The assemblages hold both stray finds collected by laypersons and artefacts found on archaeological surveys and excavations. Descriptions of the objects and raw materials, more or less accurate information about the context and geographical location, and also how and by whom the artefacts were recovered follow all these incoming artefact assemblages. An identification number is given to each assemblage, with sub-numbers to separate different artefact classes. If artefacts have been collected on different occasions on one site, separate identification numbers are given to each collection event.

The artefacts that arrived to the NTNU University Museum in the time span 1871–1988 were documented in the so-called *collection catalogues*. The catalogues are now digitalized and available as searchable documents (.txt-documents 1871–1981, .pdf-documents 1982–1988), and are also incorporated into the *National Artefact Database*. This database thus holds a complete listing of incoming artefacts up to 1988. For the last decades, however, the register is more fragmentary: artefacts from most of the large Stone Age excavations are catalogued in the database, but there is substantial lag when it comes to stray finds and surveys conducted within the last 25-30 years. A simpler digital register is available for this timespan. This database provides information on location, site type and chronological period, but does not describe artefact types. In addition to these digital resources, descriptions of investigated sites are available in individual printed, unpublished reports.

5.1.2 Characterizing Early Mesolithic sites and artefact assemblages

Following Bjerck's (2008i) divisions of the Mesolithic period, the Early Mesolithic chronozone can be dated to the time span of 9500–8000 cal BC (see also Table 1). The artefact assemblages from Early Mesolithic sites are typologically characterized by a number of distinct types and technological traits. The technocomplex have been refined through many studies (e.g. Bjerck 1983; Bjerck *et al*. 2008; Fuglestvedt 2005, 2007; Kutschera and Waraas 2000; Mikkelsen 1975; Olsen 1992; Waraas 2001) and includes flake-adzes, core-adzes (Lerberg and similar), small tanged points (single-edged and oblique-edged), microliths (lancets and rhombic lancets), micro burins and unifacial cores with opposed platforms and acute striking angle (Fig.2). My chronological determination of the assemblages in study was mainly based on the presence or not of these objects. Additionally, burins, drill-bits (Høgnipen), large irregular blades, large flakes and irregular platform cores and debris from flake-adze production as well as edge rejuvenation are common. Direct technique with soft hammer seems to be dominant (Fuglestvedt 2007; Kutschera 1999), often leaving a large bulb and remnants of the core platform visible in the proximal end. In south and central Norway, flint is by far the most dominant raw material (e.g. Bjerck 1983:30; Møllenhus 1977:153; Olsen 1992:79), but a small amount of quartz, quartzite and rock crystal also appear on many sites. These traits were also taken into consideration when dating the assemblages.

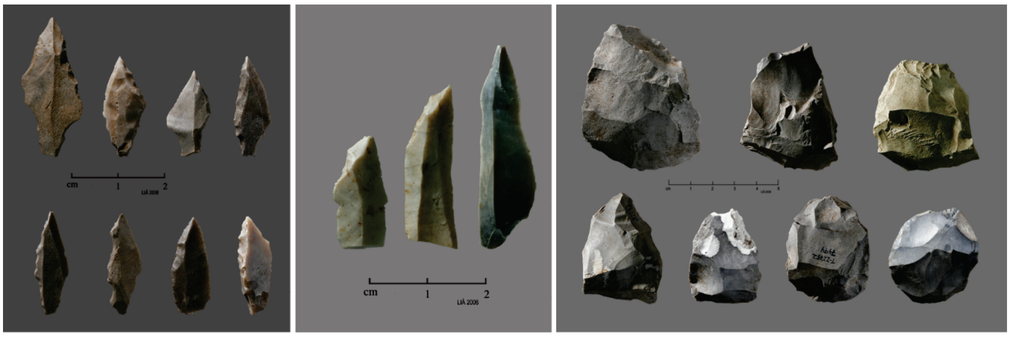


Figure 2: Some Early Mesolithic diagnostic artefacts. From left: Tanged points, microliths, flake-adzes. The artefacts are from Ormen Lange Site 48. Illustrations from Bjerck *et al*. 2008:225–227, Figs. 3.222, 3.223 and 3.220.

5.1.3 Procedure and results

My text and data mining for Early Mesolithic sites and artefacts is based on Svendsen's list of search terms (Svendsen 2007b, Appendix C). His list mainly builds on the diagnostic technocomplex of this period (see above). As the Norwegian language is under constant change, and the classification keys we use today have been developed through a long history of research, we find other terms to describe our well-incorporated categories in the collection catalogues and publications from early 20th century. Svendsen's list is designed to capture both old and new classification terms. It also includes more generic search words in order to detect Early Mesolithic artefacts and sites that are not classified by using the contemporary terminology. With regards to the time frame of the project, these generic terms were not applied in my own work. A complete list of the 66 (Norwegian) search terms applied is presented in Appendix F.

The .txt-documents from 1871–1981 were approached through the text editing program TextPad, version 5.4.2. This program allows you to search through multiple files simultaneously after typing your search term. The .pdf-documents from 1982–1988 were opened individually, and each of the search terms were typed in the search box. The procedure was repeated in the National Artefact Database. In the simpler digital register, I merely searched for the relevant chronological periods, as information on the artefacts is missing. Additionally, colleagues have helped by advising me about sites that were missing from my lists. Although a complete overview of Early Mesolithic sites in the region has been aimed for here, there are surely more sites that I have not discovered.

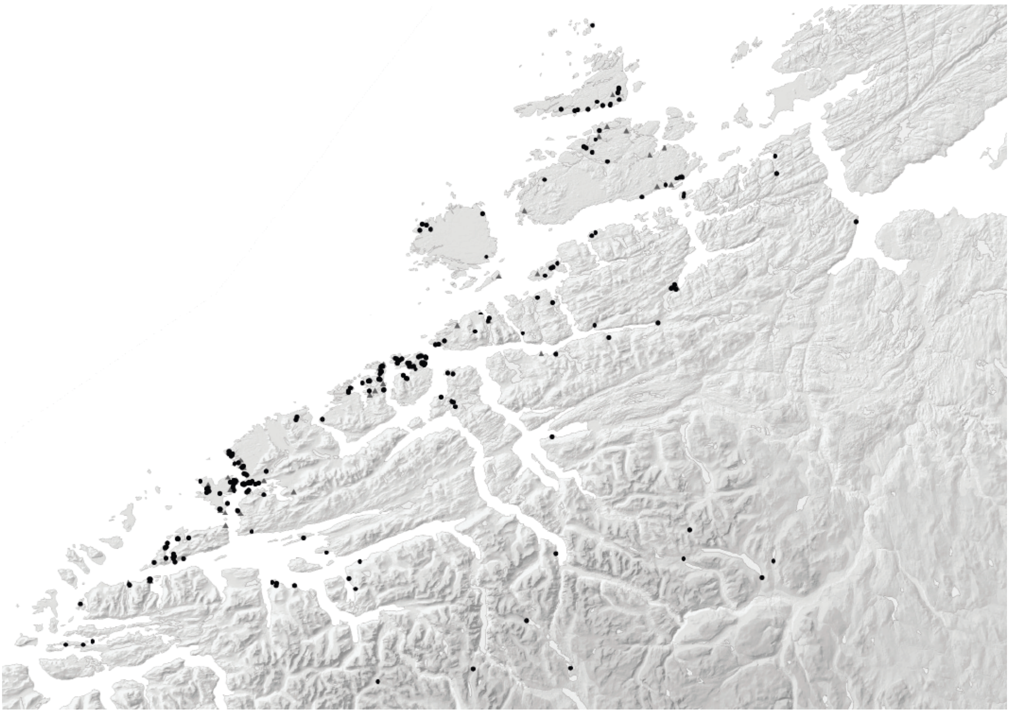


Figure 3: Map showing the distribution of Early Mesolithic sites in Møre og Romsdal and Sør-Trøndelag, where the main concentration of sites can be found. "Certain" sites (sites containing diagnostic artefact(s) and/or radiocarbon dates) are marked with black dots; "uncertain" sites (sites without diagnostic artefacts but dated by shore-displacement curves/raw material/technological traits) are marked with grey triangles. Se Appendix C-1 for a complete map and list of the sites in the region.

My search resulted in over 1200 single entries, of which several belonged under the same identification number. After the sorting process I was left with 950 identification numbers – each containing all from one to several thousand artefacts. These collections were examined with the purpose of confirming or invalidating an Early Mesolithic date. The assemblages already examined and validated by Bjerck (1983), Møllenhus (1977) and Svendsen (2007b) were only in some cases inspected by me. All sites which included one or more diagnostic artefact (flake-adzes, core-adzes, unifacial cores, burins, tanged points, microliths, micro burins) were counted as a "certain" Early Mesolithic site.

I ended up with a potential of 305 sites in the region (Fig.3; see Appendix C-1 for map and list of the sites). This total includes around 53 sites where the material is "uncertain" in terms of an Early Mesolithic date, but they are all sea-level dated to the period (see Chapter 5.1.5 for a discussion about this).

5.1.4 The database

All sites which contained one or several Early Mesolithic artefacts were included in the database. Each site, with all its connected identification numbers, was allocated one sheet in the database where as much information as possible was recorded. The main factors were *location*, *features and site character*, *artefacts* and *dating*. For a full review of the recorded information, see Appendix G.

Location

The Early Mesolithic sites were geographically placed as precisely as possible according to the information provided in the collection catalogues and National Artefact Database. The coordinates were projected in UTM 32. The site elevation was plotted in the cases where it was given. The macro-topographical location was roughly outlined, and information about micro-topographical conditions was added where available.

Features and site character

Information about features and on-site stratigraphy was recorded. It was also noted whether the site consisted of one concentration, several units, or if the lithics were found scattered over a larger area. This was only relevant for excavated or surveyed sites.

Artefacts

Emphasis was put on counting and describing the diagnostic artefacts. My classifications were based on Andersson *et al*. (1975) and Helskog, Indrelid and Mikkelsen (1976). Only a superficial overview was given for the rest of the material in the assemblage. Several of the sites also contained artefacts from other periods. In these cases the younger elements were registered and roughly dated, and it was evaluated whether the site seemed to have been used for a longer time span or on several occasions. The raw material types were registered.

Dating

As very few of the sites was radiocarbon dated, the age was tentatively determined by the use of shore-displacement curves. The isobase values for the sites were retrieved from Mangerud and Svendsen (1987:115, Figure 2). Shore-displacement curves were then calculated by using a program designed by David Simpson (SeaLevelCurveSunm-STrondelag_v2.xls, 2003) (see Appendix H for isobases and shore-displacement curves in central Norway). Only the sites with information about site elevation could be dated.

Additionally, information on how, when and by whom the site was discovered was recorded. For professionally investigated sites, more comprehensive descriptions were added.

5.1.5 Problems and issues related to the sites and assemblages

Several issues were encountered in my work with the artefacts and sites.

Accuracy in geographical mapping information

Many of the assemblages lacked sufficient mapping data and could be geographically placed only within the boundaries of the named farm. Their location was still regarded as adequate for the purpose of regional and national distribution maps, though not for micro-topographical reflections. In many cases the elevation of the site was inaccurate or left out from the descriptions in the catalogue. These sites could not be dated by shore-displacement curves, and were merely classified as 'Early Mesolithic'. The level of accuracy in mapping information was described for each site in the database.

Assemblages from the same area, collected on different occasions

In cases where two or more artefact assemblages evidently were retrieved from roughly the same location, it could be difficult to decide whether they were collected from the very same archaeological site, or from different occupations within the same area. This was particularly problematic where farmers had been gathering objects from their property over many years. In cases where this matter could not be determined, the assemblages (with their respective identification numbers) were allocated to the same site. In cases where it was apparent from the catalogue texts that the assemblages were found on different places of the property, they were recorded under different site numbers – e.g. "Kleiven (1)" and "Kleiven (2)".

Identification numbers associated with the sites

As far as possible, I have tried to include all identification numbers that are associated with each site in the database. Also numbers connected to the site that do not contain Early Mesolithic artefacts are included, though not all of these assemblages are examined by me. It is important to note that there also may be additional identification numbers associated with the sites.

Classification of artefacts

Numerous times, it was challenging to decide on the typological classification of the artefacts. The reason could be that the artefact was fire-cracked, water-rolled or damaged in any other way, but it could also be that the artefact held unclear morphological traits, or that the criteria defined in the classification system was not completely fulfilled. An evaluation was made on the basis of the complete assemblage from the site. The most doubtful cases, where the object in question was the sole Early Mesolithic indicator on the site, were categorized as "uncertain" in the database. The uncertain sites were included (but separated from the "certain" sites by using a different legend) in my site distribution map in Paper 3 (Breivik 2014), but were otherwise excluded from my analyses (see Fig.4).

Shore-displacement dating

Shore-displacement dating relies on the comprehensive knowledge about the nature of land uplift and sea-level fluctuations in the late Pleistocene–Early Holocene period (e.g. Hafsten 1983; Møller 1987; Svendsen and Mangerud 1987). Due to differences ice thickness, and geological and topographical conditions during the last Ice Age, there are great geographical variations in isostatic rebound and sea-level fluctuations, resulting in a gradual alteration in isobase-levels and sea-level curves as you move along the coast or from coast to inland (see Appendix H). Isobase-levels and shore-displacement curves are interpolated from sites sampled and dated for this purpose, and are thus estimates rather than accurate measurements. The estimates in central Norway are mainly founded on data collected by Svendsen and Mangerud (1987). The dating method builds on the assumption that the archaeological sites in question were situated close to the contemporary shoreline. As a rule, the shore-displacement curves provide us with the oldest possible date of the site: If we were to argue that the site was older than the dated sea-level, we would at the same time state that the people inhabiting the site lived underwater. Sites may, on the other hand, be younger than the dated sea-level, as people could have established their settlements at some distance from the water.

The great meltdown after the Younger Dryas was followed by a severe isostatic rebound, leaving us with a steep shore-displacement curve for the Early Holocene/Early Mesolithic period. From 10000–9000 BP (c. 9500–8000 cal BC) the sea-level in central Norway "dropped" 20–60 m, depending on where you are in the region (based on isobase levels 30–

150; see Appendix H). This is a rate of 1.3–4.0m/100 calendar years, or 2–6m/100 BP years. Taking the gradient of the slope of the site into consideration, the actual distance to the water margin would increase even more rapidly (see Bjerck *et al*. 2008:75-76). Recognizing the close relation between Early Mesolithic settlement location and the presence of good natural harbours (see e.g. Bang-Andersen 1996b, 2012; Barlindhaug 1996, 1997; Bergsvik 1991, 1995; Bjerck 1990), the sea-level fluctuations could change the character (and consequently the attractiveness) of a site in a matter of decades. Sea-level datings from this time span can thus be regarded as quite reliable.

A number of studies, based on radiocarbon dated sites, do point to variations in the distance from the settlement to the shore. Helskog (1978) finds that the Stone Age settlements in Finnmark were situated 2.5–3.0 m asl, while Møller (1987) operates with an average of 4.8 m asl in the same region. Barlindhaug's (1996, 1997) analysis of Early Stone Age settlements in Troms speaks for variations within 2–6 m asl. Several of the Early Mesolithic sites from the Ormen Lange excavations on Aukra on the coast of central Norway were situated 4–5 m above the current sea-level (Bjerck *et al*. 2008). A study from an extended area within the same region shows that while some of the Early Mesolithic sites were located on the beach at the time of settlement, several sites are found 7–10 m above the concurrent sea-level (Årskog 2009). The great portions of water-rolled artefacts recovered from e.g. Ormen Lange Site 51 (Bjerck 2008c) shows that immediate access to the water margin was desired in other cases. In other words, operating with a mean value that is supposed to represent the distance between the site and the water margin in the Early Mesolithic does not solve the dating uncertainties associated with shore-displacement curves.

In my thesis I used shore-displacement curves to date Early Mesolithic sites and artefact assemblages from central Norway. I found it valid for my purposes, which were to give a chronological overview of a relatively large quantity of sites and to investigate temporal trends among these sites (see Paper 2 (Breivik and Bjerck in press) Paper 3 (Breivik 2014) and Paper 4 (Breivik and Callanan in press)).

5.2 Early Mesolithic sites in other regions of Norway

The mapping of Early Mesolithic sites in other regions of Norway largely builds on work conducted within the 'Pioneer network' in the collaborative project 'Joint research'

("Forskning i fellesskap"). The collaborative project was initiated by the five University museums in the country (Museum of Cultural History, University of Oslo; Museum of Archaeology, University of Stavanger; University Museum of Bergen, University of Bergen; NTNU University Museum, Trondheim; Tromsø University Museum, UiT, The Arctic University of Norway), and the 'Pioneer network' includes scholars who work with the earliest settlement phases of Norway.

Within the network, it was decided to map sites where Early Mesolithic flake-adzes had been recovered. Representatives for each region had the responsibility to make a list of relevant sites in their district. The sites were then located and mapped by me. The work resulted in c. 150 sites on a national basis.

Although the map with flake-adzes proved to give a fairly good representation of the distribution of Early Mesolithic sites, it was an aim within my project to get a holistic overview of sites both regionally and nationally. An effort was therefore made to record all known sites with Early Mesolithic inventories. The map was nevertheless a good point of departure for my further chartings of Early Mesolithic sites.

5.2.1 Procedure and results

The timeframe of the project gave me no opportunity to study artefact assemblages in other regions of Norway. The mapping of sites in the rest of the country was thus approached by way of searching published and unpublished literature for sites with Early Mesolithic artefacts (see Appendix C for literature references for each site). The lists of sites retrieved from the literature study were sent to colleagues who kindly verified or rejected my findings and advised me about sites not presented in the mentioned literature.

The review resulted in 466 sites of which 282 included at least one diagnostic artefact and were dated by shore-displacement curves and/or radiocarbon analyses. These were regarded as verified or "certain" sites (see Appendix C for complete lists and distribution maps for all regions). The remaining sites did not include typological markers, but were dated by shore-displacement curves and contained raw materials, and in many cases technological traits, associated with the Early Mesolithic period. Generally speaking, though, the latter sites were of a more "uncertain" character. The uncertain sites were included (but separated from the "certain" sites by using a different legend) in my site distribution map in Paper 3 (Breivik 2014) (see also Fig.4).

Except for the feedback from colleagues, there was not made any attempt to critically assess the classification of artefacts or dating of the sites. This information is thus presented as it is published in literature or verified by colleagues.

5.2.2 Comments to the sites and assemblages

South and southeast Norway (the geographical district of the Museum of Cultural History, University of Oslo) includes the counties of Østfold, Akershus, Oslo, Hedmark, Oppland, Buskerud, Vestfold, Telemark, Aust-Agder and Vest-Agder. Here, 42 sites were verified by the presence of diagnostic artefacts, while 80 sites dated to the Early Mesolithic period lacked such markers. All of these uncertain sites were recovered through survey projects, and found on Preboreal elevations, but the positive test pits did not yield lithic material with conclusive age determination. Most sites which according to shore-displacement curves are located on Preboreal elevations have by later excavations proved to be of Early Mesolithic age. It is therefore highly likely that the 80 uncertain sites can be dated to this period.

Southwest and west Norway (the geographical districts of the Museum of Archaeology, University of Stavanger and the University Museum of Bergen, University of Bergen) comprises the counties of Rogaland, Hordaland, Sogn og Fjordane and Sunnmøre. In southwest Norway (the geographical district of the Museum of Archaeology, University of Stavanger), 81 sites included diagnostic artefacts. 2 other sites were regarded as uncertain due to the absence of datable lithics. In west Norway (the geographical district of the University Museum of Bergen, University of Bergen), 92 sites included diagnostic artefacts and were regarded as verified Early Mesolithic sites. The 15 remaining sites were found on Preboreal elevations, but lacked undisputable typological markers. One of these uncertain sites is a stray find of a possible flake-adze made of green schist; another is a site excavated in the early 20th century, which included a similar adze of the same raw material. The rest of the uncertain sites were recovered through surveys.

The range of diagnostic artefacts in these regions is basically the same as in central Norway, and has traditionally been named the 'Fosna technocomplex' (Bjerck 2008i). In some cases the term 'Zohnhoven points' are applied on projectiles which otherwise would be characterized as microliths (e.g. Fuglestvedt 2007; Prøsch-Danielsen and Høgestøl 1995; Waraas 2001). Large tanged points, or spear points, has also been recorded on some sites (Fuglestvedt 2005; Waraas 2001).

Northern Norway (the geographical district of Tromsø University Museum, UiT, The Arctic University of Norway) includes the counties of Finnmark, Troms and Nordland (north of Helgeland). Here, 67 sites included diagnostic artefacts. 88 more sites were regarded as uncertain due to the lack of clear typological markers or incongruity between the shore-displacement curves and the artefact inventory. Four of the uncertain sites were discovered by Nummedal around 1930. These contained no typological markers. Two other sites that did hold diagnostic artefacts are according to shore-displacement curves and radiocarbon dates likely to belong to the Middle Mesolithic (Schanche 1988:72-77). The rest of the uncertain sites were recovered through systematic surveys.

The Early Mesolithic technocomplex of northern Norway (often referred to as the 'Komsa technocomplex') have a slightly different character than the southern artefact assemblages. Chert, quartz, quartzite, rock crystal and dolomite are more common than flint (Schanche 1988:104-125). In addition to the traditional inventory, discoidal and bipolar cores are common to find on Early Mesolithic sites in north Norway (Hauglid 1993; Hesjedal *et al*. 1996:163; Sandmo 1986:131; Schanche 1988:104; Woodman 1993).

The total number of Early Mesolithic sites in Norway recorded through my work is 771 (see Appendix C; and Fig.4).

6.0 Results and discussion

In the introduction, the following topics and research questions were outlined:

- *Environmental trajectories in the Late Glacial/Post-glacial periods*: What kind of environmental and climatic changes did the terrestrial and marine environments undergo during the Early Mesolithic period?
- *Colonizing the Norwegian landscape*: How and when did people approach the new landscape, and how did they organize themselves and their technology and settlements in order to meet the challenges posed by the varied Early Mesolithic environment of Norway?
- *Adaptive strategies in different and shifting environments*: Do we find changes in adaptive strategies through time, or adaptive variations between different regions and/or ecozones in Norway?
- *Adaptive strategies in similar environments*: Did similar environments on opposite sides of the globe invite to similar mobility strategies, and does the environment structure human behaviour in a predictable way?

In this chapter, the results from my papers will be presented in order to highlight and discuss these issues.

6.1 Environmental trajectories in the Late Glacial/Post-glacial periods

Based on the palaeo-environmental review from the coasts of Norway and Sweden (Paper 3 (Breivik 2014)), it seems appropriate to divide the Late Glacial/Post-glacial period into three time slices: Younger Dryas (c. 10,700–9500 cal BC), Early Preboreal (c. 9500–8800 cal BC) and Late Preboreal (c. 8800–8000 cal BC). The environmental trajectories within these time slices will be presented in the following.

6.1.1 Skagerrak–Kattegat during Younger Dryas (c. 10,700–9500 cal BC)

At the end of Younger Dryas (YD), the terrestrial ice margin extended across, or north of, the Vänern Basin in southern Sweden, around Drøbak in the Oslofjord area, and Grimstad on the south coast (Fredén 1988; Gyllencreutz 2005). The coastal fringes along the Skagerrak strait appeared as clusters of islands in the regions of Bohuslän and Østfold. The landmass west of the Oslofjord was almost completely ice-covered at this time (Glørstad 2013, 2014; Schmitt *et al*. 2006), but large areas of land were exposed along the southern and western seaboard (Andersen and Borns 1994:75-76; Anundsen 1996).

The North Sea was greatly affected by glaciers and meltwater in the Pleistocene–Holocene transition. The final draining of the Baltic Ice Lake c. 9600 cal BC, discharge through Vänern Basin/Uddevalla strait and meltwater from the retreating Oslofjord glacier (Gyllencreutz 2005) resulted in marine conditions with low temperatures and high freshwater content. Seasonal ice-cover lasting up to seven months is recorded on the southwest coast of Norway at the end of Pleistocene (Rochon *et al*. 1998) – a scenario that may have been even more severe in the Skagerrak–Kattegat region. This region probably hosted large areas with firm ice-cover in the cold season, and in summer mostly open, cold sea with loose ice drift, into the Early Holocene period (Bjerck *et al*. in press).

Low vegetation consisting of grasses, herbs and bushes existed at the close of the YD in southwest Sweden. A pioneer forest vegetation of *Betula* was rapidly immigrating at the beginning of the Holocene. In open places probable remnants of the light-demanding Late Weichselian vegetation persisted for some time (Digerfeldt and Håkansson 1993). Pollen samples from Rogaland County in Norway likewise demonstrate sparsely developed communities of juniper, *Artemisia*, the shrub species *Empetrum* and the herb *Filipendula* around 10,500 cal BC (Paus 1995). A similar development probably occurred in exposed land also elsewhere in southern Norway.

Faunal remains from the Skagerrak–Kattegat region suggest a rich marine fauna in this period. Of pinnipeds, ringed seal (*Phoca hispida*), harp seal (*Phoca groenlandica*) and walrus (*Odobenus rosmarus*) were frequent until the terminal Pleistocene. Finds of bearded seal (*Erignathus barbatus*) from the same period have been made in southern Sweden. Several cetaceans probably also inhabited these waters: white-beaked dolphin (*Lagenorhynchus albirostris*), killer whale (*Orcinus orca*), harbour porpoise (*Phocoena phocoena*), beluga whale/narwhale (*Delphinapterus leucas/Monodon monoceros*), sperm whale (*Physeter macrocephalus*), common minke whale (*Balaenoptera acutorostrata*), bowhead whale (*Balaena mysticetus*). Polar bear (*Ursus maritimus*) is known from the region, and of terrestrial mammals, reindeer (*Rangifer tarandus*) and arctic fox (*Vulpes lagopus*) are known from the Swedish west coast (Aaris-Sørensen 2009; Fredén 1975; Jonsson 1995).

From Norway, an almost complete skeleton of a polar bear found in Rogaland has been dated to the early YD (Hufthammer 2001). An antler of reindeer from the same region is dated to the end of YD (Grøndahl *et al*. 2010). Skeletal parts of ringed seals are retrieved from two Late Weichselian contexts in central and west Norway (Hufthammer 2001). A range of cold tolerant bird and fish species were certainly also present along the Swedish and Norwegian coasts. Polar cod (*Boreogadus saida*), cod (*Gadus morhua*) and bullsheads (*Cottidae*) are known from Weichselian contexts in western Norway as are coastal bird species like fulmar (*Fulmarus glacialis*), king eider (*Somateria spectabilis*), puffin (*Fratercula arctica*), arctic skua (*Stercorarius parasiticus*), common gull (*Larus canus*) and kittiwake (*Rissa tridactula*) (Hufthammer 2001).

The palaeo-environmental data thus paints a picture of an arctic environment with ample marine resources prior to the initial colonization of Norway (see Paper 3 (Breivik 2014)). The terrestrial landmass was quite limited, due to the extension of the ice sheet and the higher sea-level, and was dominated by islands and islets. During winter, the islands would probably be interconnected by firm ice-cover, providing new possibilities for hunting and travelling. During summer, boats were required for the same tasks.

6.1.2 Norway during the Early Preboreal phase (c. 9500–8800 cal BC)

The transition from YD to Preboreal is described as a severe and rapid climatic event (Burroughs 2005:43-47). On the continent temperatures rose rapidly, the ice sheet was diminishing, tundra turned into grasslands and then forests. On the Scandinavian Peninsula, the ice lingered long into the Preboreal phase, and the environment was still influenced by cool temperatures, meltwater and ice during the first few centuries of this period. Many of the large fjords were still glaciated and/or were transporters of meltwater from the diminishing ice sheet. This probably caused seasonal freezing scenarios in adjacent waters. In northernmost Norway (Finnmark County), more severe freezing is recorded, as the ice-cover in the southwest Barents Sea extended further south than today. This would have caused conditions similar to the YD situation in the Skagerrak–Kattegat region. In zones with more or less permanent ice-cover, polynyas – areas of open water surrounded by ice – could have been formed. In most other regions, the coastal conditions are reported to be cool but ice free (Paper 3 (Breivik 2014)).

Large areas of land were exposed along the Norwegian coast at the beginning of Early Preboreal. While southeast Norway and long stretches of the western seaboard was mainly made up of small islands, some regions included exposed lowland and alpine areas: southwest, central and north Norway. At 8800 cal BC, substantial parts of the country were ice free, although parts of the inland were still glaciated.

During the first Preboreal phase, light-demanding, low vegetation was still dominating in most regions. Pollen of birch tree (*Betula*) is identified in great amounts at c. 9500 cal BC in Rogaland County. In the most exposed outer coastal areas, the open vegetation persisted, probably due to strong winds (Paus 1995). On the island of Tromsø, in north Norway, birch (*B. pubescens* and *B. nana*) was likewise established already at 9500 cal BC. Equally early dates farther north in central and eastern Finnmark suggests an eastern immigration of the tree species in this region (Fimreite, Vorren and Vorren 2001).

An abrupt cold event, referred to as the Preboreal Oscillation, is documented in north Europe at 9300–9200 cal BC. The Preboreal Oscillation (PBO) had widespread ecological consequences that must have been noticeable to humans occupying Norwegian landscapes: air and sea temperatures plummeted, vegetation diminished, and terrestrial ice sheets re-advanced. It may also have caused longer lasting seasonal ice covers in sheltered waters and fjords.

From the reconstructed climatic and environmental conditions we can gather that the arctic fauna referred to in the section above was still frequenting the Norwegian coast in this phase. Ice-obligate species (polar bears, walruses, bearded seals, and ringed seals; see Moore and Huntington 2008) would thrive in the frozen waters during the coldest months. An almost complete skeleton of a bearded seal from the Trondheimsfjord in central Norway has recently been dated to c. 9300 cal BC (Rosvold and Breivik in press). In northernmost Norway arctic sea mammals may have found suitable habitats throughout the year. The terrestrial animal population was certainly increasing in size as more land became available.

6.1.3 Norway during the Late Preboreal phase (c. 8800–8000 cal BC)

Around mid-Preboreal an environmental shift seem to have occurred, as the glacier retreated from fjords and the Norwegian Atlantic current became well established along the Norwegian coast. The arctic climate gave way to warmer conditions and the oceanic regime stabilized and became more like the present, meaning less meltwater influx and more input of warm and salty water masses. In the northernmost region, however, cold conditions lingered.

During the Late Preboreal phase a gradual change in the vegetation structure is identified. From being largely dominated by low vegetation, birch stands now became established in all regions: Betula was present in the Oslo area and southernmost Norway by 8800 cal BC; on the west coast, near Bergen, at 8600 cal BC and in Sogn og Fjordane County at c. 8900 cal BC. Near Trondheim, in central Norway, samples have been dated to 8600–7800 cal BC. Microfossil samples from inland sites indicate the presence of birch by 8000 cal BC in the Dovre region, and 8800–8000 cal BC on the southern Hardangervidda plateau. Mitocondrial DNA of spruce (*Picea*) dating to 8300 cal BC has recently been detected from lake samples in Trøndelag (Parducci *et al*. 2012). The environmental shift midway through the Preboreal phase had an impact on both marine and terrestrial fauna. Ice-obligate marine mammals would have been pushed northward as the temperatures increased and the ice dissolved. At the same time, gray seal (*Halichoerus grypus*) probably immigrated. New fish species would find their way into Norwegian waters, and a more diverse avian fauna is expected. As tree populations were established, terrestrial animals associated with Norwegian woodlands would migrate: i.e. wolf, bear, fox, wolverine, and lynx. An elk (*Alces alces*) antler from Fluberg in Oppland county, in the interior of southeast Norway, has been dated to the time span 8450–8250 cal BC (Grøndahl *et al*. 2010).

The palaeo-environmental review from the Late Glacial/Post-glacial period thus speaks for quite severe changes, not only in the transition from YD to Preboreal but also *through* the Preboreal timespan. As such, the Preboreal can be considered as a 1500 years long transition phase from a cold to a mild climate.

6.2 Colonizing the Norwegian landscape

At present, the archaeological record from the Early Mesolithic period of Norway potentially comprises close to 800 sites (Paper 3 (Breivik 2014); Fig.4). Shore-displacement curves and radiocarbon dates place them within a span of 1500 years (9500–8000 cal BC) (e.g. Bjerck 2008i). It has been debated whether we have sites that reach even farther back in time. The sites of Galta 3 and Sarnes B4 are central in this discussion (see Blankholm 2004; Fuglestvedt 2007; Prøsch-Danielsen and Høgestøl 1995; Thommessen 1996b). Also a few single artefact finds, lithic assemblages and bone deposits have tentatively been attributed to the Paleolithic period. In a critical evaluation of the morphology, nature and contexts of the finds, however, Bjerck (1994) concludes that none of them can be taken as certain evidence for a Paleolithic occupation of Norway. The same conclusion has been reached by other authors who have studied this material (see e.g. Eigeland and Solheim 2012; Glørstad and Kvalø 2012).

Based on radiocarbon dated sites, Glørstad (2013, 2014) has argued that the colonization of Norway took place shortly after the Preboreal Oscillation (PBO) 9300–9200 cal BC. It may be opposed, however, that the ten dated sites hardly provide a representative picture of the chronological distribution of Early Mesolithic sites. Taking shore-displacement datings into consideration, numerous sites from central Norway are very likely older than the PBO (see Appendix A for a list of sites dated by the use of shore-displacement curves). Some of the sites that according to the diagram can be dated to 10,000-9800 BP (c. 9500–9300 cal BC) have a substantial portion of water-rolled artefacts, indicating a position very close to the contemporaneous water margin and thus lending credibility to the age determination (Paper 2 (Breivik and Bjerck in press)). Consequently, I find it appropriate to maintain that the initial colonization of Norway took place around 9500 cal BC, shortly after the YD cold event, as postulated by Bjerck (1995).

The archaeological record of Early Mesolithic Norway points towards a 'streaming' colonization pattern, as described by Rockman (2003; see Chapter 4.3.2), rather than an even, wave-like expansion: There is no obvious starting and ending point for an 'advancing front' – the archeological record instead shows great similarity over vast distances. Neither does the present dating evidence show a gradual expansion from one direction to the other – the earliest radiocarbon datings from northern Norway are just as old as the ones farther south, suggesting a rapid colonization over long distances (Bjerck 1995:138). The concentration of sites some places, and the absence other places, furthermore makes the even, wave-like expansion doubtful, and the streaming pattern more plausible.

Figure 4: Map showing the distribution of Early Mesolithic sites in Norway. "Certain" sites (sites containing diagnostic artefact(s) and/or radiocarbon dates) are marked with black dots; "uncertain" sites (sites without diagnostic artefacts but dated by shore-displacement curves/raw material/technological traits) are marked with grey triangles (See Appendix C for a complete list of the sites).

Based on similarities between settlement patterns (Kindgren 1995; Schmitt *et al*. 2006, Schmitt *et al*. 2009), technology, and tool inventories (Fischer 1996; Kindgren 1996; Schmitt 1994) it has been argued that the earliest Norwegian cultures have their direct origins in the south Swedish Hensbacka culture (c. 10,000–8500 cal BC). From the distribution of sites, it seems that marine resources were the staple in the Hensbacka groups' subsistence: the majority is located in the archipelago, in relation to topographical features that would enhance marine productivity. It has been suggested that this rich marine environment was the initial attractor for the first humans that settled this land area (Fischer 1996; Kindgren 1995; Schmitt *et al*. 2006, Schmitt *et al*. 2009). The Late Glacial/Post-glacial oceanic conditions in the Bohuslän archipelago have been investigated by Schmitt (Schmitt *et al*. 2006, Schmitt *et al*. 2009; Schmitt 2015). He emphasizes that the sediment types, the complex topography, the strong tidal exchanges, mixing between Atlantic water and shallow glacial meltwaters, and mild climate create good conditions for juvenile fish of the species capelin (*Mallotus villosus*) and herring (*Clupea harengus*). Harp seals, ringed seals and bearded seals, as well as deep water cod fish, all of which were around at this time (Aaris-Sørensen 2009, Fredén 1975, 1988; Jonsson 1995), are known to exploit these fish resources. They would also attract baleen whales and sea birds (Schmitt *et al*. 2006, Schmitt *et al*. 2009).

Several authors have argued for a gradual incorporation of the west coast of Sweden and its resources – probably on a seasonal basis – in the Late Glacial period (Bjerck *et al*. in press; Cullberg 1996; Kindgren 1996; Schmitt 1994, 1999; Schmitt *et al*. 2009; Welinder 1981). The earliest exploitation of this area may have been based on marine resources accessible from land or ice, as suggested by Bjerck *et al*. (in press). Here, pinnipeds are proffered as an attractive resource with their meat, blubber, skin, bones and tendons, and it is further proposed that this animal became an increasingly important element in the forages' lives. An eventual dependency on this animal suggestively initiated the development of a maritime technology and knowledge about marine environments and resources sufficient to exploit the seascapes efficiently. The expansion into the Norwegian landscapes is by the authors regarded in light of this development (see also Bjerck 2008i). The increase in the use of the outer archipelago of the Swedish west coast during Late Hensbacka phase (after 9700 BP) (Kindgren 1995) substantiates this model. Moreover, the small islands in the Stockholm archipelago were occupied almost as soon as they emerged, and marine resources – gray seal in particular – were exploited throughout the whole Mesolithic (Pettersson and Wikell 2006, 2014). Thus, the Bohuslän region might have acted as a point of departure both for the colonization of Norway and the small islands of eastern Sweden. In Paper 3 (Breivik 2014), I found relations between archaeological site density and productive marine habitats. The fact that the most rewarding patches (according to the chosen subsistence focus) were sought out, indicates that the initial occupation of Norway was carried out by conscious movements toward certain habitats, grounded in knowledge about marine productivity and animal behaviour. This would fit the models outlined above.

As the marine foragers were moving into pristine land in the Early Holocene, they entered a familiar landscape with resources similar to that of the Swedish west coast. Yet, along the Norwegian coast they also faced a landscape configuration that was radically different from the open, flat landscapes of the Northwest coast of Europe and around the North Sea basin. Behind the rich shorelines, skerries and islands of southwest Norway lay high alpine peaks and mountain plateaus that were clearly visible from the coast. Not only were the distances between these landscapes relatively short, in many cases they were also connected by long fjord arms that were easily navigable. Although the distribution of Early Mesolithic sites clearly shows that colonizers relied heavily on coastal environments and marine resources, it also shows that the mountain landscapes in southwest and central Norway were taken into use as part of the colonization process. Our study of 12 Early Mesolithic sites and assemblages in coastal and mountain contexts (Paper 4 (Breivik and Callanan in press)) suggests that the mountain sites are of a similar size and structure to those used on the coast. Some ecozone-specific variations in the artefact inventories with respect to type frequencies are visible among the material. Yet the lithic package that we see in the mountains is made of elements that originate from the broader repertoire seen on the coast, and the basic form and size of the technical pieces in question are the same. There is thus no clear evidence, in the lithic material at least, for any technological adaptation towards a particular ecozone. The colonizers made use of several risk-reducing strategies (see Chapter 4.3.2). In addition to seeking out the most productive habitats, they moved around in small groups, kept a high residential mobility and employed a standard, generalized lithic technology. This strategy enabled the colonizing groups to overcome the risks and difficulties associated with settling and seeking out resources in new and unknown landscapes.

6.3 Adaptive strategies in different and shifting environments

The Early Mesolithic was a period of great climatic and environmental changes (see above). Also, the Norwegian landscape provided regional variations in topography, vegetation and fauna. It has been demonstrated that changes in climate and resource situations may lead to alterations in settlement patterns and technology (e.g. Crombé *et al*. 2011; Riede 2009; Tallavaara and Seppä 2011; see also Chapter 4.3.2). In Paper 3 (Breivik 2014), archaeological material from central Norway was chronologically arranged and set against the environmental trajectory in order to look for coinciding patterns. In the same study, it was explored whether geographical variations across Norway lead to different adaptive strategies. In Paper 4 (Breivik and Callanan in press) adaptations across ecozones were examined. The results, concerning human adaptation strategies in relation to temporal, geographic and topographic variations in climate and environment, will be discussed in Chapter 6.3.1–6.3.3 below.

6.3.1 Human adaptations in a temporal perspective

The environmental shift that occurred midway through the Preboreal period (c. 8800 cal BC), created conditions suitable for new animal species (see above). It must also have caused changes in, and displacement of, habitats, and a general stabilization of the marine and terrestrial conditions seems to have occurred. Such changes may hypothetically lead to alterations in hunting strategies (as expressed through tool technology/inventory) and site location patterns from one phase to another, in order to exploit landscapes and resources in the best manner.

The analyses in Paper 3 (Breivik 2014) suggested that the lithic technology and tool inventory remained more or less unchanged throughout the period (Fig.5). However, a change in the site distribution pattern could be identified; from almost exclusively exposed locations (in the outer archipelago, oriented towards the open sea) in the first phase, to an increasing number of sites with retracted locations (in fjord basins or sheltered sounds, oriented towards the mainland) in the second phase (Fig.6). A similar change in location pattern is previously proposed for southwest Norway (Waraas 2001:105).

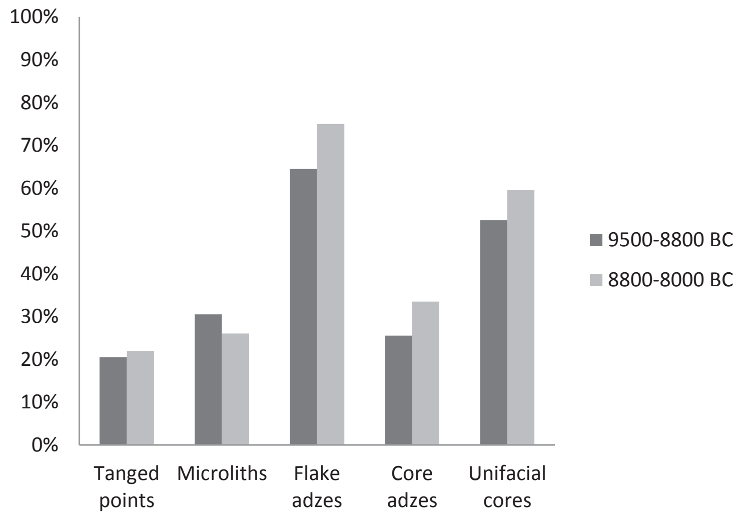


Figure 5: The percentage of sites with tanged points, microliths, flake-adzes, core-adzes and unifacial cores in the Early and Late Preboreal phases. The calculations are based on 86 sea-level dated sites from central Norway (9500–8800 cal BC: N=59; 8800–8000 cal BC: N=27; see Appendix A for a list of the sites). The diagram shows that the tool inventory remained more or less unchanged throughout the Early Mesolithic period.

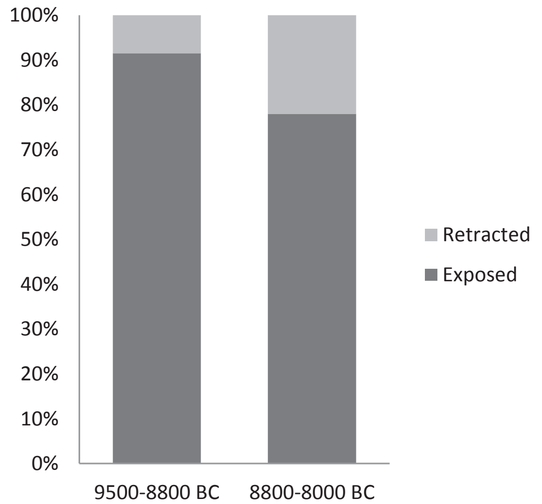


Figure 6: The percentage of sites with retracted (in fjord basins or sheltered sounds, oriented towards the mainland) and exposed (in the outer archipelago, oriented towards the open sea) location in the Early and Late Preboreal phases. The calculations are based on 86 sea-level dated sites from central Norway (9500–8800 cal BC: N=59; 8800–8000 cal BC: N=27; see Appendix A for a list of the sites). The diagram shows that there are an increasing number of sites with retracted location in the second phase.

It has been argued that changes in settlement patterns – in terms of both location and duration – during the Middle and Late Mesolithic phases express alterations in subsistence strategy partly connected to environmental changes (e.g. Bergsvik 1995; Bjerck 1990; Indrelid 1978; Lindblom 1984; Nygaard 1990; Olsen 1992). The present study (Paper 3 (Breivik 2014)) not only suggests that environmental changes and shifts in settlement patterns are highly related; it also suggests that the implementation of new species and new habitats may have started already toward the end of the Early Mesolithic period.

In addition to the gradual shift outlined above, the more abrupt cold event (the Preboreal Oscillation (PBO)) occurred at 9300–9200 cal BC (see above). The climatic changes would have affected the dispersal and composition of animals, as their habitats were rapidly altering. As a work hypothesis, this abrupt climatic event was expected to cause a decline in population density, as measured by a descending trend in site numbers. The analysis in Paper 3 (Breivik 2014), however, did not reveal direct relations between the PBO and a decline in site numbers (Fig.7).

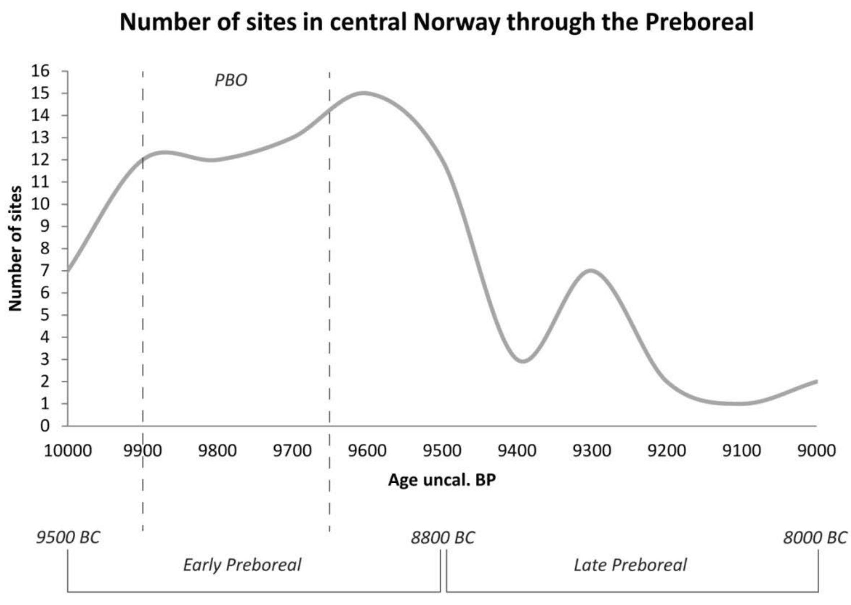


Figure 7: Changes in site density through the Early Mesolithic period. The diagram shows no direct relations between the Preboreal Oscillation (PBO) cold event and a decline in site numbers. The calculations are based on 86 sea-level dated sites from central Norway (see Appendix A for a list of the sites).

It must be noted that the final stages of the period are hampered by non-cultural factors as the relatively low elevations on which the youngest sites are found may be affected by the Tapes transgression (see e.g. Bjerck 1986). The strong declining trend at the end of the Early Mesolithic seen in Figure 7 must therefore be considered with caution. Still, an argument for a decrease in site number in relation to the PBO could not be sustained. On this basis, it was suggested that either did the cold event have a minor impact on the resource base, or that the humans were able to adapt to rapidly changing resource situations. In fact, both conclusions are probable. Recognizing polar marine environments as highly productive (see Chapter 3.4) would propose that the coastal zone provided ample resources also during climatic cold events. The latter conclusion will be discussed below.

6.3.2 Human adaptations in a geographical perspective

The palaeo-environmental data presented in Paper 3 (Breivik 2014) suggests that there were regional variations in the Preboreal conditions. Much of the western seaboard experienced the gradual shift from arctic to subarctic conditions outlined above. A similar development is recorded in southeast Norway, but here the earliest phase was characterized by unstable hydrological conditions, with large portions of freshwater draining into the Skagerrak–Kattegat area in periods when the Baltic Sea was not completely dammed. Another trajectory is recorded in northernmost Norway, where stable and cool conditions lingered throughout the period.

It is likely that the oceanic conditions created comparable resource situations along the coast of central and southern Norway, as well as in western Sweden. The colder climate and more severe seasonal freezing in northern Norway, on the other hand, may have resulted in a more restricted distribution of marine species, inviting to a different approach to the landscape in terms of hunting strategies and settlement patterns.

The analysis in Paper 3 (Breivik 2014) interestingly showed certain differences in choice of site location in northernmost Norway compared to the rest of the country: while the outer archipelago seemed by far to be the most preferred location in central, southwest and southeast Norway, there are relatively large numbers of sites in fjord areas and along protected channels in north Norway (Fig.8). Again, we have to handle the site distribution data with caution: The Preboreal shorelines in outer parts of Troms and western Finnmark are greatly affected by transgressions, meaning that sites from this region may be eroded or superimposed (see Møller 1986). Nevertheless, the larger number of retracted sites in this region is still evident, and it is plausible to think of these as camps related to winter/spring hunting of ice-obligate marine mammals on frozen water.

Figure 8: Map showing the distribution of sites in northern Norway. On a national basis we can see certain differences in choice of site location: In northern Norway there are relatively large numbers of sites in fjord areas and along protected channels, compared to the rest of the country. "Certain" sites (sites containing diagnostic artefact(s) and/or radiocarbon dates) are marked with black dots; "uncertain" sites (sites without diagnostic artefacts but dated by shore-displacement curves/raw material/technological traits) are marked with grey triangles (See Appendix C-4 for a complete map and list of the sites in the region).

In other studies it has been discussed whether the north Norwegian Early Mesolithic artefact assemblage differs considerably from the technocomplex of south and central Norway (Blankholm 2004; Hauglid 1993; Olsen 1994; Woodman 1993). Bipolar technique and discoidal cores are common in Troms and Finnmark counties (Bjerck 2008i with reference to Sandmo 1986:131; Schanche 1988:104; Hesjedal *et al*. 1996:163; Woodman 1993). Bipolar cores are also found in Saltstraumen, Nordland (Hauglid 1993). Microliths and arrow points are reported to be infrequent compared to the south Norwegian material (Hauglid 1993:144-145; Schanche 1988:104-125). Presently, however, there seems to be an agreement that the technological differences are related to the raw material from which the artefacts are produced (Bjerck 2008i:86): Chert, quartz, quartzite, rock crystal and dolomite are more common than flint in the northernmost regions (Schanche 1988:104-125). The technological differences thus seem to reflect the local geological conditions rather than an adaptation to another climate and food resource situation.

Returning to the discussions in Paper 3 (Breivik 2014), small geographical variations are also evident between central and southern Norway: the material from central Norway demonstrates temporal stability in tool types, technology and raw materials, while on the southwest and southeast coasts there seem to be a shift from the use of tanged points to microliths in the Late Preboreal phase (e.g. Kutschera 1999). Whether this development is connected to the contemporaneous environmental shift is currently unclear, but the fact that this technological shift does not appear in central Norway suggests that it is not directly related to changing resource situations. The local changes in tool composition, together with the high density of sites in Rogaland and Hordaland counties compared to adjacent regions, has given rise to hypotheses about the start of a regionalization process already in the Late Preboreal period (Waraas 2001:110).

6.3.3 Human adaptations in a topographical perspective

The Early Mesolithic site distribution pattern in Norway shows that different ecozones were exploited during the period. In Paper 2 (Breivik and Bjerck in press), we distinguished between four topographical zones in which the currently recorded 244 sites of central Norway are situated (Fig.9; Appendix B; see also Svendsen 2007b).

Zone A: The outer archipelago: This zone is characterized by islands and peninsulas situated in the outermost coastal zone. According to the palaeo-oceanographic review in Paper 3 (Breivik 2014), the outer archipelago seems to have been the most productive zone during the Early Mesolithic period. Meltwater draining from the receding ice through fjords would have benefitted productivity by creating phytoplankton blooms in the downcurrent wake of the islands. The islands would almost certainly have housed colonies of seals and birds, and a variety of fish species is also expected in this environment. Species associated with pelagic waters could have been encountered in the outermost zone. In central Norway 87% of the sites are found in this zone.

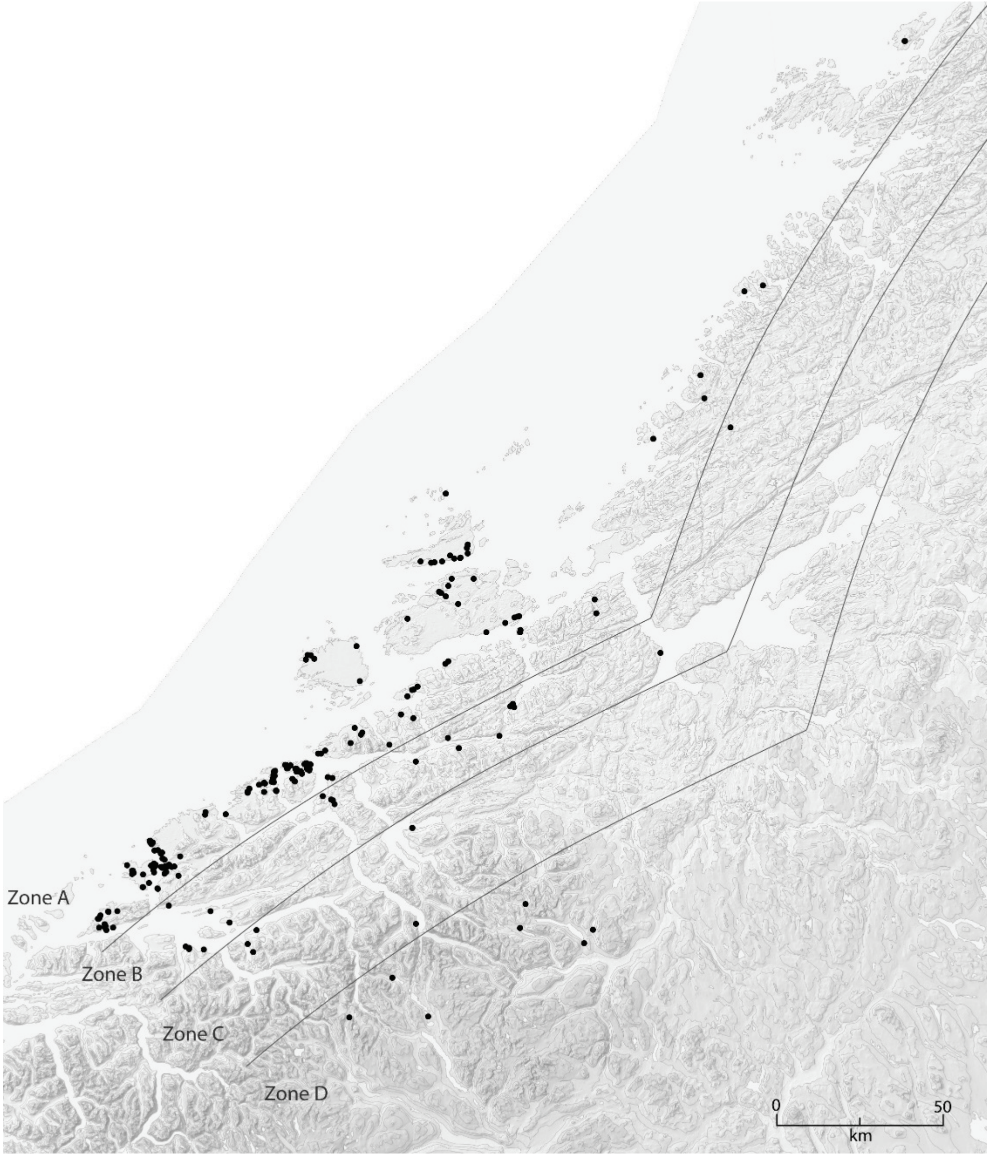


Figure 9: Map showing the distribution of 244 Early Mesolithic sites in central Norway according to macro-topographical zones: Zone A: The outer archipelago (87% of the sites); Zone B: Around fjord heads or retracted channels (8% of the sites); Zone C: Inner fjord areas (2% of the sites); Zone D: Mountain (3% of the sites). See Appendix B for a list of the sites.

<ins>Zone B: Around fjord heads or retracted channels</ins>: This zone is found in the transition between mainland and archipelago, between fjords and open sea. In the Preboreal period, this would be a fruitful sector where meltwater from the fjords would mix with the warmer and

saltier water masses found along the coast. In the Late Preboreal period, this zone would have provided stable conditions for fish and other marine species (Paper 3 (Breivik 2014)). In central Norway, 8% of the sites are situated in this zone.

<u>Zone C: Inner fjord areas</u>: This zone is found around the inner parts of the long fjords. The inner fjord areas are generally regarded as less productive than the outer fjord and archipelagic zone during the Early Preboreal. The silty sediments from the draining glaciers would cause poor light conditions for plankton, and nutrient rich water would mix first on its way to the coast (Paper 3 (Breivik 2014)). In central Norway, 2% of the sites are situated in this zone.

<u>Zone D: Mountain</u>: The last zone is characterized by subalpine terrain. The mountain zone was influenced by the retreating glacier during the Preboreal. Low vegetation and snow patches would have provided good pastures for reindeer. Smaller animals, like foxes and hares, would also have thrived in this environment. In central Norway, 3% of the sites are situated in this zone.

On the most coarse scale, we can distinguish between coastal and mountain sites; nationally, 96% of the sites are situated along the coast and 4% in the mountain zone (Paper 3 (Breivik 2014)). The relation between coast and inland sites has been a topic for discussion in Stone Age research (see Chapter 3). In southwest Norway, 20 mountain sites around the lakes of Myrvatnet and Fløyrlivatnet in Rogaland have been dated to Early Mesolithic by radiocarbon and/or typology (see Appendix C-2). The excavations, which were conducted during the 1980s and 1990s, gave details about time of occupation, palaeo-environment and intra site matters. Bang-Andersen interprets the sites as special purpose camps where hunting activities, performed by task groups with home territories on the coast, were undertaken. He finds it likely that the mountain camps were used during summer and early autumn when the meat and hides of reindeer and elk were at their best. The mountain zone was accessed through fjords and river systems, and he suggests that anadromous fish, which were abundant during summer in this intermediate zone, could have been exploited on the way (Bang-Andersen 1990, 1996a, 2003b, 2012).

A similar model is proposed for central Norway. Here, seven sites are recorded in mountain contexts (see Appendix B and C-1 for information about the sites). The large amount of sites situated in the archipelagic zone is attributed to an exceptionally rich marine environment (e.g. Bjerck 2007, 2008i, 2009a; Bjerck *et al*. 2008), while the mountain sites are interpreted as camps mainly related to reindeer hunting (Gustafson 1986, 1988; Svendsen 2007b). Svendsen suggest that the few fjord sites found in the region may be related to fishing and terrestrial hunting, as these marine environments are less productive than the outer coast (Svendsen 2007b:74-87). Fjord sites can also represent intermediate stations between coast and mountain, as suggested for the Geita site in the Trondheimsfjord area (Pettersen 1999).

In the Varanger area in northern Norway, the Mesolithic settlement pattern is suggested to reflect a highly mobile lifestyle with movements between the inner fjord-bottom during winter and the outer fjords and coast during summer, when marine resources were more abundant (Odner 1964; Schanche 1988). Another interpretation is that the sites in the inner fjord are maintenance sites, while sites in the outer fjord areas are procurement sites (Bølviken *et al*. 1982). In his work about the Early Mesolithic site Målsnes I in the Malangenfjord Blankholm (2008) see the site as a part of a settlement system which is largely focused on the outer coast and inner fjord systems. He promotes a seasonal pattern where the coast is used during winter and interior lakes and rivers during mid-summer. Inner fjord systems were utilized early summer and autumn, on the way to and from the outer coast. More generally it is, like for central Norway, suggested that inner fjord sites reflect a focus on terrestrial resources while the more exposed coastal sites are oriented towards marine resources (Olsen 1994:38).

These very different environments and resource situations would have demanded different approaches that may be reflected in the archaeological record. In Paper 4 (Breivik and Callanan in press) 12 sites and artefact assemblages (see Appendix D for overview of the analyzed sites) from the outer archipelagic zone and the mountain zone in central Norway were compared for the purpose of detecting ecozone-specific adaptations and specializations as manifested through site organization, lithic artefact composition, projectiles and raw material use. The analyses showed that the settlements in both zones were organized equally in terms of size, structure and features. The lithic inventories also seem to share a fundamental structure reflecting all the steps of lithic tool production; from primary reduction of flint nodules, through production, maintenance, and use, to discard of artefacts. Moreover, upon studying the single most common tool category within the selected assemblages, projectile points, it was concluded that the size and shape were similar across the ecozones (Fig.10a and b; see Appendix E for a complete list of the projectiles included in the analysis).

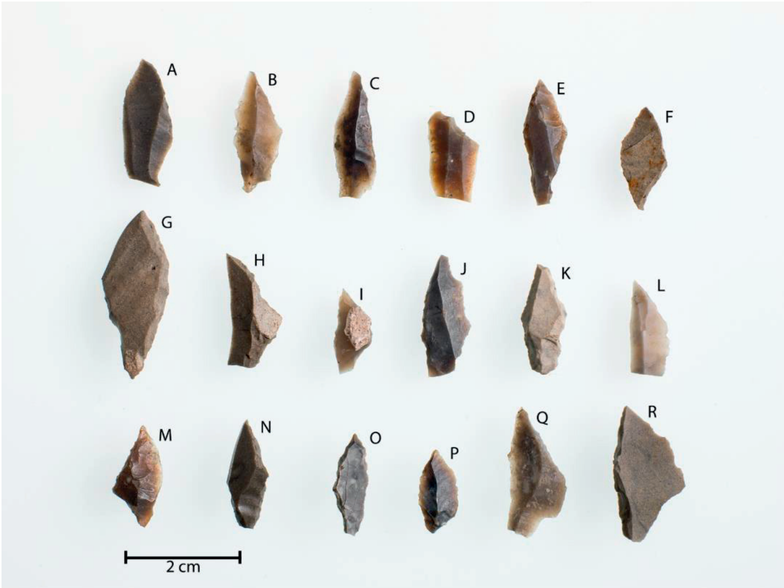


Figure 10a: Early Mesolithic flint projectiles found on coastal sites in central Norway. A–C: Ormen Lange Site 48 Unit G; D–F: Ormen Lange Site 48 Unit A; G–I: Ormen Lange Site 72 Unit X; J: Ormen Lange Site 48 Unit I; K: Ormen Lange Site 48 Unit J; L: Hestvikholmene 3; M & N: Hestvikholmane 2-2012; O & P: Kvernberget Site 20; Q & R: Ormen Lange Site 72 Unit Y. Photograph by permission of NTNU University Museum/Åge Hojem.

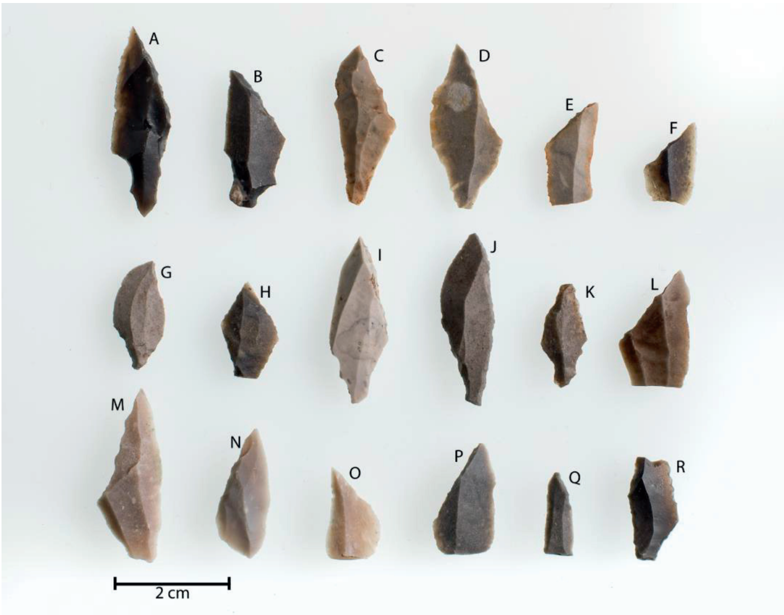


Figure 10b: Early Mesolithic flint projectiles found on mountain sites in central Norway. A–H: Reinsvatnet R1; I–L: Sandgrovbotnen; M–R: Brannhaugen. Photograph by permission of NTNU University Museum/Åge Hojem.

Some ecozone-specific variations in the artefact inventories were found: The mountain sites had a generally lower percentage of flakes and debris, larger amounts of blades and cores, and a relatively high percentage of tools (Fig.11). Projectiles and scrapers played a more important part in mountain inventories compared to the coastal assemblages (Fig.12). Yet, the lithic package found on mountain sites were made of elements that originated from the broader repertoire seen on the coast, and the basic form and size of the technical pieces in question were the same. It was concluded, therefore, that the Early Mesolithic colonizers employed a generalized lithic technology that included tools suitable for a wide range of tasks. Their tool technology can further be categorized as expedient (Binford 1977), and the toolkit has a low diversity (Torrence 1983) (see Chapter 4.3.1). According to the assumptions made by the cited authors, little time was spent on tool manufacture with subsequently more time in task execution.

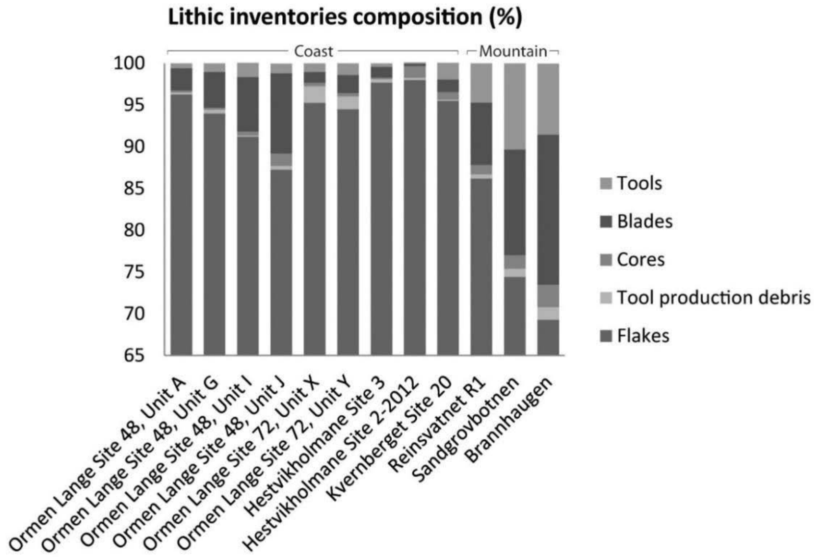


Figure 11: Comparative overview of the composition of the Early Mesolithic inventories found on 12 coastal and mountain sites in central Norway. The values presented are percentages of the total inventory (see Appendix D for a complete list of the artefact inventory). The diagram shows that the mountain sites have a lower percentage of debris and a higher percentage of tools than the coastal sites.

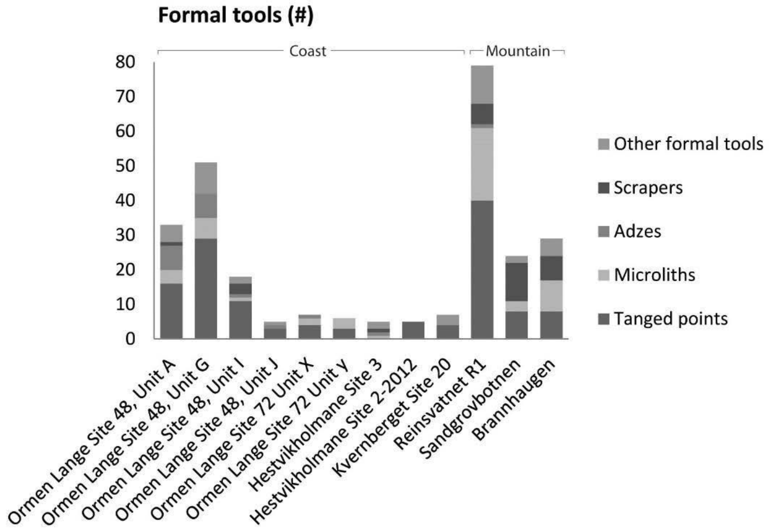
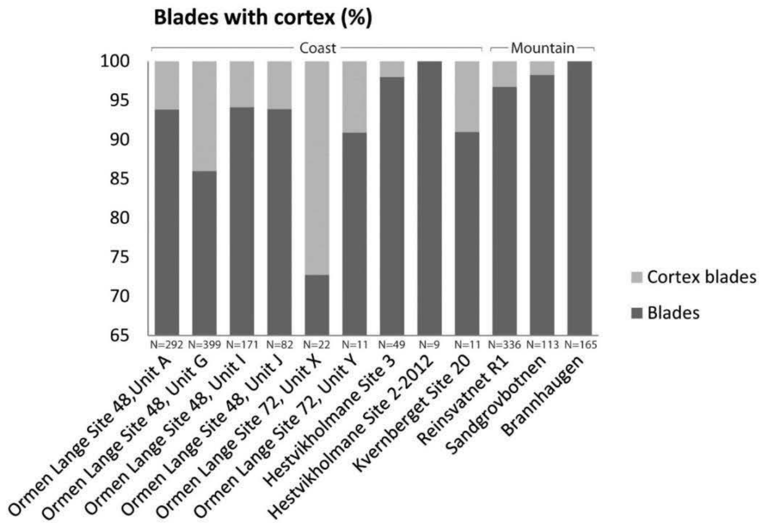


Figure 12: Comparative overview of the number and composition of formal tools found on 12 Early Mesolithic coastal and mountain sites in central Norway. The diagram shows that projectiles and scrapers play a more important part in mountain tool inventories than the coastal ones.

According to Torrence, the structure of the tool assemblage is affected by the nature of resources exploited. If the range of preys encountered and exploited is likely to be large, it would be challenging to transport a toolkit specialized for the pursuit of each species. A better solution would be to employ a few general purpose tools capable of capturing a wide range of resource types (Torrence 1983:18). This strategy is also associated with colonization processes and movements into unfamiliar landscapes (see Chapter 6.2). Thus, upon recognizing the Early Mesolithic population of Norway as colonizers and foragers with a mobility and subsistence pattern that included the use of radically different landscapes and habitats (coastal and mountain ecozones) the choice of a generalized toolkit makes sense.

The artefact inventories do represent slightly varied patterns of activity and production across the zones. There appears to be a higher dependency on informal tools in the mountains. This probably reflects the particular situation where the Early Mesolithic groups relied heavily on flint – a raw material that only could be found as pebbles in beach deposits. Flint from the coast must have been intensively reduced and used for both formal and informal tools. The relatively small proportions of cortex blades (blades where at least 50 per cent of the outer cortex usually found on natural flint nodules is still present) recovered from the mountain sites underlines that flint nodules were prepared before they were brought inland (Fig.13).

The great amount of lithic waste and debris on coastal sites speaks for a higher degree of continuous production and maintenance of tools, including the preparation of cores and blanks to bring along on inland hunting expeditions during certain seasons.



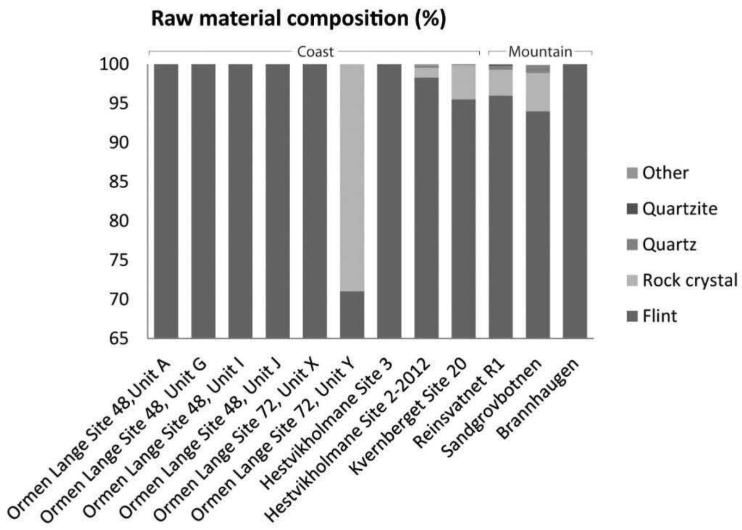


Figure 13: Comparative analysis of reduction strategy and lithic raw material use on 12 Early Mesolithic coastal and mountain sites in central Norway. Top: The diagram displays the relative percentage of cortex blades and blades without cortex on each site. Bottom: The diagram displays the relative percentage of the raw materials used on each site.

Based on the lithic artefact composition, it was argued that the assemblages from the coastal sites generally spoke for a wide range of more or less fixed activities, while the three mountain assemblages appeared to reflect a narrower set of activities. The high percentage of tools on mountain sites supports the idea that they were camps where gearing-up and tool maintenance sessions connected to hunting events were undertaken.

An interesting perspective here may be Kenneth Ames' (2002) observation that among boat-using hunter-gatherers, a great deal of animal processing occurs at the residential site. Harvesting occurs elsewhere; the raw resources (food, tool stone etc.) are transported to the residential base by boat, and processed there. In inland environments, this option was not available, thus the extracted resources were processed in the field rather in the camps (Ames 2002:42). This may explain some of the differences in artefact composition across ecozones.

6.4 Adaptive strategies in similar environments

The final research question addressed in this thesis concerns adaptive strategies in similar environments but in different regions of the world. The recognition of the environment as an important structuring factor for human behaviour, has led to the presumption that similar natural conditions imposes similar behaviour. This has been the starting points for several compilations of environmental datasets and ethnographic case studies. Two of the most significant are Lewis Binford's (2001) and Robert Kelly's (1995). In these publications, large amounts of ethnographic and environmental data is combined and interpreted in order to make predictive models and generalizations about hunter-gatherer behaviour. But although the ethnographic cases range from equator to high-latitudes, and from inland to coast, it can be objected that there is a predominance of pedestrian hunter-gatherers with a terrestrial subsistence focus in these data sets (Ames 2002).

Paper 6 (Breivik *et al*. in press) explored the applicability of environmental and ethnographic reference frames to high-latitude seascapes by focusing on two cases from opposite sides of the globe: The skerry–fjord coasts of Argentina and Norway, more specifically the Early Mesolithic forager groups of central Norway (c. 9500–8000 cal BC) and the Yámana "canoe indians" of southern Tierra del Fuego, Argentina (c. 5500 cal BC to 1900 AD) (Fig.14).

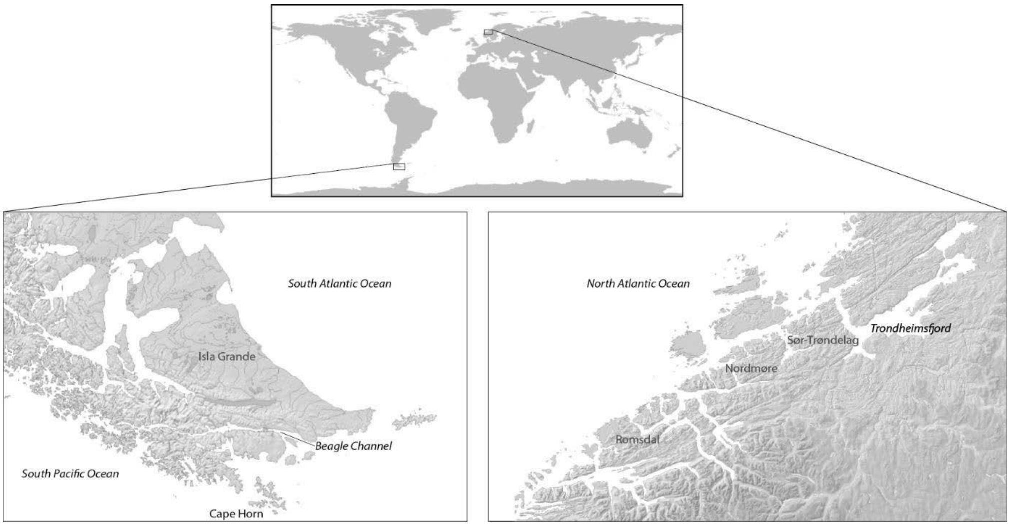


Figure 14: Map showing the topographic similarities between central Norway and southern Tierra del Fuego.

The first objective was to investigate whether the similar environments of central Norway and the southern fringes of Tierra del Fuego initiated similar behaviour among the earliest marine hunter-gatherers inhabiting these regions. The second objective was to test if the generalizations derived from ethnographic and environmental datasets around the world (cf. Binford 2001; Kelly 1995) applied to our high-latitude, boat-using marine foragers. These questions were addressed by exploring the mobility aspect of adaptive behaviour (mobility type, range, frequency and stability). For this purpose we applied James Chatters' (1987) list of suggested 'archaeological measures' or archaeological manifestations of adaptive behavior. To make our cases comparable with the existing ethnographic and environmental datasets, the climatic and environmental settings of the regions, in terms of effective temperature (ET), and faunal distribution and abundance, were charted. ET is derived from the mean temperatures of the warmest and coldest months, and expresses both the annual temperature range and distribution of solar radiation. Low ET values are associated with cold, seasonal environments while high ET values are associated with tropical, non-seasonal environments (Binford 2001:58-70 with reference to Bailey 1960; Kelly 1995:66-69). The record of faunal distribution and abundance was approached by way of giving a characterization of faunal diversity and productive habitats within the regions.

The study suggested that similar mobility strategies were in fact chosen within these similar environments: Both groups practiced a residential mobility type (i.e. forager behaviour as defined by Binford 1980) with occasional logistical expeditions (i.e. collector behaviour as defined by Binford 1980). They had a narrow foraging radius, but longer trips were probably made on an irregular basis. They moved frequently, but made use of the same areas repeatedly.

When we compare our cases to generalizations about human–environment relations derived from ethnographic and environmental datasets, we find that they do not behave in the predicted way. According to e.g. Binford (1980, 2001), *mobility type* is dependent on climate and the distribution of critical resources. This can be measured by calculating the effective temperature (ET). Forager behaviour is reported to be rare in zones where ET is below 18°C. With ETs below 10°C, our foragers challenge this pattern. Looking behind the measurements of ET, forager behavior (residential mobility) is essentially predicted where resources are homogenously distributed and food is available almost year round (Binford 1980). Our contrasting results can be explained by the fact that unlike the primary terrestrial biomass, the marine productivity is greatest in the high-latitude oceans around the poles – the phenomenon referred to as an ecosystem productivity paradox by Huston and Wolverton (2009). Environmental data from our regions suggested that the marine faunal diversity was higher than the terrestrial. Moreover, the coasts were probably productive on a year round basis. Focus on a specter of aquatic resources in these environments would thus offer equally good preconditions for foraging behavior, provided that suitable technologies for exploiting off shore resources were available.

In the literature cited in Paper 6 (Breivik *et al*. in press) (i.e. Kelly 1995), *mobility range* (the distance moved between residential locations) is interlinked with the foraging radius, which in turn is connected to the abundance and distribution of food resources. Where the resources are scattered, the foraging radius has to be wide in order to obtain enough food. As food resources tend to become more spatial segregated away from equator, it is predicted that the average distance per residential move increase with decreasing ET. Our cases, on the other hand, reflect relatively narrow foraging radiuses and short range movements on a daily basis, despite low ETs. This pattern is also noted by Kelly (1995), who points out that extreme Arctic groups exploit dispersed resources around their camp, and the move so that they are in the center of a new hunting area. They thus tend to move over shorter distances than anticipated (Kelly 1995:128-129). Again, the focus on marine resources in these productive aquatic settings seem to be the reason for this deviating result.

Based on ethnographic cases, the *mobility frequency* (number of residential moves per year) is also connected to the abundance of food available within foraging radius: Once the immediate surroundings are depleted, or running scarce, the camp will have to be moved to a different foraging area (Kelly 1995:135). Mobility frequency is thus expected to be high where the food resources are scarce. Our cases suggest a high mobility frequency, despite clear indications of ample food resources. Here it was argued that the predictions are most applicable on food resources that are fixed or have limited mobility range. For our boat-using marine foragers, who largely nourished on highly mobile resources (e.g. seals, birds and fish), the very nature of these resources, together with an urge to seek out better places, may have been just as decisive for mobility frequency as the lack of food.

Mobility stability (the permanence and reuse of camps) is, on the basis of ethnographic and environmental reference frames, thought to be determined by the location of critical resources (e.g. food, raw materials and potable water). Repeated use of the same sites may occur among both collectors and forager groups, but extreme redundancy in the reuse of identical places are usually associated with critical resources that are fixed to a few specific locations (Binford 1980; Kelly 1995:126). Both our case studies show a repetitive settlement pattern, where camps, sites and areas were visited several times. Yet, our environmental review of the regions suggests that food resources, raw material and potable water were abundant and widely spread. It thus seems like other circumstances than critical resources were decisive for the localization and reuse of settlements. The need for good harbors or sheltered areas was accentuated as essential in this regard.

Two factors seem to be essential for a mobility pattern that differs from the predicted one: the use of boats and the abundance of marine resources in high-latitude seascapes.

The former factor may seem somewhat obvious – it only makes sense that the use of vessels for transportation and hunting is reflected in several aspects of mobility and settlement behaviour. Ames (2002) points out that the foraging radius of boat-using groups could theoretically be considerably greater than that of pedestrian hunter-gatherers. Still he finds that foraging areas on the Northwest Coast are not much larger than those expected for terrestrial groups. Thus, he continues, it is not given that this advantage is used to increase foraging radius (Ames 2002:36-37). Although the foragers of Norway seem to have had a relatively narrow foraging radius on a daily basis, the boats could take the crew nearly all the way to mountain environs. Another advantage stressed by Ames is the opportunity to transport more people and equipment (Ames 2002:39). This would ease the transport costs, perhaps encouraging frequent movements. Another interesting perspective here is Bjerck's idea of boats as a structuring element – not only for mobility itself, but also for size and composition of basic residential groups, set of activities, intervals and length of occupation at the settlements. He speaks of the boat as a mobile site: the inhabitants of the settlement came and went by means of this vessel, and that the boat was a floating work platform in their subsistence activities (Bjerck *et al*. 2008:566-568; Bjerck in prep.).

The latter factor that was lifted forward as essential for a different mobility pattern among marine hunter-gatherers (the abundance of marine resources in high-latitude seascapes) was discussed in Chapter 3.4, where it was asserted that oceans increasingly are being lifted forward as rich ecosystems – particularly in high-latitudes. It may be argued, therefore, that although our cases appear to follow a somewhat different set of rules, many of the same environmental factors seem to be of importance for the mobility pattern of terrestrial and marine hunter-gatherers. It may be a matter of adjusting the parameters; e.g. mapping the actual resource situation and seasonality instead of characterizing climate and calculating ET, and take the nature of the exploited resources into consideration (e.g. fixed or mobile).

6.5 Conclusions

The purpose of this thesis was to investigate dynamic relations between human and environment in the earliest settlement phase of Norway. Due to the distinct concentrations of Early Mesolithic sites in the coastal zone, emphasis was put on characterizing the marine conditions in the Pleistocene/Early Holocene period. This was done by way of collecting and compiling published palaeo-oceanographic data and assessing how topography, bathymetry, oceanic current systems, sea-ice and melting glaciers would have affected marine productivity in space and time. Close to 800 Norwegian Early Mesolithic sites were mapped in order to examine possible correlations between site location and productive marine habitats. Sites and artefact assemblages from central Norway were studied in greater detail in order to explore the choice of adaptive strategies in varied and shifting environments along temporal, geographical and topographical transects. Sites from the similar high-latitude seascapes of southern Tierra del Fuego, Argentina, were brought in as comparable case studies as a means of evaluating how environmental circumstances, when detached from inherited cultural traditions, structured adaptive behavior. The main conclusions of the dissertation are presented in the following.

In the Pleistocene–Holocene transition, the Scandinavian ice-sheet covered substantial parts of the Norwegian landmass. According to palaeo-oceanographic data inner fjord areas, sheltered waterways and other sea areas that experienced great meltwater influx had severe ice-cover or were seasonally frozen. A cold tolerant marine fauna, probably consisting of a range of whales, seals, fish and birds, frequented the coastal waters, and terrestrial animals like reindeer and arctic fox thrived on land. It was under these conditions that the Norwegian territory was colonized.

A review of palaeo-environmental data showed that Norway underwent quite severe changes in the course of the 1500 years Early Mesolithic pioneer phase; from a cold arctic to a milder sub-arctic climate. The changes were gradual, but around the mid-Preboreal (c. 8800 cal BC) an environmental shift seemed to occur, marked on land by the establishment of tree stands in most regions. This environmental trajectory was also reflected in palaeo-oceanographic data: From being greatly influenced by ice and meltwater in the earliest phase, the oceanic conditions became more like the present situation as the Norwegian Atlantic current stabilized along the coast around 8800 cal BC, and glaciers withdrew from the fjords. When studying the Early Mesolithic archaeological material from central Norway, it was found that the lithic toolkit and technology was maintained despite these changes. The distribution of archaeological sites from the same region, however, spoke for a shift in settlement location strategy during this time span; from almost exclusively inhabiting the islands of the outer archipelago in the first half of the period, there was a propensity towards the use of more retracted locations (fjord basins or sheltered sounds connected to the mainland) in the second half of the period. This was believed to be rooted in the gradual stabilization of the marine food resource situation following the environmental shift midway through Preboreal.

Regional differences were recognized in the palaeo-marine environments of Early Mesolithic Norway. In northernmost Norway, arctic conditions with severe seasonal ice cover and a cold-tolerant fauna lingered throughout the Preboreal, while the rest of the country experienced gradually warmer oceanic conditions with a subsequent immigration of a more temperate fauna. The previously documented discreet differences between the northern and southern artefact inventories have been attributed to the different raw material situations rather than the different environmental and climatic conditions. The present site distribution analysis spoke for a slightly different approach to the landscape between the regions: a large part of the sites in north Norway was situated around fjord heads and sheltered sounds – locations that were less appreciated farther south. The later transgressions that affected Preboreal shorelines along parts of the outermost coast of northern Norway may have distorted the site distribution somewhat. Nevertheless, the larger number of retracted sites in this region is still evident, and it was suggested that the geographical differences in climate, ice-cover and resource situation referred to above invited to a different hunting strategy – including winter/spring hunting of ice-obligate artic marine mammals in connection to frozen water in fjord areas and sheltered waterways.

The palaeo-oceanographic review also spoke for variations in marine productivity across different macro-topographic zones. An assessment of several factors related to the palaeo-marine conditions indicated that the outer coast was the most fruitful zone: Vertical mixing of different water qualities would take place in the transition zone between fjords and archipelago, and phytoplankton blooms would occur in the wake of islands in the outer archipelago. Due to high concentrations of sediments from glacial runoff, glaciated and seasonally frozen fjord bottoms, and the weaker influence of the Norwegian Atlantic current, the inner fjords was suggested to be less productive – at least during the Early Preboreal phase. The compiled distribution map showed that the archaeological sites of central Norway were typically oriented toward the zone where the primary production would be high: on the exposed islands, facing the ocean rather than the mainland. The close relation between site location and abundant marine habitats seem to be a feature of Early Mesolithic Norway: Some 96% of the sites were situated in the coastal zone, of which the majority could be found in what was defined as the most fruitful zones. On this basis it was argued that the colonization of Norway was carried out by conscious movements toward certain habitats grounded in knowledge about marine productivity and animal behavior.

The Early Mesolithic hunter-gatherer groups also exploited mountain environments. This ecozone provided a landscape and resource situation completely different from the coastal zone. Upon studying sites and artefact assemblages from central Norway it was demonstrated that site size and organization, raw material use, lithic tool technology and projectile forms were largely the same across the ecozones. Differences in artefact composition between sites were interpreted as expressions of different activities taking place. It was argued that a generalized toolkit together with small group sizes and a residential mobility pattern enabled the colonizers to make efficient use of the varied Norwegian landscape.

Hunter-gatherers' choices of adaptive strategies are influenced by many circumstances. Distribution and availability of food and other critical resources are advocated as key factors, leading to predictions about how the environment structures human behavior. When exploring adaptive behavior among the early marine foragers of central Norway and southern Tierra del Fuego, Argentina we found that the two groups employed similar mobility strategies: Both groups practiced a residential mobility type with occasional logistical expeditions; they had a narrow foraging radius, but longer trips were probably made on an irregular basis. They moved frequently, but made use of the same areas repeatedly. Looking at the cases collectively, our foragers did not behave in the predicted way, according to the reference frames founded on global ethnographic and environmental datasets. Yet it seemed like many of the same factors were decisive for the mobility pattern of terrestrial and marine hunter-gatherers. Identifying the distribution, availability, abundance and nature of marine food resources crave a different approach than do terrestrial resources. It may therefore be a matter of redefining the environmental parameters, rather than constructing a different reference frame. Another factor that should be taken into greater consideration when predicting human behavior is the means of transportation – not only when discussing mobility strategies, but also other adaptive traits.

Our studies suggest that the Early Mesolithic forager groups of Norway had resilient adaptive strategies that were able to withstand fluctuations and variations in landscape, climate, environment and resource bases. By employing a generalized and expedient lithic tool technology they could make instruments that were ready to be pressed into different tasks. Versatile weapons, like bow and arrow, could be used on a wide range of prey. Although focusing on marine environments, their subsistence strategies encompassed different habitats and resources which were approached by a residential mobility type where small social units moved to the resources which were to be exploited. They seem to have moved quite frequently, perhaps due to the mobile nature of the resources exploited. The mobility range of the human colonizers was quite limited, and the groups utilized the outer coastal zone most of the year. Their settlement pattern also included visits to mountain environs. The site structure and tool assemblages that were used on the coast were projected into this context, with small adjustments governed by the different activities and raw material situation associated with the two landscapes.

In sum, the Early Mesolithic groups chose a generalized adaptive strategy that was maintained through the temporal environmental fluctuations as well as across different geographical regions and ecozones. This generalized adaptive strategy had its roots in the Palaeolithic cultures of the continental plains. In the Pleistocene–Holocene transition, the groups expanded into archipelagic seascapes. In so doing their technology must have included sturdy sea-going vessels. The fact that their lithic toolkits and settlement organization was maintained throughout the 1500 years long Early Mesolithic phase, speaks for an adaptation strategy that was designed for a multifaceted environment. Their technology were already well-tested in harsh Late Glacial environments on the continent, where changing and unstable natural surroundings was the rule rather than the exception. Also, seasonal fluctuations in weather conditions and resource base may have been just as marked as the gradually changing climate or the differences between ecozones. Perhaps more vital than altering their material culture and social structures according to changing surroundings was the possession of knowledge about the landscapes in which they moved. Learning about animal behavior, seasonal changes, risks and opportunities connected to different habitats and ecozones may have been the key to successfully colonizing and seeking out resources in the varied Norwegian landscape as it emerged from the ice.

7.0 Looking ahead

The vast record of Early Mesolithic sites and artefacts in Norway, together with the steadily increasing high resolution palaeo-environmental data, has the potential to highlight many issues about human–environment relations.

There is a long tradition for reconstructing past environments and climate in Norway. Fluctuations in sea-levels and ice fronts have been recurrent topics throughout the archaeological history of research, and we now have quite comprehensive knowledge about these processes. Less is known about vegetation and fauna. Here, we largely have to rely on climatic proxy data in order to reconstruct the resource basis in this early phase of human occupation. The use of palaeo-environmental DNA (ancient DNA (aDNA) originating from disseminated genetic material within palaeo-environmental samples) to reconstruct past environments is an emerging area of archaeological research (see Rawlence *et al*. 2014 for a review). Good palaeo-environmental DNA-samples are able to detect genetic traces of animals and plants that were physically present on the site. Provided undisturbed contexts and good sampling and analysis methods, this may be a possible avenue in Norwegian Stone Age research.

In this present thesis an effort was made to characterize the oceanic environment, with emphasis on productive habitats and temporal and spatial variations in the marine conditions (Paper 3 (Breivik 2014). There are many possibilities to expand on this issue: Analyses of sediment cores may serve as the basis for models about meltwater discharge and sea ice. This can take us longer on the way of characterizing fjord environments and the extension of firm ice-cover and ice floes. Modellings of currents, wave action and tidal amplitudes are other factors can bring detail to our understanding of coastal environments in Early Mesolithic. Zooming in on smaller regions, e.g. central Norway, should also be interesting in this regard.

The large amount of archaeological sites recorded and the increasing number of extensive excavations has left us with a very good foundation to conclude upon. Yet there is still need for more surveys and excavations in the mountain and especially in the fjord zone. Although the settlements in these zones seem to be part of a mobility pattern that was based on the coast, questions could be asked about the relation between these sites and the role they play within this system: Are they hunting camps, intermediate stations or residential camps similar to those we find in the outer coastal areas (Paper 4 (Breivik and Callanan in press))? More detailed studies on the intra-site matters on mountain and coastal sites may reveal additional interesting similarities and differences, giving more clues as to how these sites relate to each other and how the early inhabitants approached the landscapes. Tool distribution patterns and projectile morphology may be interesting in this regard.

The investigation of Early Mesolithic sites and artefacts in central Norway has given a large record of tools and features ready to be studied in detail (Paper 2 (Breivik and Bjerck in press)). We have also recorded numerous sites that have been used for a longer timespan or during later periods. This may be an interesting site group to analyze in relation to natural surroundings and intra-site similarities and differences.

Finally, I want to emphasize the value of comparative archaeological analyses for studying cultural phenomena. Studying human populations of different latitudes in similar natural settings, enable us to ask questions about how hunter-gatherers in the different regions of the world coped with the same environmental risks and obstacles (Paper 5 (Bjerck and Breivik), Paper 6 (Breivik *et al*. in press)). Foragers in Polar Regions, or “Tops of the World” (Blankholm *et al*. 2009) or earlier deglaciated skerry-fjord seascapes (Bjerck 2008i) are possible study objects, and may include e.g. North Americas, Scotland and New Zealand.

Bibliography

Aaris-Sørensen, K. (2009). Diversity and dynamics of the mammalian fauna in Denmark throughout the last glacial–interglacial cycle, 115–0 kyr BP. *Fossils and Strata*, 57, pp. 1-60.

Alterskjær, K. and Pettersen, K. (1975). *Utgravning av steinalderslokalitet på Ulset, Tingvoll, Møre og Romsdal.* Rapport, Arkeologisk serie, 1975:2. Trondheim: Det Kongelig Norske Vitenskabers Selskab, Museet.

Ames, K. M. (1991). Sedentism: A temporal shift or a transitional change in hunter-gatherer mobility patterns? *Between bands and states*, 9, pp. 108-134.

Ames, K.M. (2002). Going by boat. The forager-collector continuum at sea. In: Fitzhugh, B. and Habu, J., eds., *Beyond foraging and collecting. Evolutionary change in hunter-gatherer settlement systems*. New York: Kluwer Academic/Plenum Publishers, pp. 19-52.

Amundsen, T. (2012a). Pauler 3. Boplass fra tidligmesolitikum. In: Jaksland, L., ed., *E18 Brunlanesprosjektet, Volume II. Undersøkte lokaliteter fra tidligmesolitikum.* Varia 80. Oslo: Kulturhistorisk museum, Universitetet i Oslo, pp. 171-240.

Amundsen, T. (2012b). Pauler 5. Boplass fra tidligmesolitikum. In: Jaksland, L., ed., *E18 Brunlanesprosjektet, Volume II. Undersøkte lokaliteter fra tidligmesolitikum.* Varia 80. Oslo: Kulturhistorisk museum, Universitetet i Oslo, pp. 241-265.

Amundsen, T. (2012c). Sky 1. Rasteplass fra tidligmesolitikum. In: Jaksland, L., ed., *E18 Brunlanesprosjektet, Volume III. Undersøkte lokaliteter fra tidligmesolitikum og senere.* Varia 81. Oslo: Kulturhistorisk museum, Universitetet i Oslo, pp. 125-134.

Andersen, B.G. and Borns, H.W. (1994). *The Ice Age world. An introduction to quaternary history and research with emphasis on North America and Northern Europe during the last 2.5 million years*. Oslo: Scandinavian University Press.

Andersson, S., Cullberg, C., Rex, K. and Wigforss, J. (1975). *Sorteringsschema för kärn- och skivyxor av flinta*. Antikvarisk arkiv 58, Kungliga Vitterhets Historie och Antikvitets Akademien. Uddevalla: Bohusläningens AB.

Anthony, D. (1997). Prehistoric migration as social process. In: Chapman, J. and Hamerow, H., eds., *Migrations and Invasions in Archaeological Explanation*. BAR International Series, 664, pp. 21-32.

Anundsen, K. (1985). Changes in shore-level and ice-front position in Late Weichsel and Holocene, southern Norway. *Norsk Geografisk Tidsskrift - Norwegian Journal of Geography*, 39(4), pp. 204-225.

Anundsen, K. (1996). The physical conditions for earliest settlement during the last deglaciation in Norway. In: Larson, L., ed., *The earliest settlement of Scandinavia and its* *relationship with neighbouring areas.* Acta Archaeologica Lundensia, Series in 8°(24). Stockholm: Almquist & Wiksell International, pp. 207-217.

Asprem, F. and Skow, S. (2002). *Arkeologisk rapport fra utgraving 2002*. Unpublished archaeological report. NTNU University Museum.

Bailey, G.N. (1978). Shell middens as indicators of postglacial economies: a territorial perspective. In: Mellars, P., ed., *The Early Postglacial Settlement of Northern Europe*. London: Duckworth, pp. 37-63.

Bailey, G.N. (2004). World prehistory from the margins: The role of coastlines in human evolution. *Journal of Interdisciplinary Studies in History and Archaeology*, 1(1), pp. 39-50.

Bailey, G.N. and Milner, N. (2002). Coastal hunters and gatherers and social evolution: marginal or central? *Before Farming: the Archaeology of Old World Hunter-Gatherers*, 3-4(1), pp. 1-15.

Bailey, G. and Parkington, J. (1988). The archaeology of prehistoric coastlines: an introduction. In: Bailey, G. and Parkington, J., eds., *The archaeology of prehistoric coastlines.* New directions in archaeology. Cambridge: Cambridge University Press, pp. 1-10.

Bailey, H.P. (1960). A method of determining the warmth and temperateness of climate. *Geografiska Annaler*, 42(1), pp. 1-16.

Bang-Andersen, S. (1988a). New findings spotlighting the earliest Postglacial settlement in Southwest Norway. *AmS-Skrifter*, 12, pp. 39-51.

Bang-Andersen, S. (1988b). Oppsiktsvekkende funn ved Myrvatnet. *Frá haug ok heiðni*, 1988(4), pp. 124-134.

Bang-Andersen, S. (1990). The Myrvatn group, A Preboreal find-complex in Southwest Norway. In: Vermeersch, P.M. and van Peer, P., eds., *Contributions to the Mesolithic in Europe.* Papers presented at the fourth international symposium 'The Mesolithic in Europe'. Leuven: Leuven University Press, pp. 215-226.

Bang-Andersen, S. (1995). Den tidligste bosetning i Sørvest-Norge i nytt lys. *Arkeologiske Skrifter*, 8, pp. 65-80.

Bang-Andersen, S. (1996a). Coast/inland relations in the Mesolithic of Southern Norway. *World Archaeology*, 27(3), pp. 427-443.

Bang-Andersen, S. (1996b). The Colonization of Southwest Norway. An Ecological Approach. In: Larson, L., ed., *The earliest settlement of Scandinavia and its relationship with neighbouring areas.* Acta Archaeologica Lundensia, Series in 8°(24). Stockholm: Almquist & Wiksell International, pp. 219-234.

Bang-Andersen, S. (2003a). Encircling the living space of Early Postglacial reindeer hunters in the interior of southern Norway. In: Larsson, L., Kindgren, H., Knutsson, K., Loeffler, D. and Åkerlund, A., eds., *Mesolithic on the move*. Oxford: Oxbow Books, pp. 193-204.

Bang-Andersen, S. (2003b). Southwest Norway at the Pleistocene/Holocene transition: Landscape development, colonization, site types, settlement patterns. *Norwegian Archaeological Review*, 36(1), pp. 5-25.

Bang-Andersen, S. (2012). Colonizing contrasting landscapes. The pioneer coast settlement and inland utilization in southern Norway 10,000-9500 years before present. *Oxford Journal of Archaeology*, 31(2), pp. 103-120.

Barlindhaug, S. (1996). *Hvor skal vi bygge og hvor skal vi bo? En analyse av lokaliseringsfaktorer i tidlig eldre steinalder i Troms*. Unpublished thesis (MA). University of Tromsø.

Barlindhaug, S. (1997). *Hvor skal vi bygge og hvor skal vi bo? En analyse av lokaliseringsfaktorer i tidlig eldre steinalder i Troms.* Universitetet i Tromsø, Institutt for arkeologi, Stensilserie B. Tromsø: University of Tromsø.

Beaton, J.M. (1991). Colonizing continents: Some problems from Australia and the Americas. In: Dillehay, T.D and Meltzer, D.M., eds., *The first Americans: Search and research*. Boca Raton: CRC Press, pp. 209-230.

Berglund, B., ed., (2001). *'Gassprosjektet' - arkeologiske undersøkelser på Tjeldbergodden, Aure kommune, Møre og Romsdal fylke i forbindelse med bygging av metanolanlegg.* Rapport, Arkeologisk serie, 2001:1. Trondheim: NTNU Vitenskapsmuseet.

Berglund, B. (2006). Stor-Fagervika i munningen av Ranen - på sporet etter de første menneskene på Helgelandskysten. *Årbok for Helgeland*, 2006, pp. 36-49.

Bergsvik, K.A. (1991). *Ervervs- og bosetningsmønstre på kysten av Nordhordland i steinalder, belyst ved funn fra Fosnstraumen*. Unpublished thesis (Cand. Mag.). University of Bergen.

Bergsvik, K.A. (1995). Bosetningsmønstre på kysten av Nordhordland i steinalder. En geografisk analyse. *Arkeologiske skrifter*, 8, pp. 111-130.

Bergsvik, K.A. (2001). Sedentary and mobile hunter-fishers in Stone Age western Norway. *Arctic Anthropology*, 38(1), pp. 2-26.

Bettinger, R.L. (1991). *Hunter-gatherers. Archaeological and evolutionary theory*. New York: Plenum Press.

Binford, L.R. (1962). Archaeology as anthropology. *American Antiquity*, 28(2), pp. 217-225.

Binford, L.R. (1965). Archaeological systematics and the study of culture process. *American Antiquity*, 31(2), pp. 203-210.

Binford, L.R. (1977). Forty-seven trips: A case study in the character of archaeological formation processes. In: Wright, R.V.S., ed., *Stone tools as cultural markers: Change, evolution and complexity*. Canberra: Australian Institute of Aboriginal studies, pp 24-36.

Binford, L.R. (1978a). Dimensional analysis of behavior and site structure: learning from an Eskimo hunting stand. *American Antiquity*, 43, pp. 330-361.

Binford, L.R. (1978b). *Nunamiut ethnoarchaeology*. New York: Academic Press.

Binford, L.R. (1979). Organization and formation processes: looking at curated technologies. *Journal of Anthropological Research*, 35, pp. 255-273.

Binford, L.R. (1980). Willow smoke and dogs' tails: Hunter-gatherer settlement systems and archaeological site formation. *American Antiquity*, 45(1), pp. 4-20.

Binford, L.R. (1982). The archaeology of place. *Journal of anthropological archaeology*, 1, pp. 5-31.

Binford, L.R. (2001). *Constructing frames of reference. An analytical method for archaeological theory building using ethnographic and environmental data sets.* Berkeley: University of California Press.

Bird, D.W. and O'Connell, J.F. (2006). Behavioural Ecology and Archaeology. *Journal of Archaeological Research*, 14, pp. 143-188.

Bjerck, H.B. (1983). *Kronologisk og geografisk fordeling av mesolitiske element i Vest- og Midt-Norge*. Unpublished thesis (Mag. Art.). University of Bergen.

Bjerck, H.B. (1986). The Fosna-Nøstvet problem. A consideration of archaeological units and chronozones in the south Norwegian Mesolithic period. *Norwegian Archaeological Review*, 19(2), pp. 103-121.

Bjerck, H.B. (1987). *Undersøkelser på Mohalsen i tidsrommet 1972-1982. En ryddeaksjon blant T-numre og funnlokaliteter*. Upublished note. NTNU University Museum.

Bjerck, H.B. (1989). *Forskningsstyrt kulturminneforvaltning på Vega, Nordland. En studie av steinaldermenneskenes boplassmønstre og arkeologiske letemetoder*. Gunneria 61. Trondheim: NTNU University Museum.

Bjerck, H.B. (1990). Mesolithic site types and settlement patterns at Vega, northern Norway. *Acta Archaeologica*, 60, pp. 1-32.

Bjerck, H.B. (1994). Nordsjøfastlandet og pionerbosetningen i Norge. *Viking*, 57, pp. 25-58.

Bjerck, H.B. (1995). The North Sea Continent and the Pioneer Settlement of Norway. In: Fischer, A., ed., *Man and sea in the Mesolithic*. Oxford: Oxbow Books, pp. 131-143.

Bjerck, H.B. (2007), Mesolithic coastal settlements and shell middens (?) in Norway. In: Milner, N., Craig, O.E. and Bailey, G.N., eds., *Shell Middens in Atlantic Europe*. Oxford: Oxbow Books, pp. 5-30.

Bjerck, H.B. (2008a). Lokalitet 31 Fredly – Aktivitetsspor fra tidligmesolittisk tid, senmesolittisk tid og førromersk jernalder. In: Bjerck, H.B., ed., Åstveit, L. I., Gundersen, J., Meling, T., Jørgensen, G. and Normann, S. *NTNU Vitenskapsmuseets arkeologiske undersøkelser Ormen Lange Nyhamna*. Trondheim: Tapir Academic Press, pp. 169-176.

Bjerck, H.B. (2008b). Lokalitet 48 Nordre Steghaugen – Tidligmesolittiske boplasser med ildsteder og telttufter. In: Bjerck, H.B., ed., Åstveit, L. I., Gundersen, J., Meling, T., Jørgensen, G. and Normann, S. *NTNU Vitenskapsmuseets arkeologiske undersøkelser Ormen Lange Nyhamna*. Trondheim: Tapir Academic Press, pp. 217-256.

Bjerck, H.B. (2008c). Lokalitet 51 Søndre Steghaugen – Tidligmesolittisk boplass. In: Bjerck, H.B., ed., Åstveit, L. I., Gundersen, J., Meling, T., Jørgensen, G. and Normann, S. *NTNU Vitenskapsmuseets arkeologiske undersøkelser Ormen Lange Nyhamna*. Trondheim: Tapir Academic Press, pp. 285-294.

Bjerck, H.B. (2008d). Lokalitet 62 Litle Grynnvika Øvre/Nedre – Boplasser fra tidligmesolittisk og senmesolittisk tid. In: Bjerck, H.B., ed., Åstveit, L. I., Gundersen, J., Meling, T., Jørgensen, G. and Normann, S. *NTNU Vitenskapsmuseets arkeologiske undersøkelser Ormen Lange Nyhamna*. Trondheim: Tapir Academic Press, pp. 347-363.

Bjerck, H.B. (2008e). Lokalitet 72 Søndre Steghaugen – Tidligmesolittisk boplass med ildsted og telttufter. In: Bjerck, H.B., ed., Åstveit, L. I., Gundersen, J., Meling, T., Jørgensen, G. and Normann, S. *NTNU Vitenskapsmuseets arkeologiske undersøkelser Ormen Lange Nyhamna*. Trondheim: Tapir Academic Press, pp. 435-444.

Bjerck, H.B. (2008f). Lokalitet 73 Søndre Steghaugen – Tidligmesolittisk boplass og produksjonssted for skiveøks. In: Bjerck, H.B., ed., Åstveit, L. I., Gundersen, J., Meling, T., Jørgensen, G. and Normann, S. *NTNU Vitenskapsmuseets arkeologiske undersøkelser Ormen Lange Nyhamna*. Trondheim: Tapir Academic Press, pp. 445-451.

Bjerck, H.B. (2008g). Lokalitet 76 og 76B Søndre Steghaugen – Tidligmesolittiske boplasser under strandvoll. In: Bjerck, H.B., ed., Åstveit, L. I., Gundersen, J., Meling, T., Jørgensen, G. and Normann, S. *NTNU Vitenskapsmuseets arkeologiske undersøkelser Ormen Lange Nyhamna*. Trondheim: Tapir Academic Press, pp. 453-467.

Bjerck, H.B. (2008h). Norwegian Archaeological Review 1968-2008: True trends? *Norwegian Archaeological Review*, 41(1), pp. 1-13.

Bjerck, H.B. (2008i). Norwegian Mesolithic Trends: A review. In: Bailey, G.N. and Spikins, P., eds., *Mesolithic Europe*. Cambridge: Cambridge University Press, pp. 60-106.

Bjerck, H.B. (2009a). Colonizing seascapes: comparative perspectives on the development of maritime relations in Scandinavia and Patagonia. *Arctic Anthropology*, 46(1-2), pp. 118-131.

Bjerck, H.B. (2009b). Colonizing seascapes: Comparative perspectives on the development of maritime relations in the Pleistocene/Holocene transition in north-west Europe. In: McCartan, S., Schulting, R., Warren, G. and Woodman, P., eds., *Mesolithic Horizons.* Papers presented at the Seventh International Conference on the Mesolithic in Europe, Belfast 2005, Volume I. Oxford: Oxbow Books, pp. 16-23.

Bjerck, H.B. (in prep.) Settlements and seafaring. Reflections on the integration of boats and settlements among marine foragers in Early Mesolithic Norway and the Yámana of Tierra del Fuego. *Journal of Island & Coastal Archaeology*.

Bjerck, H.B. and Breivik, H.M. (2012). Off shore pioneers: Scandinavian and Patagonian lifestyles compared in the Marine Ventures project. *Antiquity*, 086(333). [Online] available at http://antiquity.ac.uk/projgall/bjerck333/

Bjerck, H.B., Breivik, H.M., Fretheim, S.E. and Zangrando, A.F.J. (2012). *Report, excavation of Mohalsen 2012-II*. Unpublished archaeological report. NTNU University Museum.

Bjerck, H.B., Breivik, H.M., Piana, E.L. and Zangrando, A.F.J. (in press). Exploring the role of pinnipeds in the human colonization of the seascapes of Patagonia and Scandinavia. In: Bjerck, H.B., Breivik, H., Fretheim, S., Piana, E., Skar, B., Tivoli, A. and Zangrando, A.F.J., eds., *Marine Ventures: Archaeological Perspectives on Human–Sea Relations*. Sheffield: Equinox Publishing.

Bjerck, H.B. and Callanan, M. (2005). *Brannhaugen*. Unpublished archaeological report. NTNU University Museum.

Bjerck, H.B. and Ringstad, B. (1985). *De kulturhistoriske undersøkelsene på Tjernagel, Sveio.* Arkeologiske Rapporter, 9. Bergen: Historisk museum, Universitetet i Bergen.

Bjerck, H.B. and Zangrando, A.F.J. (2013). Marine Ventures: Comparative Perspectives on the Dynamics of Early Human Approaches to the Seascapes of Tierra del Fuego and Norway. *The Journal of Island and Coastal Archaeology*, 8(1), pp. 79-90.

Bjerck, H.B., ed., Åstveit, L. I., Gundersen, J., Meling, T., Jørgensen, G. and Normann, S. (2008). *NTNU Vitenskapsmuseets arkeologiske undersøkelser Ormen Lange Nyhamna*. Trondheim: Tapir Academic Press.

Bjørn, A. (1931). Hovedlinjer i den norske tilblivelseshistorie. *Naturen*, 55, pp. 224-245.

Blankholm, H.P. (2004). Earliest Mesolithic site in Northern Norway? A reassessment of Sarnes B4. *Arctic Anthropology*, 41(1), pp. 41-57.

Blankholm, H.P. (2008). *Målsnes I. An Early Post-glacial Coastal Site in Northern Norway.* Oxford: Oxbow Books.

Blankholm, H.P. (2015). Macro-level predictive modeling of early Post-glacial pioneer sites in Varanger, Norway. In: Pizziolo, G. and Sarti, L., eds., *Predicting prehistory predictive models and field research methods for detecting prehistoric contexts.* Proceedings of the International Workshop Grosseto (Italy), September 19-20, 2013. Firenze: Museo e Istituto Fiorentino di Preistoria, pp. 65-73.

Blankholm H.P. (in press). Macro-level predictive modelling of Early Stone Age pioneer settlement locations in Varanger, northern Norway. In: Blankholm, H.P., ed., *The early settlement of Northern Europe – economy, settlement and society*, Vol. 3. Sheffield: Equinox Publishing.

Blankholm, H.P., Barceló, J., Estévez, J. and Hood, B.C. (2009). Introduction: Tops of the World (TOW): The Dawn of a Concept. *Arctic Anthropology*, 46(1-2), pp. 1-7.

Bollig, M. and Schulte, A. (1999). Environmental change and pastoral perceptions: degradation and indigenous knowledge in two African pastoral communities. *Human Ecology*, 27(3), pp. 493-514.

Bowdler, S. (1977). The coastal colonization of Australia. In: Allen, J., Golson, J. and Jones, R., eds., *Sunda and Sahul: Prehistoric studies in Southeast Asia, Melanesia and Australia*. London: Academic Press, pp. 205-246.

Brede, A. (2012). *Arkeologisk undersøkelse i forbindelse med utbyggingsplaner for Hestvikholmane industriområde, Averøy kommune, Møre og Romsdal, 2012. Lokalitet 1 og 2.* Unpublished archaeological report. NTNU University Museum.

Breivik, H.M. (2014). Palaeo-oceanographic development and human adaptive strategies in the Pleistocene–Holocene transition: A study from the Norwegian coast. *The Holocene*, 24(11), pp. 1478-1490.

Breivik, H.M. and Bjerck, H.B. (in press). Early Mesolithic central Norway: A review of research history, settlements, and tool tradition. In: Blankholm, H.P., ed., *The early economy and settlement in Northern Europe: Pioneering, resource use, coping with change*, Vol. 3. Sheffield: Equinox Publishing.

Breivik, H.M., Bjerck, H.B., Zangrando, A.F.J. and Piana, E.L. (in press). On the applicability of environmental and ethnographic reference frames: An example from the high-latitude seascapes of Norway and Tierra del Fuego. In: Bjerck, H.B., Breivik, H., Fretheim, S., Piana, E., Skar, B., Tivoli, A. and Zangrando, A.F.J., eds., *Marine Ventures: Archaeological Perspectives on Human–Sea Relations*. Sheffield: Equinox Publishing.

Breivik, H.M. and Callanan, M. (in press). Hunting High and Low: Postglacial Colonization Strategies in Central Norway between 9500 and 8000 cal BC. *European Journal of Archaeology*.

Breivik, H.M. and Ellingsen, E.J.G. (2014). 'A Discovery of Quite Exceptional Proportions: Controversies in the Wake of Anders Nummedal's Discoveries of Norway's First Inhabitants. *Bulletin of the history of archaeology*, 24(9), pp. 1-13.

Brøgger, A.W. (1910). Nye skivespaltere fra norsk stenalder. *Naturen*, 1910(34), pp. 379-381.

Brøgger, W.C. (1901). *Om de senglaciale og postglaciale nivåforandringer i Kristianiafeltet (Molluskfaunan)*. Kristiania: Aschehoug & Co.

Brøgger, W.C. (1905). *Strandliniens beliggenhed under stenalderen i det sydøstlige Norge*. Kristiania: Aschehoug & Co.

Burroughs, W.J. (2005). *Climate change in prehistory. The end of the reign of chaos*. Cambridge: Cambridge University Press.

Bøe, J. and Nummedal, A.J. (1936). *Le Finnmarkién. Les Origines de la Civilisation dans l'Extreme-Nord de l'Europe*. Oslo: Instituttet for sammenlignende kulturforskning.

Bølviken, E., Helskog, E., Helskog, K., Holm-Olsen, I.M., Solheim, L. and Bretelsen, R. (1982). Correspondence analysis: an alternative to principal components. *World Archaeology*, 14(1), pp. 41-60.

Chatters, J.C. (1987). Hunter-gatherer adaptations and assemblage structure. *Journal of Anthropological Archaeology*, 6, pp. 336-375.

Clark, J.G.D. (1936). *The Mesolithic settlement of Northern Europe. A study of the food-gathering peoples of northern Europe during the early Post-glacial period*. New York: Greenwood Press Publishers.

Cohen, K.M., MacDonald, K., Joordens, J.C.A., Roebroeks, W. and Gibbard, P.L. (2012). The earliest occupation of north-west Europe: a coastal perspective. *Quaternary International*, 271, pp. 70-83.

Crombé, P., Sergant, J., Robinson, E. and De Reu, J. (2011). Hunter-gatherer responses to environmental change during the Pleistocene–Holocene transition in the southern North Sea basin: Final Palaeolithic–Final Mesolithic land use in northwest Belgium. *Journal of Anthropological Archaeology*, 30, pp. 454-471.

Cullberg, C. (1996). West-Sweden: On the earliest settlements. In: Larson, L., ed., *The earliest settlement of Scandinavia and its relationship with neighbouring areas.* Acta Archaeologica Lundensia, Series in 8°(24). Stockholm: Almquist & Wiksell International, pp. 177-189.

Dahl, B. and Bergsvik, T. (2001). *Arkeologisk rapport fra utgraving 2001*. Unpublished archaeological report. NTNU University Museum.

De Geer, G. (1884). Om den Skandinaviska landisens andra utbredning. *Geologiska Föreningen i Stockholm, Förhandlingar*, 7(7), pp. 436-466.

De Geer, G. (1888). Om Skandinaviens nivåförändringar under qvartärperioden. *Geologiska Föreningen i Stockholm, Förhandlingar*, 10(5), pp. 366-379.

De Geer, G. (1910). A geochronology of the last 12,000 years', *International Geographical Congress. Stockholm 1910*, fasc., 1, pp. 241-257.

Demuth, V. (2009). *Kulturhistorisk registrering, Porsgrunn kommune. Ny jernbanetrasé Larvik-Porsgrunn.* Unpublished archaeological report. Telemark fylkeskommune.

Digerfeldt, G. and Håkansson, H. (1993).The Holocene paleolimnology of Lake Sämbosjön, Southwestern Sweden. *Journal of Paleolimnology*, 8, pp. 189-210.

Dixon, E.J. (2001). Human colonization of the Americas: timing, technology and process. *Quaternary Science Reviews*, 20(1-3), pp. 277-299.

Dugstad, S.A. (2002). En boplass fra eldre steinalder på Hundvåg. *Frá haug ok heiðni*, 2002(4), pp. 21-25.

Dugstad, S.A. (2007). *Hushold og teknologi. En studie av tidlig preboreale lokaliteter i Rogaland*. Unpublished thesis (MA). University of Bergen.

Eigeland, L. (2014). Nedre Hobekk 1. Rasteplass fra mesolittisk tid med spesialisert aktivitet. In: Melvold, S. and Persson, P., eds., *Vestfoldbaneprosjektet. Arkeologiske undersøkelser i forbindelse med ny jernbane mellom Larvik og Porsgrunn. Bind 1. Tidlig- og mellommesolittiske lokaliteter i Vestfold og Telemark*. Kristiansand: Portal Forlag A/S, pp. 144-151.

Eigeland, L. and Solheim, S. (2012). Blomvågfunnet – veid og funnet for lett. *Viking*, 75, pp. 7-26.

Erlandson, J.M. (2001). The archaeology of aquatic adaptations. Paradigms for a new millennium. *Journal of Archaeological Research*, 9(4), pp. 287-350.

Erlandson, J.M. (2010). Food for thought: The role of coastlines and aquatic resources in human evolution. In: Cunnane, S. and Stewart, K., eds., *Human brain evolution: The influence of freshwater and marine food resources*. Hoboken: John Wiley & Sons, pp. 125-136.

Erlandson, J.M. and Fitzpatrick, S.M. (2006). Oceans, islands and coasts: current perspectives on the role of the sea in human prehistory. *Journal of Island and Coastal Archaeology*, 1(1), pp. 5-32.

Erlandson, J.M., Graham, M.H., Bourque, B.J., Corbett, D. Estes, J.A. and Steneck, R.S. (2007). The kelp highway hypothesis: Marine ecology, the coastal migration theory, and the peopling of the Americas. *The Journal of Island and Coastal Archaeology*, 2(2), pp. 161-174.

Eskeland, K.F. (2013). *Rapport fra kulturhistorisk registrering, E18 Tvedestrand–Arendal*. Archaeological report. Aust-Agder fylkeskommune.

Estévez, J. (2009). Ethnoarchaeology in the Uttermost Part of the Earth. *Arctic Anthropology*, 46(1-2), pp. 132-143.

Fimreite, S., Vorren, K.D. and Vorren, T.O. (2001). Vegetation, climate and ice-front oscillations in the Tromsø area, northern Norway during the Allerød and Younger Dryas. *Boreas*, 30, pp. 89-100.

Fischer, A. (1996). At the border of human habitat. The Late Palaeolithic and Early Mesolithic in Scandinavia. In: Larson, L., ed., *The earliest settlement of Scandinavia and its relationship with neighbouring areas.* Acta archaeologica Lundensia, Series in 8°(24). Stockholm: Almquist & Wiksell International, pp. 157-176.

Floor, J. (1989). Dyrnes, en eldre steinalders boplass i Finnøy kommune. *Frá haug ok heiðni*, 1989(3), pp. 281-288.

Fossum, G. (2014). Solum 1. En tidligmesolittisk lokalitet med metaryolitt. In: Melvold, S. and Persson, P., eds., *Vestfoldbaneprosjektet. Arkeologiske undersøkelser i forbindelse med ny jernbane mellom Larvik og Porsgrunn. Bind 1. Tidlig- og mellommesolittiske lokaliteter i Vestfold og Telemark*. Kristiansand: Portal Forlag A/S, pp. 126-143.

Fredén, C. (1975). Subfossil finds of Arctic whales and seals in Sweden. *Sveriges Geologiska Undersökning*, C710, Årsbok 69(2), pp. 1-62.

Fredén, C. (1988). *Marine life and deglaciation chronology of the Vänern Basin, southwestern Sweden.* Uppsala: Sveriges geologiska undersökning.

Fretheim, S.E. (2008). *Arkeologisk undersøkelse i forbindelse med utviding av Kristiansund lufthavn, Kvernberget, Kristiansund kommune, Møre og Romsdal, 2007. Lokalitet 1.* Unpublished archaeological report. NTNU University Museum.

Freundt, E.A. (1948). Komsa–Fosna–Sandarna. Problems of the Scandinavian Mesolithicum. *Acta Archaeologica*, 19(1948), pp. 1-68.

Fuglestvedt, I. (1999). The Early Mesolithic site at Stunner, Southeast Norway: A discussion of Late Upper Palaeolithic/Early Mesolithic chronology and cultural relations in Scandinavia. In: Boaz, J., ed., *The Mesolithic of Central Scandinavia.* Universitetets oldsaksamlings skrifter, ny rekke 22. Oslo: Universitets oldsaksamling, pp. 189-202.

Fuglestvedt, I. (2005). *Pionerbosetningens fenomenologi. Sørvest-Norge og Nord-Europa 10200/10000–9500 BP.* AmS-NETT, 6. Stavanger: Arkeologisk museum i Stavanger.

Fuglestvedt, I. (2007). The Ahrensburgian Galta 3 site in SW Norway. Dating, technology and cultural affinity. *Acta Archaeologica*, 78(2), pp. 87-110.

Fuglestvedt, I. (2009). *Phenomenology and the pioneer settlement on the western Scandinavian peninsula.* Göteborg: Bricoleur Press.

Fuglestvedt, I. (2012). The Palaeolithic Condition on the Scandinavian Peninsula: the last frontier of a 'Palaeolithic way' in Europe. *Norwegian Archaeological Review*, 45(1), pp. 1-29.

Futuyma, D.J. (1979). *Evolutionary Biology*. 3rd ed. Sunderland, Massachusetts: Sinauer Associates.

Gamble, C. (1997). The skills of the Lower Palaeolithic. *Proceedings of the Prehistoric Society*, 63, pp. 407-410.

Gamble, C., Davies, W., Pettitt, P. and Richards, M. (2004). Climate change and evolving human diversity in Europe during the last glacial. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 359(1442), pp. 243-254.

Gaustad, F. (1973). Kyst og innland i Nordland. *Tromsø Museums Skrifter*, XIV, pp. 183-189.

Gjerland, B. (1986). Buplassar i Nordmarka, Strand. *Frá haug ok heiðni*, 1986(3), pp. 96-99.

Gjerland, B. (1990). *Arkeologiske undersøkingar på Haugsneset og Ognøy i Tysvær og Bokn kommunar, Rogaland*. AmS-Rapport, 5. Stavanger : Arkeologisk museum i Stavanger

Gjessing, G. (1945). *Norges steinalder*. Oslo: Johan Grundt Tanum.

Glassow, M.A., Wilcoxon, L.R. and Erlandson, J. (1988). Cultural and environmental change during the Early Period of Santa Barbara Channel prehistory. In: Bailey, G. and Parkington, J., eds., *The archaeology of prehistoric coastlines.* New directions in archaeology. Cambridge: Cambridge University Press, pp. 64-77.

Glørstad, H. (2013). Where are the missing boats? The pioneer settlement of Norway as long-term history. *Norwegian Archaeological Review*, 46(1), pp. 57-80.

Glørstad, H. (2014). Deglaciation, sea-level change and the Holocene colonization of Norway. *Geological Society, London, Special Publications*, 411, pp. 9-25.

Glørstad, H. et al. (2013). Where are the missing boats? The pioneer settlement of Norway as long-term history. With comments from Bang-Andersen, S.; Bjerck, H.B; Bonsall, C., Pickard, C. and Groom, P.; Cummings, V.; Eriksen, B.V.; Fuglestvedt, I.; Rowley-Conwy, P.; Wikell, R. and Pettersson, M. Reply by Glørstad, H. *Norwegian Archaeological Review*, 46(1), pp. 57-120.

Glørstad, H. and Kvalø, F., eds., (2012). *HAVVIND – Paleogeografi og arkeologi.* Arkeologisk rapport 2012:12. Oslo: Norsk Maritimt Museum.

Graham, M.H., Dayton, P.K. and Erlandson, J.M. (2003). Ice ages and ecological transitions on temperate coasts. *Trends in Ecology and Evolution*, 18, pp. 33-40.

Granados, T.J. (2011). *Skiveøkser frå Vest-Noreg: Ein analyse av teknikk, klassifikasjon og distribusjon*. Unpublished thesis (MA). University of Bergen.

Grydeland, S.E. (2006). *Nytt lys på eldre steinalder i Finnmark. En sammenlignende studie over bosetningsmønster og bruk av steingjenstander i Varanger, Alta og Nord-Finland.* Unpublished manuscript in possession of S.E. Grydeland.

Grøndahl, F.A., Hufthammer, A.K., Dahl, S.O. and Rosvold, J. (2010). A preboreal elk (Alces alces L., 1758) antler from south-eastern Norway. *Fauna norvegica*, 30, pp. 9-12.

Gustafson, L. (1986). Fangstfolk i fjellet. *SPOR*, 1986(1), pp. 18-23.

Gustafson, L. (1988). Fjellpionerene. In: Indrelid, S., Kaland, S. and Solberg, B., eds., *Festskrift til Anders Hagen*. Arkeologiske Skrifter. Bergen: Historisk Museum, Universitetet i Bergen, pp. 450-467.

Gustafson, L. (1999). Stunner – the «first» Early Mesolithic site in Eastern Norway. In: Boaz, J., ed., *The Mesolithic of Central Scandinavia.* Universitetets oldsaksamlings skrifter, ny rekke 22. Oslo: Universitets oldsaksamling, pp. 181-187.

Gutiérrez-Zugasti, I., Andersen, S.H., Araño, A.C., Dupont, C., Milner, N., Monge-Soares, A.M. (2011). Shell midden research in Atlantic Europe: State of the art, research problems and perspectives for the future. *Quaternary International*, 239, pp.70-85.

Gyllencreutz, R. (2005). Late Glacial and Holocene paleoceanography in the Skagerrak from high-resolution grain size records. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 222(3-4), pp. 344-369.

Hafsten, U. (1963). A Late-Glacial Pollen Profile from Lista, South Norway. *Grana Palynologica*, 4(2), pp. 326-337.

Hafsten, U. (1983). Shore-level changes in South Norway during the last 13,000 years, traced by biostratigraphical methods and radiometric datings. *Norsk Geografisk Tidsskrift - Norwegian Journal of Geography*, 37(2), pp. 63-79.

Hagen, A. (1963). Mesolittiske jegergrupper i norske høyfjell. Synsmåter om Fosnakulturens innvandring i Vest-Norge. *Universitetets Oldsaksamling Årbok*, 1960/1961, pp. 109-142.

Hagen, A. (1972). Man and nature. Reflections on culture and ecology. *Norwegian Archaeological Review*, 5(1), pp. 1-22.

Hansen, A.M. (1904). *Landnåm i Norge: En Utsigt Over Bosætningens Historie*. Kristiania: W.C. Fabritius & sønner.

Hastorf, C.A. (1990). The ecosystem model and long-term prehistoric change: An example from the Andes. In: Moran, E.F., ed., *The ecosystem approach in anthropology. From concept to practice*, 2nd ed. Ann Arbor: The University of Michigan Press, pp. 131-157.

Hatleskog, A.B., Bjerck, L.G.B. and Wenaas, T. (1988). *Arkeologiske undersøkingar 1987 i samband med planlagt ilandføring av gass frå Haltenbanken. Alternativ: Akset.* Rapport, Arkeologisk serie, 1988-2. Trondheim: Universitetet i Trondheim, Vitenskapsmuseet.

Haug, A. (1997). *Rapport fra arkeologiske undersøkelser på Leka gnr 9/18 og gnr 10/9 i tidsrommet 9/6-13/6 1997*. Unpublished archaeological report. NTNU University Museum.

Haug, A. (2003). På sporet av den eldste bosetningen i Kristiansund. *Årbok for Nordmøre*, 2003, pp. 8-49.

Hauglid, M. (1993). *Mellom Fosna og Komsa. En preboreal «avslagsredskapskultur» i Salten, Nordland.* Unpublished thesis (Cand. Mag.). University of Tromsø.

Helskog, K. (1974). Stone Age settlement patterns in interior North Norway. *Arctic Anthropology*, XI, pp. 266-271.

Helskog, K. (1978). Late Holocene sea-level changes seen from prehistoric settlements. *Norsk Geografisk Tidsskrift – Norwegian Journal of Geography*, 32, pp. 111-119.

Helskog, K., Indrelid, S. and Mikkelsen, E. (1976). Morfologisk klassifisering av slåtte steinartefakter. *Universitetets Oldsaksamling Årbok*, 1972-1974, pp. 9-40.

Hemdorff, O. (2001). De første fangstfolk på Hundvåg – 10500 år gamle boplasser. *Frá haug ok heiðni*, 2001(4), pp. 19-22.

Hernæs, P. (1979). En boplass på Karmøy med funn fra eldre og yngre steinalder. *Frá haug ok heiðni*, 1979(1), pp. 183-188.

Hesjedal, A., Damm, C., Olsen, B. and Storli, I. (1996). *Arkeologi på Slettnes: Dokumentasjon av 11.000 års bosetning.* Tromsø Museums Skrifter, XXVI. Tromsø: Tromsø Museum.

Hesjedal, A., Ramstad, M. and Niemi, A.R. (2009). *Undersøkelsene på Melkøya. Melkøyaprosjektet – kulturhistoriske registreringer og utgravninger 2001 og 2002.* Tromura, Kulturvitenskap 36. Tromsø: Tromsø Museum – Universitetsmuseet.

Hood, B.C. and Kjellman, E. (2012*). Lokalitet 10 (Id.105042): foreløpig rapport om Eldre steinalder-boplasser fra Preboreal og Boreal tid.* Unpublished archaeological report. University of Tromsø.

Hufthammer, A.K. (2001). The Weichselian (c. 115,000–10,000 B.P.) vertebrate fauna of Norway. *Bollettino Della Societa Paleontologica Italiana*, 40(2), pp. 201-208.

Huston, M.A. and Wolverton, S. (2009). The global distribution of net primary production: Resolving the paradox. *Ecological Monographs*, 79(3), pp. 343-377.

Høgestøl, M. (1990). Glimt fra årets utgravninger i Rennesøy. *Frá haug ok heiðni*, 1990(1), pp. 6-11.

Høgestøl, M. (1995). *Arkeologiske undersøkelser i Rennesøy kommune, Rogaland, Sørvest-Norge*. AmS-Varia, 23. Stavanger: Arkeologisk museum.

Høgestøl, M., Berg, E. and Prøsch-Danielsen, L. (1995). Strandbundne Ahrensburg- og Fosnalokaliteter på Galta-halvøya, Rennesøy kommune, Sørvest-Norge. *Arkeologiske Skrifter*, 8, pp. 44-64.

Indrelid, S. (1973). *Hein 33: En steinalderboplass på Hardangervidda. Forsøk på kronologisk og kulturell analyse.* Årbok for Universitetet i Bergen. Humanistisk serie, 1972(1). Bergen: Universitetsforlaget, pp. 7-44.

Indrelid, S. (1975). Problems relating to the Early Mesolithic settlement of Southern Norway. *Norwegian Archaeological Review*, 8(1), pp. 1-18.

Indrelid, S. (1978). Mesolithic economy and settlement patterns in Norway. In: Mellars, P., ed., *The early postglacial settlement of Northern Europe. An ecological perspective*. London: Duckworth, pp. 147-176.

Indrelid, S. (2009). *Arkeologiske undersøkelser i vassdrag: faglig program for Sør-Norge*. Oslo: Riksantikvaren.

Iversen, F., ed., (2006). *Veien gjennom Vestfold – E18. Arkeologiske registreringer 2005/2006. Foreløpig delrapport Sky–Nøklegård*. Archaeological report. Vestfold fylkeskommune.

Jaksland, L., ed., (2012a). *E18 Brunlanesprosjektet, Volume II. Undersøkte lokaliteter fra tidligmesolitikum.* Varia 80. Oslo: Kulturhistorisk museum, Universitetet i Oslo.

Jaksland, L., ed., (2012b). *E18 Brunlanesprosjektet, Volume III. Undersøkte lokaliteter fra tidligmesolitikum og senere.* Varia 81. Oslo: Kulturhistorisk museum, Universitetet i Oslo.

Jaksland, L. (2012c). Pauler 6 – boplass fra tidligmesolitikum. In: Jaksland, L., ed., *E18 Brunlanesprosjektet, Volume III. Undersøkte lokaliteter fra tidligmesolitikum og senere.* Varia 81. Oslo: Kulturhistorisk museum, Universitetet i Oslo, pp. 59-92.

Jaksland, L. (2012d). Pauler 7 – boplass fra tidligmesolitikum. In: Jaksland, L., ed., *E18 Brunlanesprosjektet, Volume III. Undersøkte lokaliteter fra tidligmesolitikum og senere. Varia* 81. Oslo: Kulturhistorisk museum, Universitetet i Oslo, pp. 93-124.

Jaksland, L. and Persson, P., eds., (2014). *E18 Brunlanesprosjektet, Volume I. Undersøkte lokaliteter fra tidligmesolitikum og senere.* Varia 79. Oslo: Kulturhistorisk museum, Universitetet i Oslo.

Jochim, M. (1979). Breaking down the system: Recent ecological approaches in archaeology. In: Schiffer, M., ed., *Advances in Archaeological method and theory 2*. New York: Academic Press, pp. 77-117.

Jochim, M. (1990). The ecosystem concept in archaeology. In: Moran, E.F., ed., *The ecosystem approach in anthropology. From concept to practice,* 2nd ed. Ann Arbor: The University of Michigan Press, pp. 75-90.

Johannessen, L. (2009). *Ahrensburgkulturens lokalitetsplassering: en redegjørelse av forholdet mellom kyst og innland*. Unpublished thesis (MA). University of Oslo.

Johansen, A.B. (1969). *Høyfjellsfunn ved Lærdalvassdraget I. Den teoretiske bakgrunn og det første analyseforsøk.* Årbok for Universitetet i Bergen. Humanistisk serie, 4. Bergen: Universitetsforlaget.

Johansen, A.B. (1975). Ulla/Førre-undersøkingane sidan sist. *Frá haug ok heiðni*, 1975(2), pp. 286-291.

Johansen, E. (1964). Høgnipen-funnene. Et nytt blad av Norges eldste innvandringshistorie. *Viking*, 27, pp. 177-179.

Johansen, K., Herje, T., Fastner, J., Pettersen, K., Sanden, J., Selvik, S.F., Wik, B. og Ringstad, B. (1988). *Arkeologiske undersøkingar 1987 i samband med planlagt ilandføring av gass frå Haltenbanken. Alternativ: Vågøy.* Rapport, Arkeologisk serie, 1988-4. Trondheim: Universitetet i Trondheim, Vitenskapsmuseet.

Johansen, T. (2008). *Steinalderfunn fra Ekkilsøy, 1982-1991*. Upublished note. NTNU University Museum.

Jonsson, L. (1995). Vertebrate fauna during the Mesolithic on the Swedish west coast. In: Fischer, A., ed., *Man and sea in the Mesolithic*. Oxford: Oxbow Books, pp 147-160.

Juhl, K. (2001). *Austbø og Hundvåg gennem 10000 år. Arkæologiske undersøgelser i Stavanger kommune 1987-1990, Rogaland, Syd-vest Norge*. AmS-Varia, 38. Stavanger: Arkeologisk museum.

Kalseth, J. (in prep). *Arkeologisk utgravning av Lokalitet 1, Vikansvingen, Hitra, Sør-Trøndelag.* Unpublished archaeological report. NTNU University Museum.

Kalseth, J. and Callanan, M. (2003). *Arkeologisk rapport fra utgraving 2003*. Unpublished archaeological report. NTNU University Museum.

Kankaanpää, J. and Rankama, T. (2012). New «Post-Swiderian» finds from Arctic Norway. In: Oshibkina S.V., ed., *Prehistoric Eurasia: on Aleksei N. Sorokin's 60th birthday*. Moscow: Institute of Archaeology, pp. 257-266.

Kelly, R.L. (1992). Mobility/sedentism: Concepts, archaeological measures, and effects. *Annual Review of Anthropology*, 21, pp. 43-66.

Kelly, R.L. (1995). *The foraging spectrum. Diversity in hunter-gatherer lifeways*. New York: Percheron Press.

Kelly, R.L. (2003). Colonization of new land by hunter-gatherers. Expectations and implications based on ethnographic data. In: Rockman, M. and Steele, J., eds., *Colonization of Unfamiliar Landscapes. The archaeology of adaptation*. London: Routledge, pp. 44-58.

Kindgren, H. (1995). Hensbacka-Hogen-Hornborgarsjön: Early Mesolithic coastal and inland settlements in western Sweden. In: Fischer, A., ed., *Man and sea in the Mesolithic*. Oxford: Oxbow Books, pp.171-184.

Kindgren, H. (1996). Reindeer or seals? Some Late Palaeolithic sites in central Bohusläan. In: Larsson, L., ed., *The earliest Settlement of Scandinavia and its relationship with neighbouring areas.* Acta Archaeologica Lundensia, Series in 8º(24). Stockholm: Almquist & Wiksell International, pp. 193-203.

Kjemperud, A. (1981). A shoreline displacement investigation from Frosta in Trondheimsfjorden, Nord-Trøndelag, Norway. *Norsk Geologisk Tidsskrift - Norwegian Journal of Geology*, 61, pp. 1-15.

Kleppe, J.I. (2010). Klubbvik 1. Tidlig bosetning og klima i Varangerfjorden i lys av nye undersøkelser nær Mortensnes, Nesseby kommune. *Varanger årbok*, 2010, pp. 71-78.

Kleppe, J.I. (2014). Desolate landscapes or shifting landscapes? Late glacial/early post-glacial settlement of northernmost Norway in the light of new data from Eastern Finnmark. In: Riede,

F. and Tallavaara, eds., *Lateglacial and Postglacial pioneers in Northern Europe.* BAR International Series 2599, pp. 121-146.

Kristoffersen, K.K. (1995). *De arkeologiske undersøkelsene på Bjorøy 1992-1994.* Arkeologiske rapporter 20. Bergen: Universitetet i Bergen.

Kristoffersen, S. (1990). *FV 018 Austvik–Brandasund 1988-1990.* Arkeologiske rapporter 13. Bergen: Universitetet i Bergen.

Kutschera, M. (1999). Vestnorsk tidligmesolitikum i et nordvesteuropeisk perspektiv. In: Fuglestvedt, I., Gansum, T. and Opedal, A. eds., *Et hus med mange rom. Vennebok til Bjørn Myhre på 60-årsdagen.* AmS-Rapport 11, Bind A. Stavanger: Arkeologisk museum, Universitetet i Stavanger, pp. 43-52.

Kutschera, M. and Waraas, T.A. (2000). Steinalderlokaliteten på ”Breiviksklubben” på Bratt-Helgaland i Karmøy kommune. In: Løken, T., ed., *Åsgard: natur- og kulturhistoriske undersøkelser langs en gassrør-trasé i Karmøy og Tysvær, Rogaland*. AmS-Rapport 14. Stavanger: Arkeologisk museum, Universitetet i Stavanger, pp. 61-96.

Laland, K.N. and Brown, G.R. (2010). *Sense & Nonsense. Evolutionary Perspectives on Human Behaviour*. Oxford: Oxford University Press.

Larsen, M.O. (2011). *Sørrollnes. Ibestad kommune*. *Registreringsrapport*. Unpublished archaeological report. Troms fylkeskommune.

Lee, R.B. and Daly, R. (1999). Foragers and others. In Lee, R.B. and Daly, R., eds., *The Cambridge Encyclopedia of Hunters and Gatherers*. Cambridge: Cambridge University Press, pp. 1-19.

Lia, V. (2008). *Opp fra havet. Arkeologisk registreringer langs ny jernbanetrasé Farriseidet-Telemark grense.* Unpublished archaeological report. Vestfold fylkeskommune.

Lindblom, I. (1978). *Former for økologisk tilpasning i Mesolitikum, Østfold.* Unpublished thesis (Cand. Mag.). University of Oslo.

Lindblom, I. (1983). 9-10000 år gammel boplass i Boknafjorden – en av Norges eldste! *Frá haug ok heiðni*, 1983(2), pp. 202-203.

Lindblom, I. (1984). Former for økologisk tilpasning i Mesolitikum, Østfold. *Universitetets Oldsaksamling Årbok*, 1982/1983, pp. 43-86.

Lorentzen, A.B. (2012). *Rapport sikringsgraving – Mohalsen, Vega*. Unpublished archaeological report. NTNU University Museum.

Lorentzen, A.B. (2013). *Rapport sikringsgraving – Mohalsen, Vega*. Unpublished archaeological report. NTNU University Museum.

Mangerud, J. (1970). Late Weichselian vegetation and ice-front oscillations in the Bergen district, Western Norway. *Norsk Geografisk Tidsskrift – Journal of Norwegian Geography*, 24, pp. 121-148.

Mangerud, J. (1977). Late Weichselian marine sediments containing shells, foraminifera, and pollen, at Ågotnes, western Norway. *Norsk Geologisk Tidsskrift - Norwegian Journal of Geology*, 57, pp. 23-54.

Mangerud, J., Andersen, S.T., Berglund, B.E. and Donner, J.J. (1974). Quaternary atratigraphy of Norden, a proposal for terminology and classification. *Boreas*, 3(3), pp. 109-128.

Martens, I. and Hagen, A. (1961). *Arkeologiske undersøkelser langs elv og vann. Gyrinosvatn, Hallingdal og Tokke–Vinje-vassdraget, Telemark.* Norske Oldfunn, X. Oslo: Universitetets Oldsaksamling.

Matsumoto, M. (2004). Austein og Melau. Tidligmesolittiske boplasser i Vestfold. *Viking*, 67, pp. 49-68.

Matsumoto, M. and Uleberg, E. (2006). Sandbekk. En tidligmesolittisk boplass i Rakkestad kommune, Østfold. *Viking*, 69, pp. 45-68.

Meling, T. (2008). Lokalitet 49 Nordre Steghaugen – Bosetningsspor fra eldre/yngre steinalder og førromersk jernalder. In: Bjerck, H.B., ed., Åstveit, L. I., Gundersen, J., Meling, T., Jørgensen, G. and Normann, S. *NTNU Vitenskapsmuseets arkeologiske undersøkelser Ormen Lange Nyhamna*. Trondheim: Tapir Academic Press, pp. 257-266.

Meltzer, D.J. (2009). *First peoples in a New World: colonizing Ice Age America*. Berkeley: University of California Press.

Melvold, S. and Persson, P., eds., (2014). *Vestfoldbaneprosjektet. Arkeologiske undersøkelser i forbindelse med ny jernbane mellom Larvik og Porsgrunn. Bind 1. Tidlig- og mellommesolittiske lokaliteter i Vestfold og Telemark*. Kristiansand: Portal Forlag A/S.

Mikkelsen, E. (1975). Mesolithic in South-eastern Norway. *Norwegian Archaeological Review*, 8(1), pp.19-35.

Mikkelsen, E. (1978). Seasonality and adaptation in Norway. In: Kristiansen, K. and Paludan-Müller, C., eds., *New Directions in Scandinavian Archaeology. Studies in Scandinavian Prehistory and Early History*, Volume I. Copenhagen: The National Museum of Denmark, pp. 79-119.

Moore, S.E. and Huntington, H.P. (2008). Arctic marine mammals and climate change: Impacts and resilience. *Ecological Applications*, 18(2), pp. S157-S165.

Moran, E.F. 1984. Preface. In: Moran, E.F., ed., *The ecosystem approach in anthropology. From concept to practice*, 1st ed. Ann Arbor: The University of Michigan Press, pp. xiii-xvi.

Moran, E.F. (1990). Ecosystem ecology in biology and anthropology: a critical assessment. In: Moran, E.F., ed., *The ecosystem approach in anthropology. From concept to practice*, 2nd ed. Ann Arbor: The University of Michigan Press, pp. 3-40.

Murdock, G.P. (1969). *Ethnographic Atlas*. 2nd ed. Pittsburgh: University of Pittsburgh Press.

Møllenhus, K.R. (1977). *Mesolitiske boplasser på Møre- og Trøndelagskysten*. Gunneria, 27. Trondheim: Det Kongelige Norske Videnskabers Selskab, Museet.

Møller J. (1986). Holocene transgression maximum about 6000 years BP at Ramså, Vesterålen, North Norway. *Norsk Geografisk Tidsskrift – Norwegian Journal of Geography*, 40(2), pp. 77–84.

Møller, J. (1987). Shoreline relation and prehistoric settlement in northern Norway. *Norsk Geografisk Tidsskrift – Journal of Norwegian Geography*, 41, pp. 45-60.

Nesje, A. and Dahl, S.O. (1993). Lateglacial and Holocene glacier fluctuations and climate variations in western Norway: A review. *Quaternary Science Reviews*, 12, pp. 255-261.

Niemi, A.R., Cerbing, M., Oppvang, J. and Nergaard, R. (in press). *Melsvik i Alta - Brudd og boplass gjennom 10000 år*. Tromura. Tromsø: Tromsø Museum.

Nordhagen, R. (1933). *De senkvartære klimavekslinger i Nordeuropa og deres betydning for kulturforskningen*. Oslo: H. Aschehoug & Co.

Nummedal, A.J. (1914). Et bosted fra den yngre stenalder i «Allanenget» i Kristiansund. *Oldtiden*, IV, pp. 9-23.

Nummedal, A.J. (1922). Nordmøre i Steinalderen. *Aarsskrift for Nørdmør Historielag*, 1922, pp. 48-59.

Nummedal, A.J. (1929). *Stone Age finds in Finnmark*. Oslo: H. Aschehoug & Co.

Nummedal, A.J. (1975). Finnmarks-fundene. (Published on the 50th Anniversary of the Discovery of the Komsa Culture). *Acta Borealia*, B. Humaniora, 15, pp. 11-24.

Nygaard, S. (1987). Socio-economic developments along the southwestern coast of Norway between 10,000 and 4,000 BC. In: Rowly-Conwy, P., Zvelebil, M. and Blankholm, H.P., eds., *Mesolithic Northwest Europe: Recent Trends*. Sheffield: University of Sheffield, pp. 147-154.

Nygaard, S. (1990). Mesolithic Western Norway. In: Vermeersch, P.M. and van Peer, P., eds., *Contributions to the Mesolithic in Europe.* Papers presented at the fourth international symposium 'The Mesolithic in Europe'. Leuven: Leuven University Press, pp. 227-237.

Nyland, A.J. (2011). Hellevik lok. 3A – en godt bevart korttidslokalitet fra tidligmesolitikum. In: Skjelstad, G., ed., *Steinalderboplasser på Fosenhalvøya: Arkeologiske og naturvitenskapelige undersøkelser 2004-2007 T-Forbindelsen, Karmøy kommune, Nord-Rogaland*. AmS-Varia, 52. Stavanger: Arkeologisk museum, Universitetet i Stavanger, pp. 137-147.

Nyland, A.J. (2012a). Lokaliseringsanalyse av tidligmesolittiske pionerboplasser. Appendix 4. In: Glørstad, H. and Kvalø, F., eds., (2012). *HAVVIND – Paleogeografi og arkeologi.* Arkeologisk rapport 2012:12. Oslo: Norsk Maritimt Museum.

Nyland, A.J. (2012b). Pauler 2, boplass fra tidligmesolitikum. In: Jaksland, L., ed., *E18 Brunlanesprosjektet, Volume II. Undersøkte lokaliteter fra tidligmesolitikum.* Varia 80. Oslo: Kulturhistorisk museum, Universitetet i Oslo, pp. 127-170.

Nyland, A.J. (2012c). Pauler 4 – tidligmesolittisk bosetning. In: Jaksland, L., ed., *E18 Brunlanesprosjektet, Volume III. Undersøkte lokaliteter fra tidligmesolitikum og senere.* Varia 81. Oslo: Kulturhistorisk museum, Universitetet i Oslo, pp. 3-58.

Nyland, A.J. and Amundsen, T. (2012). Bakke – en boplass fra tidligmesolittikum. In: Jaksland, L., ed., *E18 Brunlanesprosjektet, Volume III. Undersøkte lokaliteter fra tidligmesolitikum og senere.* Varia 81. Oslo: Kulturhistorisk museum, Universitetet i Oslo, pp. 143-198.

Nærøy, A.J. (1994). *Troll-prosjektet. Arkeologiske undersøkelser på Kollsnes, Øygården kommune Hordaland, 1989-1992*. Arkeologiske rapporter, 19. Bergen: Arkeologisk institutt, Universitetet i Bergen.

Nærøy, A.J. (1995a). Early Mesolithic site structure in western Norway – a case study. *Universitetets Oldsaksamling Årbok*, 1993/1994, pp. 59-77.

Nærøy, A.J. (1995b). Tidligmesolittisk lokalitets-struktur – et eksempel fra Øygarden på ytterkysten av Vestlandet. *Arkeologiske Skrifter*, 8, pp. 81-94.

Nærøy, A.J. (1998). *Stone Age living spaces in western Norway.* Unpublished thesis (Dr. Art.). University of Bergen.

Nærøy, A.J. (2000). *Stone Age living spaces in western Norway.* BAR International Series 857.

Odner, K. (1964). Erhverv og bosetning i Komsakulturen. *Viking*, 28, pp. 117-128.

Odner, K. (1965). Vivik ved Holmevatn på Haukelifjell. Arkeologiske undersøkelser i Røldal–Suldal. *Viking*, 29, pp. 201-242.

Odner, K. (1966). *Komsakulturen i Nesseby og Sør-Varanger.* Tromsø Museums skrifter, XII. Tromsø: Tromsø museum.

Odum, E.P. (1971). *Fundamentals of ecology*. 3rd ed. Philadelphia: W.B. Saunders Company.

Olsen, A.B. (1992). *Kotedalen – en boplass gjennom 5000 år. Bind I. Fangstbosetning og tidlig jordbruk i Vestnorsk steinalder, Nye funn og nye perspektiver*. Bergen: University of Bergen.

Olsen, B. (1994). *Bosetning og samfunn i Finnmarks forhistorie*. Oslo: Universitetsforlaget.

Olsen, B. (1997). *Fra ting til tekst. Teoretiske perspektiv i arkeologisk forskning*. Oslo: Universitetsforlaget.

Olsen, M. (2012). *Arkeologisk registrering E-18 Rugtvedt–Dørdal*. Archaeological report. Telemark fylkeskommune.

Osborn, A.J. (1977). Strandloopers, mermaids and other fairytales: ecological determinants of marine resource utilization – the Peruvian case. In: Binford, L.R., ed., *For theory building in archaeology*. New York: Academic Press, pp. 157-205.

Oswalt, W.H. (1976). *An Anthropological Analysis of Food-Getting Technology*. New York: Wiley.

Panter-Brick, C., Layton, R.H. and Rowly-Conwy, P. (2001). Lines of enquiry. In: Panter-Brick, C., Layton, R.H. and Rowly-Conwy, P., eds., *Hunter-gatherers. An interdisciplinary perspective*. Cambridge: Cambridge University Press, pp. 1-11.

Parducci, L. *et al*. (2012). Glacial Survival of Boreal Trees in Northern Scandinavia. *Science*, 335, pp. 1083-1086.

Paus, Aa. (1995). The Late Weichselian and early Holocene history of tree birch in south Norway and the Bølling Betula time-lag in northwest Europe. *Review of Palaeobotany and Palynology*, 85(3-4), pp. 243-262.

Perlman, S.M. (1980). An optimum diet model, coastal variability, and hunter-gatherer behaviour. *Advances in Archaeological Method and Theory*, 1980(3), pp. 257-310.

Pettersen, K. (1975). *Utgravning av steinalderlokaliteter på Stabblandet, Tustna, Møre og Romsdal.* Rapport, Arkeologisk serie, 1975:1. Trondheim: Det Kongelige Norske Videnskabers Selskab, Museet.

Pettersen, K. (1982). *Steinalder på Vega. En introduksjon og et analyseforsøk.* Rapport, Arkeologisk serie, 1982:9. Trondheim: Det Kongelig Norske Vitenskabers Selskab, Museet.

Pettersen, K. (1994). *Steinalderlokalitet Vorpbukta 1*. Unpublished archaeological report. Sør-Trøndelag fylkeskommune.

Pettersen, K. 1999. The Mesolithic in southern Trøndelag. In: Boaz, J., ed., *The Mesolithic of Central Scandinavia.* Universitetets oldsaksamlings skrifter, ny rekke 22. Oslo: Universitets oldsaksamling.

Pettersen, K. (2008). *Arkeologisk rapport. Registrering av boplassområde fra tidlig eldre steinalder (tidligmesolittikum), Orkdal, Gjeiten nordre*. Unpublished archaeological report. Sør-Trøndelag fylkeskommune.

Pettersen, K., Aukan, N., Bjerck, L.G.B. and Wik, B. (1988). *Arkeologiske undersøkelser 1987 i forbindelse med planlagt ilandføring av gass fra Haltenbanken. Alternativ: Grisvågøy.* Rapport, Arkeologisk serie, 1988:5. Trondheim: Universitetet i Trondheim, Vitenskapsmuseet.

Pettersson, M. and Wikell, R. (2006). Mesolitiska boplatser i Stockholms skärgård. Fiske och säljakt på utskären under 10000 år. *Fornvännen*, 101, pp. 153-167.

Pettersson, M. and Wikell, R. (2014). Where sky and sea are one. Close encounters with early seafarers and seal-hunters off the Swedish Baltic coast. In: Riede, F. and Tallavaara, eds., *Lateglacial and Postglacial pioneers in Northern Europe.* BAR International Series 2599, pp. 103-120.

Prøsch-Danielsen, L. and Høgestøl, M. (1995). A coastal Ahrensburgian site found at Galta, Rennesøy, southwest Norway. In: Fischer, A., ed., *Man and sea in the* Mesolithic. Oxford: Oxbow Books, pp. 123-130.

Ramberg, B. (2008). *Kulturhistorisk registrering, Tromsø kommune, Håkøybotn*. Unpublished archaeological report. Troms fylkeskommune.

Ramstad, M. (2014). Steinaldermenneskene ved Norskekysten: pionérer i maritim mestring. *Årbok for Universitetsmuseet i Bergen*, 2014, pp. 6-17.

Rankama, T. and Kankaanpää, J. (2011). First evidence of eastern Preboreal pioneers in Arctic Finland and Norway. *Quartär*, 58, pp. 183-209.

Rawlence, N.J., Lowe, D.J. Wood, J.R., Young, J.M., Churchman, G.J, Huang, Y. and Cooper, A. (2014). Using palaeoenvironmental DNA to reconstruct past environments: progress and prospects. *Journal of Quaternary Science*, 29(7), pp. 610-626.

Reite, A.J., Seines, H. and Sveian, H. (1982). A proposed deglaciation chronology for the Trondheimsfjord area, Central Norway. *Norges Geologiske Undersøkelse*, 373, pp. 75-84.

Riede, F. (2009). Climate and demography in early prehistory: Using calibrated 14C dates as population proxies. *Human Biology*, 81(2-3), pp. 309-337.

Rochon, A., de Vernal, A., Sejrup, H.P. and Haflidason, H. (1998). Palynological evidence of climatic and oceanographic changes in the North Sea during the last deglaciation. *Quarternary Research*, 49, pp. 197-207.

Rockman, M. (2003). Knowledge and learning in the archaeology of colonization. In: Rockman, M. and Steele, J., eds., *Colonization of Unfamiliar Landscapes. The archaeology of adaptation*. London: Routledge, pp. 3-24.

Rosvold, J. and Breivik, H.M. (in press). An Early Holocene bearded seal from the Trondheimsfjord: environmental and archaeological implications. In: Persson, P., Riede, F., Skar, B., Breivik, H.M. and Jonsson, L., eds., *The early settlement of Northern Europe – Economy, settlement, and society*, Vol. 1. Sheffield: Equinox Publishing.

Sandmo, A.K. (1986). *Råstoff og redskap – mer enn teknisk hjelpemiddel: om symbolfunksjoner som et aspekt ved materiell kultur; skisse av etableringsforløpet i en nordeuropeisk kystsone 10.000–9.000 BP*. Unpublished thesis (Cand. Mag.). University of Tromsø.

Sauvage, R. (2007). *Arkeologisk undersøkelse i forbindelse med reguleringsplan for Kvennbergmyran, Kristiansund kommune, Møre og Romsdal, 2007. Lokalitet 1.* Unpublished archaeological report. NTNU University Museum.

Schanche, K. (1988). *Mortensnes, en boplass i Varanger. En studie av samfunn og materiell kultur gjennom 10.000 år*. Unpublished thesis (Cand. Mag.). University of Tromsø.

Scheffler, A.M., Svendsen, F. and Demuth, V. (2011). *Kulturhistorisk registrering, Bamble kommune, ny E-18, sydlig trasé*. Archaeological report. Telemark fylkeskommune.

Schmitt, L. (1994). The Hensbacka: A subsistence strategy of continental hunter-gatherers, or an adaptation at the Pleisticene-Holocene boundary? *Oxford Journal of Archaeology*, 13(3), pp. 245-263.

Schmitt, L. (1999). Comparative points and relative thoughts: The relationship between the Ahrensburgian and Hensbacka assemblages. *Oxford Journal of Archaeology*, 18(4), pp. 327-337.

Schmitt, L. (2015). Early Colonization, Glacial Melt Water, and Island Mass Effect in the Archipelago of Western Sweden: A Case History. *Oxford Journal of Archaeology*, 34(2), pp. 109-117.

Schmitt, L., Larsson, S., Burdukiewicz, J., Ziker, J., Svedhage, K., Zamon J. and Steffen H. (2009). Chronological insights, cultural change, and resource exploitation on the west coast of Sweden during the Late Palaeolithic/Early Mesolithic transition. *Oxford Journal of Archaeology*, 28(1), pp. 1-27.

Schmitt, L., Larsson, S., Schrum, C., Alekseeva, I., Tomczak, M., Svedhage K. (2006). 'Why they came': The colonization of the coast of western Sweden and its environmental context at the end of the last glaciation. *Oxford Journal of Archaeology*, 25(1), pp.1-28.

Shetelig, H. (1922). *Primitive tider i Norge: En oversigt over stenalderen*. Bergen: John Griegs Forlag.

Simonsen, P. (1974). *Veidemenn på Nordkalotten. Innledning – Eldre steinalder*. Stensilserie B, historie, hefte 1. Tromsø: Universitetet i Tromsø.

Sjøstrand, O., Eikje, L.L. and Myrholt, E. (2004). *Arkeologisk rapport fra utgraving 2004.* Unpublished archaeological report. NTNU University Museum.

Sjøvold, T. (1970). *Arkeologisk registrering ved Grytten kraftanlegg. Rauma kommune.* Unpublished archaeological report. NTNU University Museum.

Skandfer, M., ed., (2010). *Tønsnes havn, Tromsø Kommune, Troms. Rapport fra Arkeologiske utgravninger i 2008 og 2009.* Tromura 40. Tromsø: Tromsø Museum – Universitetsmuseet.

Skar, B. and Coulson, S.D. (1985). The Early Mesolithic Site of Rørmyr II. A re-examination of one of the Høgnipen sites, SE Norway. *Acta Archaeologica*, 56, pp. 167-183.

Skar, B. and Coulson, S.D. (1989). A case study of Rørmyr II: a Norwegian Early Mesolithic site. In: Bonsall, C., ed., *The Mesolithic in Europe.* Papers presented on the third international symposium. Edinburgh: John Donald Publishers, pp. 351-361.

Skjelstad, G. (2000). Nærkontakt med forhistorien på Hundvåg. *Frá haug ok heiðni*, 2000(1), pp. 40-43.

Skjelstad, G. (2011a). Lindøy lok. 1C – en korttidslokalitet fra tidligmesolitikum med spor etter øksetilvirkning. In: Skjelstad, G., ed., *Steinalderboplasser på Fosenhalvøya: Arkeologiske og naturvitenskapelige undersøkelser 2004-2007 T-Forbindelsen, Karmøy kommune, Nord-Rogaland.* AmS-Varia, 52. Stavanger: Arkeologisk museum, Universitetet i Stavanger, pp. 177-184.

Skjelstad, G. (2011b). Lindøy lok. 5 – en lokalitet brukt i tidlig- og i senmesolitikum In: Skjelstad, G., ed., *Steinalderboplasser på Fosenhalvøya: Arkeologiske og naturvitenskapelige undersøkelser 2004-2007 T-Forbindelsen, Karmøy kommune, Nord-Rogaland*. AmS-Varia, 52. Stavanger: Arkeologisk museum, Universitetet i Stavanger, pp. 205-211.

Solheim, S. and Damlien, H., eds., (2013). *E18 Bommestad-Sky. Undersøkesler av lokaliteter fra mellommesolitikum, Larvik kommune, Vestfold fylke*. Kristiansand: Portal Forlag AS.

Stensrud, G. (2008). *Rapport: Skulgam, Gnr. 109/2, Tromsø kommune.* Unpublished archaeological report. Troms fylkeskommune.

Steward, J.H. (1955). *Theory of cultural change. The methodology of multilinear evolution*. Urbana: University of Illinois Press.

Strøm, I.O. and Breivik, H.M. (2008). *Arkeologiske undersøkelser. Reguleringsplan Kvernberget Lufthavn. Lokalitet 20*. Unpublished archaeological report. NTNU University Museum.

Svendsen, F. (2007a). *Arkeologiske undersøkelser. Reguleringsplan Kvernberget lufthavn. Lok 24, boplass fra Tidlig Mesolittisk tid.* Unpublished archaeological report. NTNU University Museum.

Svendsen, F. (2007b). *Lokaliteter og landskap i tidlig mesolittisk tid. En geografisk analyse fra Nordvest-Norge*. Unpublished thesis (MA). University of Trondheim.

Svendsen, F. (2009). *Arkeologiske undersøkelser i forbindelse med utvidelse av Leka vannverk mot Engan og Vågan over Vassdalen og Brekka. Lokalitet 1, boplass- og aktivitetsområde fra Tidlig Mesolittisk tid.* Unpublished archaeological report. NTNU University Museum

Svendsen, J.I. and Mangerud, J. (1987). Late Weichselian and Holocene sea-level history for a cross-section of western Norway. *Journal of Quaternary Science*, 2, pp. 113-132.

Søborg, H.C. (1990). *Arkeologiske undersøkelser 1988 i forbindelse med planlagt ilandføring av gass fra Haltenbanken. Alternativ: Tjeldbergodden.* Rapport, Arkeologisk serie, 1990:2. Trondheim: Universitetet i Trondheim, Vitenskapsmuseet.

Tallavaara, M. and Seppä, H. (2011). Did the mid-Holocene environmental changes cause the boom and bust of hunter-gatherer population size in eastern Fennoscandia? *The Holocene*, 22(2), pp. 215-225.

Tansley, A.G. (1935). The use and abuse of vegetational concepts and terms. *Ecology*, 16, pp. 284-307.

Thommessen, T. (1996a). Steinalderfunnene på Sarnes, Magerøya. *Ottar*, 4, pp. 25-29.

Thommessen, T. (1996b). The early settlement of Northern Norway. In: Larson, L., ed., *The earliest settlement of Scandinavia and its relationship with neighbouring areas.* Acta Archaeologica Lundensia, Series in 8°(24). Stockholm: Almquist & Wiksell International, pp.235-240.

Thuestad, A.E. (2005). *En romlig analyse av tidlig eldre steinalderlokaliteter i Vest-Finnmark og Troms*. Unpublished thesis (MA). University of Tromsø.

Torrence, R. (1983). Time budgeting and hunter-gatherer technology. In: Bailey, G., ed., *Hunter-gatherer economy in prehistory. A European perspective*. Cambridge: Cambridge University Press, pp. 1-22.

Trigger, B.G. (1996). *Arkeologiens idéhistorie*. Oslo: Pax forlag A/S.

Tømmervåg, A. (2008). *Simavik gnr 108/3. Befaringsrapport, kulturetaten.* Unpublished archaeological report. Troms fylkeskommune.

Tørhaug, V. and Åstveit, L.I. (2000). Steinalderboplassene ved Store Fløyrlivatn. *Frá haug ok heiðni*, 2000(1), pp. 35-39.

Van de Noort, R. (2011). Conceptualising climate change archaeology. *Antiquity,* 85(2011), pp. 1039-1048.

Walker, M.J.C., Berkelhammer, M., Björck, S., Cwynar, L.C., Fisher, D.A., Long, A.J., Lowe, J.J., Newnham, R.M., Rasmussen, S.O. and Weiss, H. (2012). Formal subdivision of the Holocene Series/Epoch: A discussion paper by a working group of INTIMATE (Integration of ice-core, marine and terrestrial records) and the subcommission on quaternary stratigraphy (International commission on stratigraphy). *Journal of Quaternary Science*, 27(7), pp. 649-659.

Waraas, T.A. (2001). *Vestlandet i tidleg Preboreal tid. Fosna, Ahrensburg eller vestnorsk tidligmesolitikum?* Unpublished thesis (MA). University of Bergen.

Waraas, T.A. (2005). *Arkeologisk registrering på Baraldsnes, Haram k., Møre og Romsdal. Ormen Lange prosjektet.* Kulturhistoriske skrifter og rapporter, 1. Molde: Møre og Romsdal Fylke, Kulturavdelinga.

Welinder, S. (1981). Den kontinentaleuropeiska bakgrunden till Norges äldsta stenålder. *Univeritetets Oldsaksamling Årbok*, 1980/1981, pp. 21-34.

Westley, K. and Dix, J. (2006). Coastal environments and their role in prehistoric migrations. *Journal of Maritime Archaeology*, 1(1), pp. 9-28.

Westli, C. (2009). *Å slå seg ned: en regional analyse av tidligmesolittisk lokalisering med utgangspunkt i Østfold*. Unpublished thesis (MA). University of Oslo.

Willerslev, R. (2009). Hunting the elk by imitating the reindeer: A critical approach to ecological anthropology and the problems of adaptation and resilience among hunter-gatherers. In: Hastrup, K., ed., *The question of resilience. Social responses to climate change*. Historisk.filosofiske meddelelser 106. Copenhagen: The Royal Danish Academy of Sciences and Letters.

Winterhalder, B. (1984). Reconsidering the ecosystem concept. *Reviews in Anthropology*, 11(4), pp. 301-313.

Winterhalder, B. (2001). The behavioural ecology of hunter-gatherers. In: Panter-Brick, C., Layton, R.H. and Rowly-Conwy, P., eds., *Hunter-gatherers. An interdisciplinary perspective*. Cambridge: Cambridge University Press, pp. 12-38.

Winterhalder, B. and Kennett, D.J. (2006). Behavioural Ecology and the Transition from Hunting and Gathering to Agriculture. In: Kennett, D.J. and Winterhalder, B., eds., *Behavioural Ecology and the Transition to* Agriculture. Berkeley: University of California Press, pp.1-21.

Winterhalder, B. and Smith, E.A. (2000). Analyzing adaptive strategies: Human behavioural ecology at twenty-five. *Evolutionary Anthropology: Issues, news and reviews*, 9(2), pp. 51-72.

Woodburn, J. (1980). Hunters and gatherers today and reconstruction of the past. In: Gellner, E., ed., *Soviet and Western Anthropology*. London: Duckworth, pp. 95-117.

Woodman, P. (1993). The Komsa culture. A re-examination of its position in the Stone Age of Finnmark. *Acta Archaeologica*, 63, pp. 57-76.

Yesner, D.R. (1980). Maritime hunter-gatherers: ecology and prehistory. *Current Anthropology*, 21, pp. 727-735.

Yesner, D.R. (1988). Island biogeography and prehistoric human adaptation on the southern coast of Maine (USA). In: Bailey, G. and Parkington, J., eds., *The archaeology of prehistoric coastlines. New directions in archaeology*. Cambridge: Cambridge University Press, pp. 53-63.

Ågotnes, A. (1981). Bosetningsmønster og livbergingsform i steinalderen i Vindenesområdet. *Frå Fjon til Fusa*, 1981(34), pp. 7-63.

Åhrberg, E.S. (2012a). Pauler 1 – En tidligmesolitisk boplats. In: Jaksland, L., ed., *E18 Brunlanesprosjektet, Volume II. Undersøkte lokaliteter fra tidligmesolitikum.* Varia 80. Oslo: Kulturhistorisk museum, Universitetet i Oslo, pp. 3-126.

Åhrberg, E.S. (2012b). Sky 2 – En episod i förhistorien. In: Jaksland, L., ed., *E18 Brunlanesprosjektet, Volume III. Undersøkte lokaliteter fra tidligmesolitikum og senere.* Varia 81. Oslo: Kulturhistorisk museum, Universitetet i Oslo, pp. 135-141.

Årskog, H.B. (2009). *Steinalderlokaliteter i tid og rom. En undersøkelse basert på Ormen Lange-registreringene på Nordvestlandet*. Unpublished thesis (MA). University of Oslo.

Åstveit, L.I. (2005). *Arkeologisk registrering på Gossen/Nyhamna, Aukra kommune. Ormen Lange-prosjektet.* Kulturhistoriske skrifter og rapporter, 3. Molde: Møre og Romsdal Fylke, Kulturavdelinga.

Åstveit, L.I., Olsen, T.B, Bjørkli, B., Aakvik, J. og Vik, B. (2005). *Arkeologiske registreringer på Stavneset, Averøy kommune. Ormen-Lange-prosjektet.* Kulturhistoriske skrifter og rapporter, 2. Molde: Møre og Romsdal Fylke, Kulturavdelinga.

Collection catalogues

Skrifter i det 19de Aarhundrede, 1813–1877. Trondheim: Universitetsforlaget

Det Kongelige Norske Videnskabers Selskabs skrifter, 1884–1926. Trondheim: Universitetsforlaget.

Oldsaksamlingens tilvekst, 1927–1948. Trondheim: Det Kongelig Norske Vitenskabers Selskab. Museet.

Tilvekst, 1949–1979. Trondheim: Det Kongelig Norske Vitenskabers Selskab. Museet. Den antikvariske avdeling.

Tilvekst, 1980–1981. Trondheim: Det Kongelig Norske Vitenskabers Selskab. Museet. Den arkeologiske avdeling.

Tilvekst, 1982–1988. Unpublished

Universitetets oldsaksamling årbok 1928. Oslo: Universitetets Oldsaksamling

Universitetets oldsaksamling årbok 1929. Oslo: Universitetets Oldsaksamling

Papers

Paper 1: Breivik, H.M. and Ellingsen, E.J.G. (2014). 'A Discovery of Quite Exceptional Proportions: Controversies in the Wake of Anders Nummedal's Discoveries of Norway's First Inhabitants. *Bulletin of the history of archaeology*, 24(9), pp. 1-13.

Paper 2: Breivik, H.M. and Bjerck, H.B. (in press). Early Mesolithic central Norway: A review of research history, settlements, and tool tradition. In: Blankholm, H.P. (ed.) *The early settlement of Northern Europe – Economy, settlement, and society*, Vol. 3. Sheffield: Equinox Publishing.

Paper 3: Breivik, H.M. (2014). Palaeo-oceanographic development and human adaptive strategies in the Pleistocene–Holocene transition: A study from the Norwegian coast. *The Holocene*, 24(11), pp. 1478-1490.

Paper 4: Breivik, H.M. and Callanan, M. (in press). Hunting High and Low: Postglacial Colonization Strategies in Central Norway between 9500 and 8000 cal BC. *European Journal of Archaeology*.

Paper 5: Bjerck, H.B. and Breivik, H.M. (2012). Off shore pioneers: Scandinavian and Patagonian lifestyles compared in the Marine Ventures project. *Antiquity*, 086(333). [Online] available at http://antiquity.ac.uk/projgall/bjerck333/

Paper 6: Breivik, H.M., Bjerck, H.B., Zangrando, A.F.J. and Piana, E.L. (in press). On the applicability of environmental and ethnographic reference frames: An example from the high-latitude seascapes of Norway and Tierra del Fuego. In: Bjerck, H.B., Breivik, H., Fretheim, S., Piana, E., Skar, B., Tivoli, A. and Zangrando, A.F.J. (eds.) *Marine Ventures: Archaeological Perspectives on Human–Sea Relations*. Sheffield: Equinox Publishing.

Paper 1

Breivik, H.M. and Ellingsen, E.J.G. (2014)

‘A Discovery of Quite Exceptional Proportions: Controversies in the Wake of Anders Nummedal’s Discoveries of Norway’s First Inhabitants.

Bulletin of the History of Archaeology

Breivik, H M and Ellingsen, E G 2014 'A Discovery of Quite Exceptional Proportions': Controversies in the Wake of Anders Nummedal's Discoveries of Norway's First Inhabitants. *Bulletin of the History of Archaeology*, 24: 9, pp. 1–13, DOI: http://dx.doi.org/10.5334/bha.249

PAPER

'A Discovery of Quite Exceptional Proportions': Controversies in the Wake of Anders Nummedal's Discoveries of Norway's First Inhabitants

Heidi Mjelva Breivik* and Ellen J. Grav Ellingsen†

Around the beginning of the twentieth century archaeologists believed that Norway was not inhabited until the Late Stone Age. In 1909 two pieces of flint, found by the school-teacher Anders Nummedal, launched an extensive debate about the prehistory of Norway, which in time led to the acknowledgement that there was an Early Mesolithic (9500–8000 BC) settlement of the country. However, Nummedal's lack of archaeological education worked against him when he tried to date the many flint sites he found later on, and well-established researchers found his theories about Stone Age settlements unconvincing. He was regarded as an unskilled teacher who did not know the first thing about archaeological methods and terminology. Today, Nummedal is considered to be one of the most influential participants in Norwegian Stone Age research, and his discoveries are well known and widely recognized. This paper describes Nummedal's fight to transform his reputation from ridiculed amateur to respected professional. The resistance he met when presenting his sensational theories is detailed through an extensive review of letters, newspaper articles and eulogies written by his colleagues.

Introduction

> What has been recovered to date in Norway from the Stone Age belongs to the last period of the European Stone Age (Late Stone Age). The older-looking artefacts [...] are far too few to make it plausible that the country was already inhabited during an earlier period of the Stone Age (Rygh 1885: 3).

This quotation provides a glimpse of what was considered to be the most up-to-date knowledge in 1885, of the earliest colonization of Norway. The cultural development of this northern country was seen as inferior when compared to the rich Stone Age cultures that evolved in Southern Scandinavia and Northern Europe. The early Nordic Stone Age cultures in the neighbouring country of Denmark were characterized by the rich *Ertebølle* kitchen middens (*kjøkkenmøddinger*), which along with an abundance of mollusc, and faunal remains and bone tools, were distinguished by flake axes and core axes made from flint. An even earlier stage was represented by the *Maglemose* site – which was characterized by bone tools, and additionally, by the use of flint microliths. The lack of these types of sites and artefacts in Norway made it appear as if people did not move north until the late phase of the Stone Age.

However, among the 'older-looking artefacts' described by archaeologist Oluf Rygh[1] in 1885 were several flake axes. These were discussed, in chronological terms, for the first time by the geologists Andreas Hansen[2] (1904) and Waldemar Brøgger[3] (1905). They pointed to discoveries of prehistoric sites situated well above present sea-levels which suggested there had been a strong post-glacial rebound in the Oslo Fjord region. The flake axes at issue were retrieved from sites located at high elevations, which potentially made them very old. Chronological and typological correlations between these southern Norwegian 'flint sites' and Danish kitchen middens were established by both Hansen and Brøgger, but while Hansen (1904: 339) wanted to date them to early post-glacial times, Brøgger (1905: 65) found it more appropriate to date the sites to a late phase of the Early Nordic Stone Age. Either way, their conclusions suggested that people could have lived in Norway at an earlier stage than was previously acknowledged.

A few years later, Anders Nummedal (1867–1944), a school-teacher who had studied geology and had a passion for archaeology, brought new perspectives to the debate about the first colonization of Norway. His interest in geological and cultural processes during the early stages of Norwegian prehistory motivated him to take walks along the elevated beach ridges on the island of

* Ph.D. Scholar, NTNU University Museum
Department of Archaeology and Cultural History
heidi.breivik@ntnu.no

† Archaeologist, Higher Executive Officer
NTNU University Museum
Department of Archaeology and Cultural History
ellen.ellingsen@ntnu.no

Fig. 1: Map of Norway displaying place names mentioned in the text: by the authors.

Kristiansund (see **Figure 1**) in Central Norway. In 1909 he found two pieces of flint that had, possibly, been worked by prehistoric humans. The artefacts themselves were quite ordinary and chronologically insignificant, but for Nummedal they were the key to finding traces of the earliest settlements along the Norwegian coast.

This paper describes the main issues surrounding the controversies that Nummedal and his discoveries provoked in the early twentieth century. Through an extensive review of various written sources we discuss why it was problematic for established academics to accept the theories of someone who would later be one of Norway's most famous Stone Age archaeologists.

The Teacher with the Dirty Fingernails: Nummedal's First Experiences as a Field Archaeologist

Nummedal's first foray into the field of archaeology began with two pieces of flint (see **Figure 2**) that initiated a lengthy correspondence between him and the director of the regional archaeological authority, Karl Rygh[4]. Nummedal included the stone artefacts in a letter and asked, eagerly, if they were made by humans.

Karl Rygh immediately took an interest in the enclosed artefacts, and his assurance that the flints had in fact been worked by humans whet Nummedal's appetite for finding more sites and artefacts. It was soon evident that he had

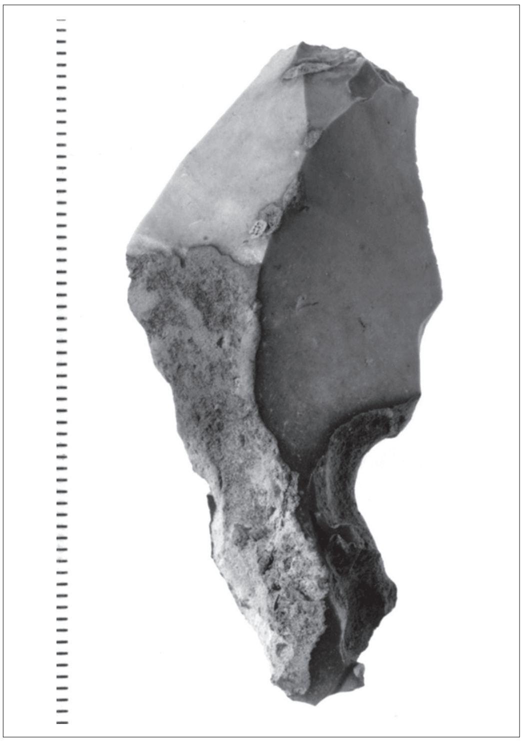


Fig. 2: One of the first flint artefacts found by Anders Nummedal near Vollvatnet Lake in Kristiansund. Photo: NTNU University Museum.

a remarkable ability for locating such Stone Age settlement sites. This unique intuition was described by many who knew him (Rosendahl 1944; Gjessing 1951; Simonsen 1994) and was also described in an early letter from Nummedal to Rygh:

> Last Wednesday I decided to look for flint on Kirklandet in Kristiansund. I sought out all the places where I knew the soil was exposed due to digging or ploughing. The result surprised me: On every place I visited I found flint clearly worked by humans. Later surveys on Kirklandet and Nordlandet have given the same result. I now know of 15 flint sites in and around the town of Kristiansund (Nummedal 1910a: 1; authors' translation).

These kinds of systematic surveys had never been conducted before, and the quantity of Stone Age sites that were found on this small island clearly exceeded Nummedal's expectations. Because these Central Norwegian Stone Age sites seemed to share many common characteristics, he described them using the collective term 'Fosna Culture' after a farm in Kristiansund (Pettersen 1998: 12) from which many artefacts were retrieved.

Nummedal's letter also recommended that some of the flint sites be further examined before spring farming began. Although he tried to express himself modestly, there was no doubt that Nummedal wanted to conduct the investigations:

> This goes far beyond my field of competence, and hence I can hardly undertake such an excavation. I

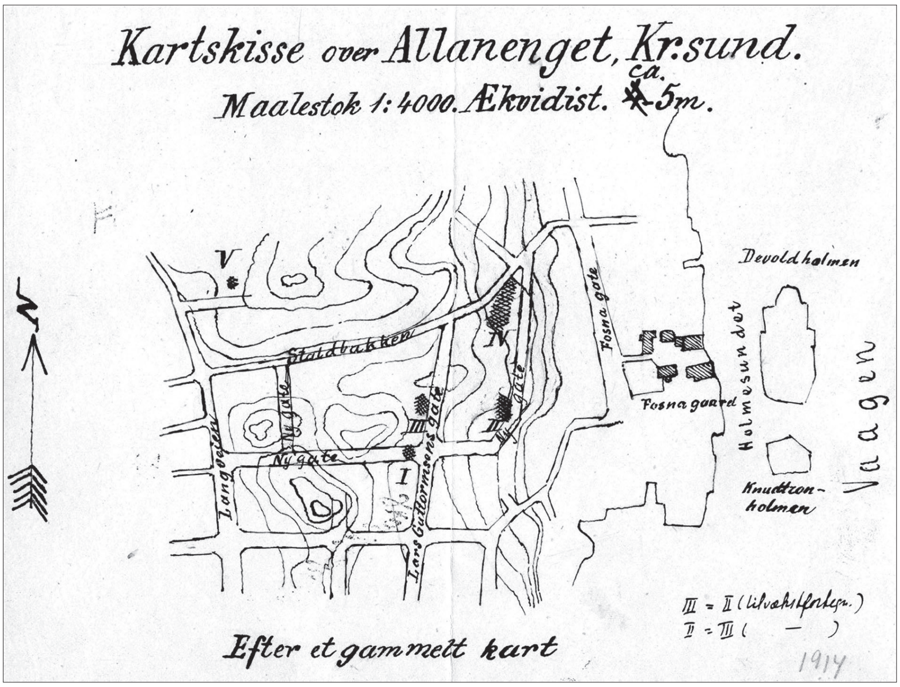


Fig. 3: A map sketch from Allanenget, Kristiansund, Norway: by Anders Nummedal (1914).

Fig. 4: Nummedal at an excavation in Frei, Kristiansund, Norway. Photo: NTNU University Museum.

> would be most willing to, however, if the museum cannot find a man for the task at this time of year (Nummedal 1910a: 1–2; authors' translation).

And despite his lack of archaeological training, Nummedal was actually entrusted with the task of digging test pits in the fields where spring planting was scheduled to begin. Karl Rygh wrote in the collections' catalogue:

> Throughout the winter and during the spring I received several assemblages followed by contextual information [...] However, when one very promising site, namely the one situated on the property of the farm 'Christies Minde', was scheduled to be turned into a potato field, I agreed to give Mr. Nummedal – whose carefully and precisely performed investigations and observations I had certainly witnessed – the opportunity to conduct an excavation within a limited area (Rygh 1911: 37; authors' translation).

Before long, Rygh trusted Nummedal to conduct full excavations of the Stone Age settlement sites he had found. Rygh, who was 70 at the time, was limited in his ability to investigate all the new localities that appeared in the region, and from the start, he appreciated Nummedal's intelligence and enthusiasm. Nummedal proved to be a methodical and systematic field archaeologist, and consulted regularly with Rygh while the investigations were underway. Detailed descriptions, photos and sketches followed with the artefacts from the excavated site (see **Figure 3**).

Nummedal's passion for archaeological fieldwork was clearly expressed in his correspondence with Karl Rygh. In one of his letters he admitted that: 'I have spent, I would say, every single moment of my spare time for what I consider as absolutely necessary work that will benefit the museum of Trondheim' (Nummedal 1914: 1).

Several of Nummedal's colleagues later described his dedication. Headmaster Olaf Yderstad[5] said that the 'pick, mattock and his own fingers were his tools on these tours that took place during the holidays [...] No wonder his colleagues and students noticed his dirty fingernails in the following days' (Yderstad 1989: 86–87). Halvor Rosendahl[6] recalled that people thought he was a bit odd, digging outside in all kinds of weather (Rosendahl 1944: 90) (see **Figure 4**).

'A Discovery of Quite Exceptional Proportions'

Nummedal soon felt confident enough to present his own theories about the Stone Age artefacts he had recovered. He quickly worked his way through the available archaeological literature and made himself familiar with its terminology. The books he could not find in the local library he borrowed from Karl Rygh. In an early letter he eagerly presented some results of his literature studies:

> I'm afraid you are starting to find me annoying, but what I'm about to tell you is so significant that I'm sure you will appreciate hearing about it right away [...] When I compare [the findings] with the plates in Professor Brøgger's 'Strandliniens beliggenhed under Stenalderen'[7] I find that most of

> the axes undisputably must be regarded as flake axes (Nummedal 1910b: 1; authors' translation).

Nummedal's excitement was based on the flake axe's alleged connection to Early Stone Age sites in Scandinavia. Moreover, this tool type was formerly only known from the southern part of Norway. If Nummedal proved to be correct, it would be the oldest site discovered in Central Norway to date.

Rygh answered the next day:

> The notification that you might have recovered flake axes doesn't actually surprise me, as some of the artefacts from Brunsviken[8] exhibit similar properties and may be regarded as badly shaped axes of this type (Rygh 1910a: 1; authors' translation).

He warned Nummedal not to be too assertive about his observations and interpretations:

> The archaeological discipline is already highly developed, and it is easy to make mistakes when you are not experienced. There are many sides to it, which easily may be overlooked, and there are detractors (or at least one) who aren't exactly friendly. Drawings may easily disappoint you when you are not accustomed to handling originals (Rygh 1910a: 1; authors' translation).

However, the same day that Nummedal sent the letter to Rygh, an article about his archaeological work was published in the local newspaper *Romsdals Amtstidende*, and summarised in the larger regional papers – *Aftenposten* in Oslo and *Adresseavisen* in Trondheim – the next day (Mehlum 1995). This article is quoted below in its entirety:

> **An Extraordinary Archaeological Discovery**
> Lecturer Nummedal has again made a discovery from the Stone Age, and this time it is absolutely unique. He has, here on Kirkelandet [on Kristiansund], recovered quite a few flint tools from early Nordic Stone Age – axes, arrow-heads, blade scrapers etc. in great numbers, as well as several so-called 'cores'.
>
> These artefacts are probably at least 5000 years old and suggest that Kristiansund not only was inhabited at this time, but also must have been home to a workshop where these kinds of tools were produced.
>
> Only about ten axes from this period, so-called 'flake axes', have been recovered from the whole country so far. Mr. Nummedal has now retrieved the same number from Kirkelandet alone. They correspond both in shape and material with the ones previously found in Italy and south Sweden. The artefacts will be thoroughly studied by professionals, and the collection will be shipped to the Museum of Trondheim, which is entitled to it by law.
>
> The finds are of extra interest since the raw material must have been transported from afar. Flint pebbles are almost absent in this region. Jæderen [Jæren] is the only place where these pebbles can be found in any numbers.
>
> Some of the artefacts are very skilfully crafted. It is almost impossible to comprehend how these prehistoric people, with their imperfect tools, could have made them. One must, for example, remember that they still didn't have the ability to polish, but only chip the stone. Some of the arrow-heads, in particular, will arouse great admiration. It will be interesting to learn what the archaeologists make of these artefacts.
>
> Mr Nummedal's achievements have greatly benefitted the archaeological science (Anon. 1910a: 1; authors' translation).

The article expressed the same statements that Nummedal had used in his letter to Rygh, and the response, from the archaeological community, was immediate. On April 14, 1910, Anton W. Brøgger[9] wrote to Rygh (Mehlum 1995: 17):

> In the newspaper 'Aftenposten' on April 12th one can read about archaeological finds made by a certain Lecturer Nummedal in Kristiansund, which are supposed to include axes of flint, arrow-heads and end scrapers. It is pointed out that the axes are flake axes. Is this really possible, or is it just an amateur's misconception of the technological terms? I kindly apologize for letting myself pose this question to you, but one can't deny that, if these really proved to be artefacts from the Early Stone Age, it would be a discovery of quite exceptional proportions! What makes me doubtful is the fact that the finds were recovered in Kristiansund. Consequently the geological circumstances preclude dating the finds to the earliest period of the Stone Age (Brøgger 1910; in Mehlum 1995: 17; authors' translation).

Nummedal's conclusions did not coincide with Brøgger's opinions about deglaciation, isostatic rebound and Stone Age sites, which certainly were adopted from his father's (W. C. Brøgger) work.

However, A. W. Brøgger was not the only one to react. In an article signed 'P' (believed to be Theodor Petersen[10]) and published in the newspaper *Adresseavisen* on the same day (Møllenhus 1977a; Mehlum 1995: 18) Nummedal's work was described as:

> ... a sensational and colourful telegraphic notice about Stone Age artefacts from Kristiansund that were supposedly '5000 years old'. It shouldn't be necessary to say that this dating is completely plucked out of thin air. Unfortunately, we haven't reached the point where we can even roughly decide the absolute date on such finds (Anon. 1910b; in Mehlum 1995: 18; authors' translation).

Later in the article, the author describes the work of Oscar Montelius'[11] and how Central Norway was far more peripheral in the past than today: '[...] the cultural waves reached up here very late' (Anon. 1910b). 'P' concludes that it would be impossible to give an absolute date for the artefacts from Kristiansund and that they could very well be of a much younger age than claimed in the newspaper article. Although the author presented the idea as very unlikely, he admitted that the artefacts could also be older. To emphasise his disapproval of Nummedal's attempt to make sensational news, 'P' adds:

> One must protest against the growing tendency to decide the age of old artefacts in superficial newspaper articles. This only contributes to creating false ideas for uncritical readers, and discredits archaeology for authoritative audiences. It is certainly a task for the archaeological community to find a way to obtain an absolute age for these kinds of finds. But there is still a long way to go, and a lot of new material has to be recovered, many new links have to be forged in the chain of evidence in order to reach this goal (Anon. 1910b; in Mehlum 1995: 18; authors' translation).

From their personal correspondence, we can deduce that Nummedal's ally Rygh disapproved of his somewhat hasty actions; the news had reached the public even before he had the chance to see the artefacts at issue:

> The matter has been put in a more difficult position by the nationally distributed telegram. It has naturally attracted attention among our few archaeological scientists. [...] I have already received a letter from an expert in Stone Age research, demanding details about the finds. He assumes that I have either inspected the site or received the artefacts by mail. They mustn't be left to wonder about this matter: if the new artefacts really are from early Stone Age, the discovery is so significant that archaeologists rightfully would say that even the most meticulous observation can't be considered good enough. This could have been avoided if the media wasn't so eager to make a sensation of it (Rygh 1910b: 1–2; authors' translation).

Comments from members of the archaeological community demonstrated that they disapproved of Nummedal's discoveries and interpretations for several reasons. Their main concerns were with his classification of the artefacts and his dating of the sites. Flake axes supposedly represented the earliest traces of humans in Norway and were typologically connected with Danish kitchen midden cultures. It was widely accepted within archaeological circles that the middens were contemporary with the 'Tapes Time' (i.e. Brøgger 1905: 22; with reference to Madsen *et al.* 1900) – a period after the last Ice Age in which the temperature was at its maximum, and when a transgression (i.e. a rise in sea levels resulting in deposition of marine strata over terrestrial strata) was recorded. As such the Scandinavian flake axes and other associated artefacts were also dated to the 'Tapes Time'. According to W. C. Brøgger (1905: 64, 277), the kitchen midden phase, and the use of flake axes in southeast Norway, had ended before the Tapes transgression reached its maximum at about 7000 years ago. Hansen (1904: 345) found it likely that the same sites belonged somewhere in the range of 6000–8000 years ago.

As such, Nummedal's estimate of 'at least 5000 years' was not controversial *per se*. However, in Norway the axes were mainly recovered around the Oslo Fjord in southeast Norway – a region that geographically could be linked to southern Sweden and Denmark, but was still regarded as the absolute periphery of any centre of Scandinavian prehistoric culture. Moreover, geological studies suggested that much of Norway was covered in ice while Stone Age civilizations developed on the Continent, and thus this environment would place a limit on human migration. If flake axes had actually been found as far north as Kristiansund, one would need to reconsider all these arguments.

We can sense that the negative reactions from the professionals were largely based on the fact that the new theories came from an amateur. Prehistoric archaeological research was in its early stages of development and was seeking to establish itself as a distinct and important discipline within the humanities. Thus it was important for only 'proper' archaeologists to deliver new theories about prehistory. When the newspapers printed the apparently irrational theories of a school-teacher the collective anger of the new archaeological research community was ignited.

But despite some obvious attempts to staunch the debate, Nummedal would not be silenced, and continued to develop and promulgate his theories.

'Norway Inhabited During the Palaeolithic Period'

On November 4, 1910, Nummedal published an article in the newspaper *Romsdals Amtstidende* with the provocative title: 'Stone Age Settlements Around Kristiansund, Norway Inhabited During the Palaeolithic Period'. In it Nummedal suggested that the settlements he had found might date from an even earlier period than what he had previously believed (Nummedal 1910c: 3). In a letter addressed to Rygh Nummedal explained that he formed his theory while reading French Archaeologist, Joseph Déchelette's book: *Le Manuel d'archéologie préhistorique, celtique et gallo-romaine* (Déchelette 1908–1914). He had noticed that several of his own artefacts resembled the sketches of French Stone Age assemblages, which suggested that the Norwegian flints could be of Palaeolithic origin (Nummedal 1910d: 1–2).

It is unnecessary to describe the effect this statement had on the already sceptical professionals. At the beginning of the twentieth century, archaeological chronology was dominated by a system of typology: that is, academics made the artefact the centre of attention, and its shape the main criterion for determining which period it belonged to. However, archaeology was also beginning to adopt new terms and theories. *Culture* was introduced as an important concept: artefacts were the physical traces of a culture or people, and since artefacts were made by humans, with different origins, they could vary from region to region. The distribution patterns of material culture, whether by diffusion or migration, and the origins of people, were consequently widely discussed. While Nummedal was deeply engaged in studying materials, he may not have been up-to-date on the theoretical directions of the discipline – he did not have the overview that was needed to make the right connections. Rygh stressed this when he entered the debate a few days later, in the newspaper *Romsdals Amtstidende*:

> The fact that there are artefacts among such a large collection of flint that resemble types from the Central European Palaeolithic inventory doesn't prove that the artefacts belong to this period [...] Nothing in the assemblage can be expected to predate the Neolithic period (Rygh 1910c: 3–4; authors' translation).

It must be emphasized that prehistoric chronological terms were not used in the same way as they are today. In nineteenth century archaeological literature, the European Stone Age was regularly divided into two phases: the Palaeolithic and Neolithic. The intermediate Mesolithic phase was not included as a concept. Moreover, Palaeolithic cultures were mainly associated with Continental hunter-gatherers – a lifestyle that was not identifiable in the artefact assemblages from Scandinavia. Rygh regarded Nummedal's interpretation of the artefacts as a misconception, and argued for more proof to support such a statement. He pointed out that there were not even sites from this period in southern Scandinavia, for the good reason that the whole region was covered with ice (Rygh 1910c: 3–4).

But Nummedal's hypotheses were not solely built on typological similarities. His mapping and surveying had helped him develop strong intuitions regarding the settlement preferences of early hunter-gatherers, and his on-site topographical and geological observations did not fit with popular opinion about the determination of the age of the flint sites. The arguments are presented in another letter to Rygh, written some days before the letter quoted above:

> The more I study the flint assemblages, the more convinced I am that some of the artefacts must be older than the Tapes time. [...] It can hardly be a coincidence that all these sites are situated between 30 and 40 m asl. Another factor that is common to all the sites are that the gravel, which is positioned under the turf, and in which the artefacts were deposited, most of all resembles beach gravel. These flint sites were thus certainly located on a beach at the time they were inhabited. There are also features in the terrain that support this idea. For example, near the Christies Minde site there would have been a sheltered harbour if the shore line was more than 30 m higher than today. However, if the shoreline was lower, the nearest landing would have been far away, as there is a long and steep cliff at this elevation. According to Rekstad, the Tapes level can be measured to 20 m asl. in Kristiansund. [...] Hence, the sites have to be considerably older than the Tapes time, and in my opinion we would need substantial archaeological proof to come to another conclusion (Nummedal 1910e: 2–3; authors' translation).

This sober line of reasoning was more significant than it appears. Nummedal's archaeological and geological investigations in Central Norway, which by this point were starting to arouse great interest among archaeologists, questionned the correlation between Norwegian flake axes and the Tapes Time – and consequently also the connections between Norwegian sites and Danish kitchen middens. Nummedal never succeeded in convincing Rygh of this – and in a short article two years before his death, Rygh (1913) maintained the connection between Norwegian prehistory and the Danish Ertebølle phase. However, Nummedal continued to work on these ideas and perhaps realized that the best way to convince others was by conducting systematic surveys.

Nummedal Becomes a Trusted Archaeologist

We can follow Nummedal's meanderings across prehistoric terrain in the archives of the Trondheim Museum at the Norwegian University of Science and Technology (NTNU). He was most active between 1910 and 1913, when he mapped numerous locations in Kristiansund. Other islands in central Norway were also subjected to Nummedal's surveys, including Aukra, Averøy, Tustna, Smøla, Frøya and Hitra, along with coastal districts farther north (DKNVS Skrifter 1911–1925). He was also invited by the authorities of the Bergen Museum to conduct similar investigations along the coast further south on the islands Hesøy and Sotra (Nummedal 1918; 1921).

From correspondence it is evident that the authorities in Trondheim, Bergen and Oslo tried to find finance for Nummedal's work, and eventually A. W. Brøgger succeeded in recruiting him on a permanent basis. In the autumn of 1921 the Norwegian Parliament allocated money for a curator's position at the Archaeological Museum of Oslo, which Nummedal accepted (Pettersen 1998: 14).

From this institutional position Nummedal carried out several investigations and published short, but descriptive papers on his work. In his syntheses from 1922 and 1923 we see more nuanced interpretations of the fieldwork he had conducted during the previous ten to fifteen years. His main concern was the age of the earliest Stone Age sites. Through a critical review of the artefacts' morphology (i.e. their shapes and forms) he maintained that the tool assemblages from Norway had different properties to those of the Danish tool assemblages found in kitchen middens. The Norwegian tool assemblages, he argued, had more in common with those of the older Danish *Maglemose* types of stone tools. The Norwegian artefact collection, he claimed, also contained late Palaeolithic shapes that had not been found elsewhere in Scandinavia. Moreover, his systematic investigations of elevated shell deposits and moraines along the coast of Central Norway suggested that the mollusc assemblages had a climatic signature that equalled the cold period, and that the coast was thus exposed at an early stage of the post-glacial period. Consequently, geological circumstances did not contradict an older date for the sites (Nummedal 1922, 1923). His arguments expressed for the first time in a long newspaper article (Nummedal 1912) were now largely supported by significant archaeologists such as Haakon Shetelig[12] (1922) and Petersen (1922).

Nummedal's confidence was put to the test in 1925. Encouraged by A. W. Brøgger, who was still reluctant to accept his dating estimates (Brøgger 1925), and with a scholarship from the University of Oslo, Nummedal began to search for Stone Age sites in Finnmark, in the northernmost part of Norway. This idea was not without its critics: if it seemed inconceivable that a Nordic settlement could have existed parallel with some of the oldest cultures on the European Continent, it must have seemed even less likely that there were settlements in the northernmost parts of Norway at the same time. The very few Stone Age sites that had been found in northern Norway were first, and foremost, characterized by polished slate instruments. Dominant and accepted archaeological opinion maintained that while the southern Norwegian flake axes and flint sites were cultural extensions that had come from the south, the 'slate culture' in northern Norway had developed through contact with eastern Scandinavian and Baltic Stone Age cultures. The slate complex, called the *Arctic Stone Age* or *Arctic-Baltic Stone Age*, was thus regarded as a younger cultural entity that could be distinguished from its southern equivalents (i.e. Brøgger 1906, 1909; Gjessing 1920; Petersen 1920). Moreover, there seemed to be a complex history of sea level and ice cover fluctuations in this region after the Ice Age, making the preconditions for an earlier settlement highly uncertain.

Nevertheless, Nummedal wanted to test his survey methods in a different landscape. Maybe his late participation in institutional archaeology gave him an advantage in this matter: he did not have the mainstream researcher's mental preconceptions that might have prevented him from thinking beyond the subject's stalled dogma – he looked where nobody dared to look. Gutorm Gjessing[13] (1944) later described it as a 'battle between the enthusiastic autodidact and sober, dogmatic knowledge (Østmo 1994: 38). And it was said that only two hours after his arrival in northern Norway, Nummedal had tracked down the first of many early Stone Age sites in the region (Simonsen 1994).

The artefact collections from these new sites seemed to resemble tools that had been found in the early sites in southern Norway, but they also contained additional and different tool types and other raw materials. These finds now launched a new debate, which this time primarily took place within academic circles but also involved a larger community of scientists.

In Nummedal's field notes from 1925 and 1926 (published in 1975) he suggested that the northern Norwegian complex of sites and artefacts could be associated with an early phase of the Palaeolithic, known as the *Aurignacien*, and which, according to Oscar Montelius' (1919) chronological divisions, was more than 15,000 years old (Nummedal 1975). Also, in successive publications Nummedal emphasized the technological parallels between the artefacts from these northernmost sites and those from Palaeolithic settlements on the Continent (Nummedal 1927, 1929a, 1929b; Nummedal and Rosendahl 1929). This suggestion could hardly be incorporated into existing theories, which were based on the idea that culture and stone tool technology had spread from the south to the north (Waraas 2001). In a lecture for his doctoral thesis in 1931, Johannes Bøe[14], an archaeologist who early in his career had studied Iron Age artefacts, largely supported Nummedal's dating estimate. These geographical and chronological connections were also acknowledged by several European archaeologists, who had themselves examined the newly recovered artefacts from northern Norway (Bøe 1931). An extensive book about the sites, *Le Finnmarkien, Les Origines De La Civilisation Dans L'Extreme-Nord De L'Europe*, was published in 1936 (Bøe and Nummedal 1936). Primarily written by Bøe, whose courageous interpretations created the basis for discussions about cultural development and immigration routes (Indrelid 1994; Simonsen 1994; Blankholm 2008) it was also written in French, which meant that archaeologists outside of Scandinavia were able to participate in the debate (Waraas 2001: 28–29).

One year after its publication A. W. Brøgger proudly and enthusiastically promoted the *Le Finnmarkien*'s conclusions, and praised Nummedal and Bøe's work, to an international audience (Brøgger 1937). Before Nummedal's surveys, the earliest prehistory of northern Norway was unknown, a chapter in prehistory to be written, and perhaps, because of the persistent notion about a distinguishing Arctic Stone Age culture, it made it easier to interpret the material culture from northern Norway as being something different to the material culture of the south. Brøgger wrote: 'in all probability these [*tranchets*] in Finnmark are 'self-grown' and, in any case, they have no connection with the so-called 'Skivespalten' [flake axe] in the Danish kitchen middens' (Brøgger 1937: 57). Today it is commonly assumed that these earliest of sites, from the north and the south, are part of the same cultural complex (i.e. Woodman 1993; Olsen 1994; Blankholm 2004).

Nummedal conducted his surveys in northern Norway every season until 1939. These were some of his last efforts as a field archaeologist (Simonsen 1994: 46). Archaeologist Povl Simonsen[15] recalls a specific episode that took place during the investigations: 'obviously Gjessing had heard much about his excavations and wanted to learn more about them [...] When a letter arrived from Gjessing, expressing the desire to join in, Nummedal became very angry and sensed some kind of control from the

Museum of Tromso'. Despite Nummedal's rejection, Gjessing came and participated in the excavation. 'Nummedal was grumpy. They were working together a couple of days at Nordli, frictions between them occurred daily, and the hot-tempered Nummedal once came very close to attacking Gjessing physically' (Simonsen 1994: 47).

'A Pioneer in the Field': Nummedal's Significance for Norwegian Stone Age Studies

The large collection of letters written by Nummedal provides us with a good sense of his personality: he was easily provoked, impulsive and assertive – to a certain degree aggressive and touchy. These properties worked both for and against him in his struggle for approval. Gjessing, who became a trusted colleague, writes that Nummedal had an unyielding belief that he was a tool in the hands of a superior being, that it was his fate to discover Norway's prehistoric settlements. Consequently he demanded immediate approval from his colleagues. This was rather unpopular among his more pragmatic fellow researchers who regarded him as arrogant and full of 'prima donna whims' (Gjessing 1944: 570). Despite this, when he died in 1944 he had finally earned his place beside other recognized archaeologists.

> When a great man dies it is said that the dense forest becomes sparse. Nummedal didn't belong in the forest at all. He was more like a wind-blown and lopsided pine standing solitary on a knoll. But that did not make him less prominent. And his labours did not die with him. His results will linger for a long time and remind us of one of the most distinctive archaeologists we have known (Gjessing 1944: 572; authors' translation).

> Nummedal had the features that characterize the noble man, and that have always been highly valued in Norway. He was of pure Norwegian origin and had a good portion of the Norwegian informal behaviour [...] The white hair covered a pure Nordic skull, the blue eyes had a beautiful and friendly touch (Rosendahl 1944: 95; authors' translation).

> Most of all he was a pioneer in the field, who during the winter was most comfortable in his office surrounded by his flint artefacts whose classification and systematic registration took much of his time [...] A visit to his office was an experience, and even the most sceptical individual left with an deep impression that something new and remarkable happened in this room (Petersen 1944: 61; authors' translation).

Nummedal's acquaintances describe a weather-beaten, hardened individual who fought to be accepted by professionals. Many of his theories were controversial, but proved to be quite precise, and important to our understanding of Stone Age livelihoods. He seemed to

Fig. 5: Anders Nummedal in his office. Photo: Sogn og Fjordane County Archive.

have the ability to dive into the mind-set of the early hunter-gatherers, and was also in this way, a pioneer of Norwegian Stone Age research. He was described as a 'Stone Age man' (see **Figure 5**) by his colleagues, as a well-meant comment on the irony of fate:

> Anders Nummedal resembled a Stone Age man who walked with heavy steps. His body and head looked like a roughly sculptured statue of stone. Underneath his stout forehead his eyes had the sharp gaze of a hunter. His face, usually in grave, brooding wrinkles, would brighten when he laughed his characteristic and loud laugh (Yderstad 1989: 91; authors' translation).

> The big bony face with a broad chin was as if it had been chiselled out of stone, and together with his peculiar appearance – a somewhat heavy trunk with long arms and big fists, short and crooked legs – made him look like he was walking around and rediscovering the settlements that he himself had inhabited in an earlier life, thousands of years ago (Gjessing 1951: 435; authors' translation).

Anders Nummedal received several 'Medals of Honour' for his archaeological efforts (Møllenhus 1977b). From our perspective today we can admire his work, which in many ways is still relevant. He was the first to integrate landscape perception into archaeological method and theory. Using

Fig. 6: The plaque in the NTNU University Museum in Trondheim still reads: 'Fosna Culture, ca. 5000? – 2000 BC', as some kind of silent opposition to Nummedal's dating efforts. Photo: Heidi M. Breivik.

his geological experience he recognized several topographical features related to the sites that he interpreted as cultural preferences: the settlements were located close to the current water margin and good natural harbours, in open terrain but protected from the prevailing winds. Following this set of presumptions as settlement preconditions, he used them to search systematically for new archaeological sites. Thanks to continued surveys during the last decades we now know hundreds of sites from the post-glacial colonization phase in Norway (Breivik In prep.), and the characters of these sites generally seem to be in line with Nummedal's ideas (i.e. Odner 1964; Møllenhus 1977a; Schanche 1988; Bjerck 1989, 1990; Bergsvik 1991, 1995; Bang-Andersen 1996; Barlindhaug 1996; Svendsen 2007; Johannessen 2009; Westli 2009; Nyland 2012).

Moreover, Nummedal's investigations of the relationship between marine deposits and flint sites revealed that early Stone Age settlements along parts of the coast would have been greatly affected by the 'Tapes' transgression (Nummedal 1923, 1933). This is important for our understanding of the distribution pattern of sites nationally, and consequently for our success in the search for new sites (i.e. Bjerck 1986, 1995; Sandmo 1986).

Better dating methods, and intensified research on geological circumstances after the last Ice Age, have improved our ability to determine the age of the earliest sites. We now argue that flake axes and associated tool types are older than the Danish kitchen middens and belong to the Early Mesolithic chronozone, ca. 9500–8000 BC. A relation between Late Palaeolithic tool assemblages and the Norwegian Early Mesolithic techno-complex is commonly acknowledged (i.e. Fuglestvedt 1999; Kutschera 1999; Waraas 2001).

But as some kind of lingering, silent opposition to Nummedal's dating efforts, the plaques in the prehistoric exhibition of NTNU University Museum in Trondheim, designed in 1930 and revised in 1956, still read: 'Fosna Culture, ca.5000? – 2000 BC' (see **Figure 6**).

Acknowledgements

This article is based on our Norwegian paper: Ellingsen and Breivik 2012. Many thanks to the two anonymous reviewers for useful comments and suggestions on how to improve the text.

Notes

1. Oluf Rygh (1833–1899) archaeologist, philologist and historian, first professor af archaeology at Royal Frederick University and director of the Museum of Cultural History.
2. Andreas Martin Hansen (1857–1899) geologist and ethnographer, associate professor, University Library, Oslo.
3. Waldemar Christopher Brøgger (1851–1940) geologist and rector of the University of Oslo from 1906 until 1911.
4. Karl Rygh (1839–1915) brother of Oluf Rygh, archaeologist and director of the Museum of Trondheim from 1870–1915 (now the Norwegian University of Science and Technology Museum, Trondheim: NTNU).
5. Olaf Yderstad (1877–1962) headmaster of Kristiansund Public School, who also worked for Kristiansund Museum (now Nordmore Museum) for more than fifty years.
6. Halvor Rosendahl (1819–1896) geologist and natural historian, Geological Museum of Oslo.
7. Brøgger, W. C. 1905 *Standliniens beliggenhed under stenalderen I det sydøstlige Norge* (The Sea-Level's Location during the Stone Age).
8. One of Nummedal's sites on Kristiansund.
9. Anton Wilhelm Brøgger (1884–1951) son of W. C. Brøgger, archaeologist and director of archaeological collections at the Museum of Cultural History, Oslo.
10. Theodor Petersen (1875–1952) archaeologist and director of the Museum of Trondheim after Karl Rygh's death in 1915.
11. Oscar Montelius (1843–1921) Swedish archaeologist who refined the concept of seriation, a relative chronological method.
12. Haakon Shetelig (1877–1955) professor of archaeology and manager of the Department of Archaeology at the Bergen Museum, 1902–1942.
13. Gutorm Gjessing (1906–1979) archaeologist at the Museum of Cultural History, Oslo 1940–1946.
14. Johannes (Johs.) Bøe archaeologist at the Bergen Museum and the University of Bergen 1921–1961.

[15] Povl Simonsen (1922–2003) archaeologist at the Tromsø Museum 1951–1992.

References

Anon. 1910a Et enestaaende arkæologisk fund. *Romsdals Amtstidende*, 11 April.

Anon. 1910b Stenaldersfundet i Kristiansund. *Adresseavisen*, 14 April.

Bang-Andersen, S 1996 The Colonization of Southwest Norway. An Ecological Approach. *Acta Archaeologica Lundensia*, Series in 8 °(24): 219–234.

Barlindhaug, S 1996 *Hvor skal vi bygge og hvor skal vi bo? En analyse av lokaliseringsfaktorer i tidlig steinalder i Troms.* M.A. Thesis, Norway: University of Tromsø.

Bergsvik, K A 1991 *Ervervs- og bosetningsmønstre på kysten av Nordhordland i steinalder, belyst ved funn fra Fosnstraumen.* M.A. Thesis, Norway: University of Bergen.

Bergsvik, K A 1995 Bosetningsmønstre på kysten av Nord-hordland i steinalder. En geografisk analyse. *Arkeologiske skrifter* 8: 111–130.

Bjerck, H B 1986 The Fosna–Nøstvet Problem. A Consideration of Archaeological Units and Chronozones in the South Norwegian Mesolithic Period. *Norwegian Archaeological Review* 2: 103–121. DOI: http://dx.doi.org/10.1080/00293652.1986.9965435.

Bjerck, H B 1989 *Forskningsstyrt kulturminneforvaltning på Vega, Nordland. En studie av steinaldermenneskenes boplassmønstre og arkeologiske letemetoder*. Trondheim: NTNU University Museum.

Bjerck, H B 1990 Mesolithic Site Types and Settlement Patterns at Vega, Northern Norway. *Acta Archaeologica* 60: 1–32.

Bjerck, H B 1995 The North Sea Continent and the Pioneer Settlement of Norway. In A. Fischer (ed.) *Man and Sea In the Mesolithic*, pp.131–143. Oxford: Oxbow Books.

Blankholm, H P 2004 A Reassessment of Sarnes B4, Supposedly the Earliest Mesolithic Site in Northern Norway? *Arctic Anthropology* 41 (1): 41–57. DOI: http://dx.doi.org/10.1353/arc.2011.0093.

Blankholm, H P 2008 *Målsnes 1. An Early Post-glacial Coastal Site in Northern Norway*. Oxford: Oxbow Books.

Bøe, J 1931 Den tidlige steinalders kultur i Finnmark: belyst ved senere års undersøkelser og fund. *Nordisk tidskrift för vetenskap, konst och industri* 7: 417–436.

Bøe, J and **Nummedal, A J** 1936 *Le Finnmarkien. Les Origines De La Civilisation Dans L'Extreme-Nord De L'Europe*. Oslo: Aschehoug & Co.

Breivik, H M (In prep.) Palaeo-oceanographic Development and Human Adaptive Strategies in the Pleistocene–Holocene Transition: A Study from the Norwegian Coast.

Brøgger, A W 1906 *Studier over Norges stenalder I. Øxer uden skafthul fra yngre stenalder fundne i det sydøstlige Norge*. Christiania: I kommission hos Jacob Dybwad.

Brøgger, A W 1909 *Den arktiske stenalder i Norge*. Christiania: I kommission hos Jacob Dybwad.

Brøgger, A W 1910 A. W. Brøgger Questions K. Rygh about A. Nummedal's Credibility (Letter dated April 14, 1910). Trondheim: NTNU University Museum.

Brøgger, A W 1925 *Det norske folk i oldtiden*. Oslo: Aschehoug & Co.

Brøgger, A W 1937 Late Palaeolithic Man in Northernmost Norway. In G. G. MacCurdy (ed.) *Early Man: As Depicted By Leading Authorities at the International Symposium, the Academy of Natural Sciences Philadelphia, March 1937*. London: J. B. Lippincott Company.

Brøgger, W C 1905 *Strandliniens beliggenhed under stenalderen i det sydøstlige Norge*. Chistiania: I kommisjon hos H. Aschehoug & Co.

Déchelette, J 1908–1914 *Le Manuel d'archéologie préhistorique, celtique et gallo-romaine*. Paris: Librairie Alphonse Picard et Fils.

DKNVS Skrifter 1911–1925 Trondheim: Aktietrykkeriet.

Ellingsen, E G and **Breivik, H M** 2012 Anders Nummedal: fra 'quasi-lærd' til steinaldernerd. *Primitive tider* 14: 47–58.

Fuglestvedt, I 1999 The Early Mesolithic Site at Stunner, Southeast Norway: A Discussion of Late Upper Palaeolithic/Early Mesolithic Chronology and Cultural Relations in Scandinavia. In J. Boaz (ed.) *The Mesolithic of Central Scandinavia. Universitetets oldsaksamlings skrifter, ny rekke*, 22: 189–202. Oslo: Universitets oldsaksamling.

Gjessing, G 1944 Konservator Anders Nummedal. *Håløygminne* 3 (25): 567–572.

Gjessing, G 1951 Konservator Anders Nummedal. In O. Hoprekstad (ed.) *Bygdabok for Vik i Sogn*, pp.433–441. Bergen: Nemndi.

Gjessing, H 1920 *Rogalands stenalder*. Stavanger: Dreyers grafiske anstalt.

Hansen, A M 1904 *Landnåm i Norge: En Utsigt Over Bosætningens Historie*. Kristiania: W.C. Fabritius & sønner.

Indrelid, S 1994 Anders Nummedal og Bergens museum. *Pridlao* 3: 37–44.

Johannessen, L 2009 *Ahrensburgkulturens lokalitetsplassering: en redegjørelse av forholdet mellom kyst og innland.* M.A. Thesis, Norway: University of Oslo.

Kutschera, M 1999 Vestnorsk tidligmesolitikum i et nordvesteuropeisk perspektiv. In I. Fuglestvedt, T. Gansum and A. Opedal (eds.) *Et hus med mange rom. Vennebok til Bjørn Myhre på 60-årsdagen. Ams-Rapport*, Bind A: 43–52.

Madsen, A P *et al.* 1900 *Affaldsdynger fra Stenalderen i Danmark, undersøgte for Nationalmuseet*. Paris: Hachette.

Mehlum, M H 1995 Historien om oppdagelsen av de første Fosnaboplassene i Kristiansund. *Årbok for Nordmøre Museum*: 15–33.

Montelius, O 1919 De mandelformiga flintverktygens ålder. *Antikvarisk Tidskrift för Sverige* 20 (6): 1–60.

Møllenhus, K R 1977a *Mesolitiske boplasser på Møre- og Trøndelagskysten.* Trondheim: Det Kongelige Norske Videnskabers Selskap.

Møllenhus, K R 1977b Anders J. Nummedal. *Det Kongelige Norske Videnskabers Selskab Skrifter:* 27–34.

Nummedal, A 1910a A. Nummedal Tells K. Rygh about the New Flint Sites He Stumbled Upon in Kristiansund (Letter dated March 28, 1910). Trondheim: NTNU University Museum.

Nummedal, A 1910b A. Nummedal Tells K. Rygh about His Interpretations of the Newly Recovered Artifacts, Based on Literature Studies (Letter dated April 11, 1910). Trondheim: NTNU University Museum.

Nummedal, A 1910c Stenaldersfundene omkring Kristiansund. Norge bebodd i den palæolitiske tid. *Romsdal Amtstidende*, 4. November.

Nummedal, A 1910d A. Nummedal Outlines the Story Behind the Newspaper Article That Dates the Artifacts to Palaeolithic Times, Addressing to K. Rygh (Letter dated November 11, 1910). Trondheim: NTNU University Museum.

Nummedal, A 1910e A. Nummedal Presents an Elaborate Model for the Stone Age Settlement Preferences, Addressing to K. Rygh (Letter dated October 25, 1910). Trondheim: NTNU University Museum.

Nummedal, A 1912 Stenaldersfundene på kysten av Romsdals amt. *Aftenposten*, 14. April.

Nummedal, A 1914 A. Nummedal's Description of Newly Recovered and Investigated Sites in Kristiansund, Addressed to K. Rygh (Letter dated April 27, 1914). Trondheim: NTNU University Museum.

Nummedal, A 1918 Arkæologiske undersøkelser paa Sotra. *Bergen Museums Aarbok 1917–18. Historisk-antikvarisk række* 4: 3–25.

Nummedal, A 1921 Slinningen, en stenalderboplads paa Sunnmøre. *Bergen Museums Aarbok 1920–21. Historisk-antikvarisk række* 4: 3–15.

Nummedal, A 1922 Den eldre steinalderen vår. *Syn og segn* 28: 241–259.

Nummedal, A 1923 Om flintpladsene. *Norsk geologisk tidsskrift* VII (2): 89–141.

Nummedal, A 1927 Stenaldersfundene i Alta. *Norsk geologisk tidsskrift* IX: 43–47.

Nummedal, A 1929a Noen stenredskaper fra Finnmark. *Universitetets Oldsaksamlings skrifter* 2: 17–34.

Nummedal, A 1929b Stone Age Finds in Finnmark. *Instituttet for sammenlignende Kulturforskning*, ser. B, Skrifter II: 17–34.

Nummedal, A 1975 A. Nummedal: Finnmarks-fundene. (Published on the 50th Anniversary of the Discovery of the Komsa Culture). *Acta Borealia*, B. Humaniora, 15: 11–24.

Nummedal, A and **Rosendahl, H** 1929 Beretning om en reise i Østfinnmark. *Norsk geologisk tidsskrift* 10: 458–459.

Nummedal, A J 1933 Kan det finnes flintplasser på kyststrekningen mellom Kristiansand og Ålesund? *Naturen*, 1933: 227–244.

Nyland, A J 2012 Lokaliseringsanalyse av tidligmesolittiske pionerboplasser. In H. Glørstad. and F. Kvalø (eds.) *HAVVIND – Paleogeografi og arkeologi. Archaeological Report, Norwegian Maritime Museum*. Oslo: Museum of Cultural History.

Odner, K 1964 Erhverv og bosetning i Komsakulturen. *Viking* 28: 117–128.

Olsen, B 1994 *Bosetning og samfunn i Finnmarks forhistorie*. Oslo: Universitetsforlaget.

Østmo, E 1994 Anders Nummedal, oppdageren av vår eldste historie. *Pridlao* 3: 37–39.

Petersen, Th 1920 Meddelelser fra stenalderen i det norden-fjeldske Norge. *Aarbøger for nordisk Oldkyndighed og Historie:* 18–35.

Petersen, Th 1922 Fra hvilken tid stammer de naturalistiske helleristninger? *Naturen* 46: 88–108.

Petersen, Th 1944 Anders Nummedal. *Det Kongelige Norske Videnskabers Selskab. Forhandlinger*, XVII(14): 55–61.

Pettersen, K 1998 'Som om han bare var rundt og fant igjen buplassar han sjøl i et tidligere tilvære hadde brukt'. Anders Nummedal – en oppdagelsesreisende til fortida. *SPOR* 2: 12–15.

Rosendahl, H 1944 Konservator Anders Nummedal. Minnetale i Norsk geologisk forening 23. Mars 1944. *Norsk geologisk tidsskrift* 24: 89–97.

Rygh, K 1910a K. Rygh Advises A. Nummedal about the Possible Flake Axes He Has Recovered (Letter dated April 12, 1910). Private Archive, no. 57. Trondheim: NTNU Gunnerus Library.

Rygh, K 1910b K. Rygh Writes to A. Nummedal about the Discoveries Published in the Newspaper (Letter dated April 17, 1910). Trondheim: NTNU Gunnerus Library.

Rygh, K 1910c *Romsdals Amtstidende* 9. November.

Rygh, K 1911 Oversigt over Videnskabsselsabets Oldsagssamlings tilvekst i 1910 af sager ældre end reformationen. *Det Kongelige Norske Videnskabers Selskab Skrifter*, 1910: 1–77.

Rygh, K 1913 Flintpladsene paa Trøndelagens kyst. *Oldtiden* II: 1–9.

Rygh, O 1885 *Norske oldsager. Ordnede og forklarede.* Christiania: Cammermeyer.

Sandmo, A K 1986 *Råstoff og redskap – mer enn teknisk hjelpemiddel: om symbolfunksjoner som et aspekt ved materiell kultur; skisse av etableringsforløpet i en nordeuropeisk kystsone 10.000–9.000 BP.* Cand. Mag. Thesis, Norway: University of Tromsø.

Schanche, K 1988 *Mortensnes, en boplass i Varanger. En studie av samfunn og materiell kultur gjennom 10.000 år.* Cand. Mag. Thesis, Norway: University of Tromsø.

Shetelig, H 1922 *Primitive tider i Norge: En oversigt over stenalderen.* Bergen: John Griegs Forlag.

Simonsen, P 1994 Anders Nummedal og Nord-Norge. *Pridlao* 3: 45–47.

Svendsen, F 2007 *Lokaliteter og landskap i tidlig mesolittisk tid. En geografisk analyse fra Nordvest-Norge.* M.A. Thesis, Norway: University of Trondheim.

Waraas, T A 2001 *Vestlandet i tidleg Preboreal tid. Fosna, Ahrensburg eller vestnorsk tidligmesolitikum?* M.A. Thesis, Norway: University of Bergen.

Westli, C 2009 *Å slå seg ned: en regional analyse av tidligmesolittisk lokalisering med utgangspunkt i Østfold.* M.A. Thesis, Norway: University of Oslo.

Woodman, P 1993 The Komsa Culture. A Re-examination of Its Position in the Stone Age of Finnmark. *Acta Archaeologica* 63: 57–76.

Yderstad, O 1989 Norske portretter: Anders Nummedal. *Årbok for Nordmøre* 1989: 85–93.

How to cite this article: Breivik, H M and Ellingsen, E G 2014 'A Discovery of Quite Exceptional Proportions': Controversies in the Wake of Anders Nummedal's Discoveries of Norway's First Inhabitants. *Bulletin of the History of Archaeology*, 24: 9, pp. 1–13, DOI: http://dx.doi.org/10.5334/bha.249

Published: 3 April 2014

]u[*Bulletin of the History of Archaeology* is a peer-reviewed open access journal published by Ubiquity Press. OPEN ACCESS

Paper 2

Breivik, H.M. and Bjerck, H.B. (in press)

Early Mesolithic central Norway: A review of research history, settlements, and tool tradition.

Early Mesolithic central Norway: A review of research history, settlements, and tool tradition

Heidi Mjelva Breivik[1] and Hein B. Bjerck[2]

[1] heidi.breivik@ntnu.no; [2] hein.bjerck@ntnu.no

NTNU University Museum
The Archaeology and Cultural History Department
7491 Trondheim
Norway

Abstract.

This paper sums up the vast record from the Early Mesolithic (EM) pioneer period (c. 10,000-9000 BP, c. 9500-8000 cal. BC) in central Norway (Fig. 1). This region holds a significant place when it comes to Stone Age research. This is where the first (Early Mesolithic) Fosna pioneer settlements were located by Anders Nummedal in 1909. It is also the region with the highest density of EM settlements in the present archaeological record of Norway. In recent years, several large-scale excavations have been conducted, revealing new and interesting details of EM dwellings, settlement structure and tool tradition.

The quantitative analysis of 244 sites has the potential to put the former studies into perspective and investigate topics that have been less treated in the past. Since the EM record from the coastal areas of northern Europe are severely hampered by Post-Glacial inundations, this archaeological information is of great importance. The nature of the isostatic uplift in central Norway has preserved these ancient shorelines, and does, unlike most other places, allow for detailed studies of early marine foragers. There is also a possibility that the high density of settlements is a result of a perfect correspondence between subsistence pattern and environmental characteristics, where fjords represent efficient communication routes between a highly productive marine biotope along the outer coast and the reindeer populations in the adjacent mountain plateaus. Thus, the EM record from central Norway constitutes an interesting case in the understanding of the social and economic conglomerate of Mesolithic Europe.

Previous research in central Norway.

The archaeological discourse at the time of Anders Nummedal's important discovery of the first flint artifacts by Vollvatnet near Kristiansund was certainly very different from today.

Then, the scholarly foci were "How old?" and "Where did they come from?", and Nummedal's findings evoked quite a debate on both these questions (see Breivik and Ellingsen 2014). Nummedal himself was a geographer and a teacher. His knowledge of raised shorelines made him quite confident that his findings were very old; older than all other sites in the region. The archaeologists, departing from their knowledge of South Scandinavian typology, were more doubtful. The fact that the Fosna finds included flake-adzes, supported by the confusion between transverse projectiles and small blade mid-fragments, lead to the conclusion that the culture complex was related to the Danish Late Mesolithic Ertebølle tradition. Further studies made it clear that the Fosna finds were of EM age, but the problem of a "missing link" to the South Scandinavian cultural sequence prevailed. Nummedal claimed, with references to his geological knowledge, that the provenience of the Fosna tradition was to be found on the now submerged plains in the North Sea basin.

Nummedal's surveys in the early 20th century created knowledge about Post-glacial landscapes and settlements on which we have built ever since. Using his knowledge about sea-level fluctuations, climate history and deglaciation, he systematically searched for prehistoric settlements along elevated shorelines. His surveys, mainly conducted in the period 1909-1917, resulted in hundreds of archaeological sites from different periods.

At least 70 EM sites from central Norway were discovered and collected by Nummedal, of which a majority is situated on the islands of Aukra, Averøy, Tustna, Smøla, Frøya and Hitra. Stray finds, recovered by dedicated locals during the following decades, contributed to build a large collection of artifacts from the pioneer phase of Norway. In more recent time, numerous surveys have been conducted along the coast. Of particular importance are the extensive survey projects associated with the establishment of the onshore gas plants of Tjeldbergodden and Ormen Lange Nyhamna. Extensive surveys have also been carried out in the Bremsnes area on the island of Averøy (Pettersen 1994, 1995).

Excavations of varying extent have been conducted on over 50 sites, of which 11 were investigated by Anders Nummedal and Karl Rygh during the years 1909-1924. Common for this early phase of excavations is the relatively small areas unearthed and scanty documentation compared to the present standard. Excavations conducted after 1970 have mainly been part of road construction projects or industrial development plans, and cover larger areas – often with several excavated sites within the same area. During the last decade, mechanical excavators have been applied in the initial stages of the excavation. The new method has given the opportunity to uncover vast areas and thus increasing the chance of grasping the overarching structure of the site as well as details in settlements and artifact composition. Tjeldbergodden (Berglund 2001), Ormen Lange Nyhamna (Bjerck *et al.* 2008), Hestvikholmane (Wammer 2006, Fretheim 2007, Sauvage 2007a, 2007b, Brede 2012) and Kvernberget (Fretheim 2008, Strøm and Breivik 2008, Svendsen 2008) are among the largest excavations conducted in recent time.

Through the years, considerable effort has been put into studies of EM lithic assemblages and location of sites in the region (Møllenhus 1977, Bjerck 1983, Narmo 1993, Svendsen 2007, Breivik 2014). Distribution patterns and location factors are frequently reoccurring topics. The EM settlement was from an early stage regarded as a coastal phenomenon (Shetelig 1922, Nummedal 1924, Gjessing 1945). However, the research was at this stage largely based on Nummedal's surveys which were exclusively carried out along elevated EM shorelines. No investigations were conducted in the interior, leaving the impression that this ecozone was not utilized. Another matter discussed was the apparently uneven geographical distribution of sites. The high density of sites found on the coast of central Norway could not be paralleled in any other part of the country. Nummedal (1933) pointed to the effects of the Tapes transgression, which occurred in the Middle and Late Mesolithic periods, to explain the scarcity of sites south of central Norway.

The geographical and topographical distribution of EM sites in the region has also been the topic of more recent studies by Hein Bjerck (1983), Frode Svendsen (2007) and Heidi M. Breivik (2014). Bjerck investigated the regional differences in Mesolithic site density in west and central Norway. By plotting 120 sites with EM adzes (flake adzes and core adzes), he found a geographical emphasis south of the Trondheimsfjord down to Romsdal, and then an absence down to Nordhordland. After evaluating several non-cultural factors he concluded that the Tapes transgression may have superimposed or eroded sites in Sogn og Fjordane and adjoining areas, and that the availability of lithic raw material and high archaeological search intensity may have added to the site density of Romsdal, Nordmøre and Sør-Trøndelag counties. The scarcity of sites in Nord-Trøndelag, on the other hand, cannot be explained by non-cultural factors, and he argued that there is a cultural legitimacy to the distribution pattern. Svendsen's study of 86 EM sites, largely from Nord-Møre, shows that c. 90% of the sites was situated on the outer coast – the majority on islands. Furthermore, 3 % were found in the fjord areas, and 7 % in the mountain zone (Svendsen 2007, p. 70-71). Breivik's study, which included all Norwegian EM sites, demonstrated the same tendencies, and it was concluded that 96% of the sites are coastal while 4% are situated in mountain terrain.

The relation between site location and resource abundance has been central in several studies. The outer archipelago is known as a particularly productive biotope with nutritious water masses that create the basis for a diversity of marine species, and islets and skerries offering important resting places for sea birds and seals (Svendsen 2007, p. 75-77, Bjerck 2008, p. 70, Bjerck *et al.* 2008, p. 552). It is argued that this zone provided even more favorable conditions in the EM phase. The inner fjord areas, on the other hand, were less bountiful (Breivik 2014). All the cited authors argue for a high marine productivity in central Norway. The topographical advantages in the region are also stressed: the archipelago forms a protective belt against the open sea that makes travelling by boat relatively safe, and narrow fjords grant easy access also into sub alpine terrain (Svendsen 2007, p. 81, Bjerck *et al.* 2008, p. 552). In the mountain zone, reindeer would have been the main attractor for human hunters, but from the present distribution pattern this resource must be interpreted as inferior when compared to marine species.

Nummedal also commented on the micro-topographical location of the sites. He noted that the sites he recovered were situated in level terrain, near good landing places for boats and sheltered against prevailing winds (Nummedal 1924, p. 90-91). These aspects have largely been integrated in archaeological methodology and theory (e.g., Bjerck 1989, Bergsvik 1991, 1995, Barlindhaug 1996, Berg-Hansen 2009). On-site topographical location factors are, however, not systematically analyzed on the central Norwegian sites in recent time.

Analysis of settlement organization, in terms of dwelling structures and artifact distribution patterns, are likewise less studied from a quantitative perspective. Kristine Johansen (1990) has examined the artefact assemblages of the site Uransbrekka in Nord-Trøndelag county. According to her analyses, the five lithic concentrations recovered represented short-term stays conducted at different times. The extensive Ormen Lange excavations in Aukra included seven EM sites of which the largest, Site 48, also gave valuable perspectives on settlement patterns. Here, a vast and complex living area with eighteen separate occupation units, first and foremost identified by lithic concentrations, was recovered. The units seemed to be structured in similar ways with the lithics deposited around a fireplace and with comparable artifact compositions. The site was interpreted as the result of several occupation events – some probably made by two or more co-residing groups – that included a repeated set of activities (Bjerck *et al.* 2008, p. 218-256).

A dwelling structure from Ormen Lange Site 72 was discussed by Leif I. Åstveit (2009). From the size, the lack of postholes and the position of the fireplace, the feature was interpreted as the remains of a ridge-tent, similar to summer tents used in Greenland. A review of EM dwellings is also given by Silje E. Fretheim *et al.* (this volume), with focus on construction, permanence and portability.

The artifacts recovered from the region have been investigated with different questions in mind. Kristen Møllenhus (1977) and Hein Bjerck (1983) have studied the Mesolithic assemblages in a broad manner. Møllenhus' publication offers a very useful review of 62 Mesolithic sites on the coast of Møre and Trøndelag. His descriptions cover morphological and technological traits for the complete Mesolithic inventory. Bjerck's study provides a chronological division of Mesolithic tool types and technology. Through analyzing the assemblages of 15 sites from four regions along the west coast he identifies three traditions within the Mesolithic. The EM phase is set to 10,000-9000 BP (c. 9500-8000 cal. BC), and is typologically defined by flake-adzes, core-adzes, tanged points, microliths/micro burins, burins, unifacial blade cores with acute striking angle, and irregular blades. These definitions are still applied today.

Studies concerning technological and functional aspects of the inventory have been conducted by Kristine Johansen (1990), Martin Callanan (2007) and John Asbjørn Havstein (2012). Johansen analyzes reduction techniques and methods applied on different raw materials from Uransbrekka in Nord-Trøndelag by refitting artifacts. The site is somewhat unusual with its high percentage of quartz and quartzite. She concludes that all raw materials were technologically handled in the same way. However, more pragmatic reduction techniques were applied when the quality of the raw material or the desired shape of the end-product required it. Callanan studies informal tool elements (flakes and blades with retouch and/or use-wear) in the assemblages of four sites: Ormen Lange Site 72, Mohalsen, Sandgrovbotnen and Brannhaugen. He thus sheds light on an artifact category which is often disregarded, and adds to our understanding of the functional composition of EM assemblages. Callanan concludes that the informal tool element display functional flexibility within a relatively rigid technological scheme that demonstrates a need for reliable yet flexible lithic toolkits – a combination of dependable and maintainable systems. Havstein examines the large collection of flake-adzes and associated production debitage recovered from the EM sites of Ormen Lange. He finds that the raw material and the adzes both seem to have been utilized to their full potential: The production strategy is characterized as pragmatic, most of the edges are rejuvenated at least once, and the adzes were discarded when the edge was found unusable. He also concludes that the tool itself is versatile, not specialized, but probably used for slaughtering, blubber cutting and skin preparation rather than for woodworking.

Trends in the archaeological record from 244 Early Mesolithic settlements

A database of 244 EM sites from the counties of Nordmøre, Romsdal, Sør-Trøndelag and Nord-Trøndelag forms the basis for our review. The database is compiled by Breivik and includes sites presented in previous literature (Møllenhus 1977, Bjerck 1983, Svendsen 2007), recently excavated settlements, as well as artifact assemblages recently studied and dated by Breivik. The assemblages are recovered through surface collections, surveys and excavations and are dated by a combination of typology, sea-level dating and/or radiocarbon dates. The following information is recorded:

- Age (estimated from shore-displacement curves where height information in meters above sea-level (m asl.) was available. Radiocarbon ages were used where available).
- Location and m asl. (more or less exact according to the information provided in the original documentation).
- Dwelling structures, fireplaces and distribution of lithic artifacts on the settlements.
- Diagnostic type artifacts, and the number of each type (flake-adzes, core-adzes, microliths, microburins, single-edged points/tanged points, unifacial cores).

Based on previous research and our extensive database of sites and artifacts, we find it relevant to review the following topics:

Age. Questions about chronology and the antiquity of the initial colonization have been addressed from early on. Our database includes numerous sites with sufficient mapping information to be dated by shore-displacement curves. We discuss the age issue on the basis of selected sites.

Location. Previous studies show a distinct density of sites in the archipelagic zone, and few sites around fjords and in mountain terrain. We present a map of our 244 sites and discuss how this coincides with the established picture.

Settlement structure. Dwelling remains and holistic overviews of lithic distribution patterns are recovered mainly on large excavation projects. With few exceptions, this information is available only in unpublished excavation reports, and discussions about intrasite organization are generally kept to a site level. Our database of 50 excavated sites gives us the opportunity to review and characterize these aspects on a regional basis.

Lithic tool tradition. Descriptions of EM artifacts have previously been given on a selection of sites in the region. Based on the complete set of sites and artifacts, we give a characterization of the most distinct tool types (flake-adzes, core-adzes, single-edged points, tanged points and microliths) and investigate the deposition rate and geographical and topographical distribution pattern of these artifacts.

These issues constitute the basis of our review of the EM period in central Norway, which in the final section will be put in a wider perspective and related to current research.

Age

Due to the varying quality of contextual information, not all sites lend themselves to elucidate chronological issues. In many cases, the reported height above sea-level is so inaccurate that it gives a discrepancy of several hundred ^{14}C-years on the shore-displacement curve. The best cases provide a precise elevation that corresponds to an equally precise ^{14}C -date on the curve. EM radiocarbon dates are retrieved from six sites in the region (Table 1). The results have a standard deviation of ±50 to ±150 ^{14}C -years. By including only the most precisely dated sites we are left with 86, which will be the basis for the following analysis.

The diagram (Fig. 2) shows that most of the sites are placed within the first half of the EM period. The final stages of the period may be hampered by non-cultural factors as the relatively low elevations on which the youngest sites are found may be affected by the Tapes transgression. It must also be stressed that no matter how precisely the site is georeferenced, the shore-displacement curves only provide the oldest possible dating. Studies which compare radiocarbon dates with shore-displacement dates have found that Stone Age settlements may have been placed as much as 2-10 m above the contemporaneous sea level (e.g., Sandmo 1986, Barlindhaug 1996, Bjerck *et al.* 2008, Årskog 2009). However, sites where a substantial portion of artifacts are water-rolled indicate that settlements could indeed be positioned very close to the contemporaneous sea level. Several of the analyzed sites in central Norway include water-rolled artifacts. Among the oldest are Ormen Lange Site 51, Hestvikholmane Site 2-2012 and Kvernberget Site 20, which, according to the shore-displacement diagram, can be dated to 9800-10,000 BP (c. 9300-9500 cal. BC) (see Table 2). It thus seems likely that the region was colonized shortly after the termination of the Younger Dryas cold event. At present, there are no certain indications of settlements older than this.

Location.

In line with previous research, our map in Fig. 3 displays a distinct pattern with most of the sites located on the islands of the outer archipelago. A smaller portion is situated around the fjord basins, and only a few are found in fjord bottoms and mountain context.

In his location analysis, Svendsen (2007) suggests a division into four macro-topographical zones: archipelago, open fjord areas/fjord basins, inner fjord areas, and alpine (Svendsen 2007, p. 68). The divisions are based on topography, oceanic preconditions, the accessibility to water and land areas, and level of exposure. The zones are further characterized by their biodiversity and faunal composition. The settlement pattern is believed to reflect a combination of logistical considerations and subsistence strategies. This is also emphasized in studies from other parts of the country (Odner 1964, Lindblom 1984, Bjerck 1989, Bergsvik 1991, Barlindhaug 1996). The extensive use of boats and distribution of marine resources have particularly been pointed out as important structural elements in the choice of camp location (Bjerck *et al.* 2008). This also creates the basis for our location analysis and macro-topographical overview, which more or less corresponds to Svendsen's four zones.

Zone A: The outer archipelago.

This zone is characterized by islands and peninsulas situated in the outer archipelago. Considering that marine resources were the staple in the EM subsistence strategy, the outer archipelago must be regarded as the most productive and attractive zone. In the first half of the EM (10,000-9500 BP, 9500-8800 cal. BC), meltwater draining from the receding ice through fjords would have benefitted the production by creating phytoplankton blooms in the wake of the islands. During the second half of the EM, the increasingly influential Norwegian Atlantic Current would have transported nutritious warm and salty water masses into the outer coastal zone. These palaeo-oceanographic and climatic changes in the course of EM would have caused a gradual replacement of the arctic fauna by more temperate species (Breivik 2014). Throughout the period, the islands would most likely have had colonies of seals and birds. A variety of fish species is also expected to have been present in this environment, and in increasing amounts during the later parts of the EM. Species associated with pelagic waters would have frequented the outermost zone.

87% of our sites are found in this zone (Fig. 3). We may distinguish between two locational situations within the Zone A. The first is on highly unprotected locations with the sites being oriented towards large bodies of open water. This situation is mainly found on Frøya, Smøla and Hitra – islands that are detached from the mainland. On Smøla and Mausund, Frøya, in particular, the sites are totally exposed and would have been situated 10-15 km from the nearest mainland. The other location pattern in Zone A, which seems to be more common, is represented by the sites on the islands situated along the mainland. The sites on these islands are generally positioned along the protected channels between the islands rather than the more exposed shores facing open sea.

To move around in this seascape would mean occasional crossings of large bodies of unsheltered water, requiring both stable boats and good navigating skills. Very likely, the protected channels were important transport routes.

Zone B: Around fjord heads or retracted channels

This zone is the transition between mainland and archipelago; between fjords and open sea. This would also have been a productive sector throughout the EM. In the early phase, the combination of reduced westerly wind-forcing, a weaker Norwegian Atlantic Current, and runoff from melting glaciers via the fjords would have resulted in a mixing of different water masses in this zone. In the second half of the EM, the oceanic circulation regime became more like the present with a subsequent increased stability in the marine conditions and more constant habitats for fish and sea mammals (Breivik 2014).

Only 8% of the sites are situated in Zone B. Although the sector can be characterized as topographically less exposed and with more sheltered oceanic conditions than Zone A, the sites in Zone B still seem to be oriented towards the archipelagic zone. The larger group of sites (Vestnes, Molde, Tingvoll, Orkanger and Åfjord) are found around fjord basins which opens up towards the belt of islands and skerries of the outer coast. More protected are the remaining sites (Halsa and Hemne), which are situated along what would be a narrow sound going all the way to Fræna in the early part of the EM period.

The sites in Zone B could be reached from the archipelago through sheltered channels. Once there, long and narrow waterways offered easy travelling by boat along the mainland and further inland.

Zone C: Inner fjord areas.

The inner fjord areas apparently had a lower marine productivity than Zones A and B during the EM. The silty sediments from the melting glaciers in the early phase would cause bad light conditions for plankton, and nutrient-rich water would first begin to mix on its way to the coast. In the late EM phase this situation would improve, but the conditions were not as stable and productive as in the outer coastal areas (Breivik 2014).

Just 2% of the sites are situated in this zone. The sites in Rauma are positioned by the entrance to the narrow Langfjorden, while the sites in Surnadal and Sunndal are found further into their respective fjords. Due to the unfavorable marine conditions and the physical connection to alpine terrain, it seems likely to interpret the sites in this zone as connected to inland rather than marine environment.

The narrow fjords give sheltered and quick access by boat between coast and inland. During the EM period, seasonal ice cover would probably have permitted travelling by foot during winter.

Zone D: Mountain.

The mountain zone was influenced by the retreating glacier during the EM. Large parts of the mountain plateau was deglaciated before valleys and fjord heads, and hosted good pastures for terrestrial animals such as reindeer, foxes and hares at an early stage.

Three per cent of the sites are situated in Zone D. They are positioned near the innermost part of the fjord or in tributary valleys, and it seems reasonable to interpret these sites as logistically connected to the other zones. The relation to the coast is further manifested through the use of flint, which only appears as ice-rafted nodules deposited in beach sediments, on mountain sites.

The above review gives the same impression as previous analyses: an overwhelming portion of the settlements are located in the archipelagic zone; a few have a more retracted position on the coast; even fewer are found in the inner parts of the fjord and in mountain terrain.

Some issues that may have distorted the location pattern must be critically assessed and discussed. First, there are the extensive investigations performed by Anders Nummedal. His efforts were first and foremost focused on the islands in Sør-Trøndelag county and Nord-Møre – the area with the highest abundance of sites. That being said, it seems that his surveys in adjoining areas were less rewarding, suggesting that the site density in this part of the region may in fact reflect the location preferences of the pioneer groups. Another issue is the tendency towards higher survey frequency in coastal regions than in inland regions, not only in the early stages of archaeological investigation, but also in more recent times: Industrial development and road constructions, leading to archaeological salvage projects, have been most significant in Zone A. During the last 50 years, however, large archaeological mapping projects, related to the development of hydroelectric power, have been conducted in mountain and forest zones. In south and central Norway, over 1000 Stone Age sites from the inland have been mapped and surveyed, yet few can be dated to the EM (Indrelid 2009, Foosnæs and Stenvik 2010). Scarce vegetation and soil formation entail high visibility of mountain settlements, meaning that the low ratio of sites in these areas should be trusted. It can be objected, though, that the inland surveys have been concentrated around lakes and waterways, and large expanses in between are less investigated. The inner fjord areas are also not systematically surveyed. Although more sites may turn up in these zones in the future, it would take hundreds of sites to flip the presented distribution pattern. We conclude, therefore, that despite differences in search intensity across different zones, our distribution map expresses a real culture historical tendency: That the coastal zone, in particular the outer archipelago, was the preferred zone in the EM period.

Settlement structure.

The greater part of the 244 recovered EM sites in the region are artifact assemblages collected directly from a spot, or a larger area, and come with little contextual information. 50 sites have been excavated to varying extents (Table 2), and are more suited to give us information about lithic distribution patterns and on-site features. These will constitute the basis for our review of settlement structure.

Lithic distribution patterns.

Lithic distribution patterns are best illuminated by sites where vast areas of top soil are removed on and around the settlements. In recent projects, mechanical excavators are used, allowing us to get this overview. 17 EM sites in the region have been excavated using this method.

On most of these sites, one or two lithic concentrations were recovered. Each of the sites of Kvennbergmyra, Hestvikholmane 6, Ormen Lange Site 51 and Ormen Lange Site 62 Øvre had one marked lithic concentration, probably denoting a single occupation event. Ormen Lange Sites 73 and 76 also had one main concentration, but they seemed to include several deposits, perhaps accumulated from different occupation events. Also Hestvikholmane Site 2 and Hestvikholmane Site 2-2012 had comparable deposition patterns, and may be interpreted in the same way. Ormen Lange Site 72 included two artifact concentrations – both associated with dwelling structures. Each of the concentrations was interpreted as depositions from one single stay. On Kvernberget Site 20 and Hestvikholmane Site 3, two concentrations, of which one coincided with a tent ring, were unearthed. On the latter it was found likely that the two concentrations denote different modes of production. The settlements were interpreted as traces from one or two visits. Two lithic accumulations were also revealed on Hestvikholmane Site 4/5. Here, one of the concentrations included production debris of a flake adze, while the other may have been connected to projectile production. Whether the material was deposited during one or several visits was not concluded upon.

On a few sites, more than two lithic concentrations have been found. On Vassdalen-Brekka, four accumulations, with no connection to features, were recovered. They were interpreted as *in situ* knapping debitage and redeposited material, probably originating from several occupation events. Numerous marked concentrations were found on Hestvikholmane Site 1. One of them was found immediately outside a dwelling structure, and interpreted as redeposited material from the inside. Several reduction sequences were identified, and the site was understood as a single stay of longer duration. On Kvernberget Site 1, 12-14 small lithic concentrations were recovered. Only rarely were they found in connection to fireplaces. Half of the concentrations seemed to be associated with a single house structure, and were consequently interpreted as redeposited debris originally produced inside the dwelling. Another concentration was regarded as possibly indicating the traces of a tent. The site was regarded as an area with several reoccupations. Finally, Ormen Lange Site 48 yielded 18 lithic concentrations, or occupation units, of comparable size and artifact compositions. In most cases the lithics were deposited around a fireplace, but only a few distinct remains of dwelling features were recovered. The units were understood as remains from several occupation events. While several of the units seemed to have been use only once, the densest of them were interpreted as the result of up to five visits. All together the site may represent 30 occupation events of which some were undertaken by two or more co-residing groups.

It may be concluded from this, that a settlement pattern where a single occupation event resulted in one to two lithic concentrations is the common one. Several of the presented sites have been visited only once, but they all seem to be part of a larger system of sites positioned close to each other (six sites in the Hestvikholmane area and four sites in the Kvernberget/Kvennbergmyra area). Sites like Vassdalen-Brekka and Ormen Lange Site 48 represents denser accumulations of several occupation events. Hestvikholmane Site 1 and Kvernberget Site 1, with their multiple lithic concentrations and redeposited debitage connected to dwelling structures, are particular cases and seem to reflect occupations of longer duration than other sites.

It also seems that while many of the lithic concentrations include a wide and comparable range of tool types, denoting a repeated set of activites (e.g., Ormen Lange Site 48), other concentrations reflect the performance of specific tasks (e.g., Hestvikholmane Site 3 and Hestvikholmane Site 4/5).

Dwelling structures.

Features interpreted as distinct remains from dwellings have been found on eight sites. By far, and in agreement with the general picture from EM Norway, most dwelling remains seem related to tents (Bjerck 2008, Fretheim *et al.* this volume).

Tent rings are found on six sites in central Norway. They commonly measure 2-3 m in diameter, but larger (4.5-6 m) are documented on Ormen Lange Site 48 Unit G (Fig. 4) and Tjeldbergodden, Kalvheiane 2a. The structures consist of a varying number of stones, commonly from six to twelve. The ring on Hestvikholmane Site 2 was made up of about 40 stones. The shape tends to be more or less circular, and the floor is often cleared of larger rocks.

Tent floors, recognized as dense concentrations of sorted stones, are documented on two sites. The two tent floors found on Ormen Lange Site 72 measured 6.0-6.5 m^2. The most elaborate of these (found in Unit X) were partly surrounded by a ditch and large stones. This structure also contained a fireplace with an associated concentration of artefacts. On Hestvikholmane Site 1 an area of 3 x 4 m covered with small rocks was interpreted as a possible floor area. The structure contained relatively small amounts of artifacts, but lithic artifacts seemed to have been redeposited outside. With the exception of Kalvheiane 2a, fireplaces were associated with the recovered dwelling remains: On Hestvikholmane Site 1 and Ormen Lange Site 72, Unit Y, the fireplaces were found nearby the dwellings, while the rest had fireplaces placed within the former dwelling. We can certainly imagine that not all stopovers required heated dwellings (e.g., during warm summer days), and that activities related to fires in many cases could be kept away from the actual living space.

Dwelling structures have doubtless been more common than the few direct traces indicate. As noted by Bjerck (2008) the low energy produced by blubber-fuelled fireplaces would require some type of superstructure to conserve heat. If this is right, most dwellings did not include stone alignments. Several sites contain evidence of a more vague nature. On three sites (Hestvikholmane Site 6, Hestvikholmane Site 2-2012 and Sandgrovbotnen) areas cleared of stones and with high artifact density have been understood as traces of dwelling structures.

On other sites, lithic concentrations corresponding to the suggested measure of tent rings are interpreted in the same way. This vague impression may be related to the actual essence of a tent structure. This is a dwelling that is erected and dismantled as part of a particular occupation. During summer or calm conditions, the construction (hides, poles) itself weighs enough to support itself without an alignment of stones. Rough winds (or a more lengthy occupation) entailed a need for a ring of stones. In all cases, the dismantling of the construction included disrupting of the alignment of stones.

A feature interpreted as a *house structure* was found on Kvernberget Site 1. The feature measured 3.0x3.5 m. and had a defined, oblong wall. A dark layer containing decomposed organic material and eroded pebbles was found inside, and most of the lithics were found within this area. The feature was placed nearby a large boulder believed to be a part of the construction. The dwelling floor contained a fireplace, and a second fireplace was found nearby. Without doubt, the Kvernberget 1 site include an EM settlement, but also remains of later activity as documented by a series of ^{14}C-dates, and also by the presence of bipolar cores, that normally do not occur in EM context. Thus, the EM age of the quite exceptional house structure may be questioned.

Fireplaces.

Substantial remains of fireplaces are recovered on 19 of the excavated sites in the region. They are usually described as more or less circular or oval concentrations of stones, embedded in a layer of sooty sediments mixed with pieces of charcoal. Often the stones are (lightly) firecracked, sometimes disintegrated into gravel (e.g., Ormen Lange Site 48). The fireplaces may be aligned by larger stones, structuring the feature (e.g., Kvernberget Site 20, Ormen Lange Site 48, Units I and J). The features are normally arranged directly on the ground. In some cases a layer with a higher density of soot and charcoal is identified under the stone packing (e.g., Hestvikholmane Site 1, Kvernberget Site 1). In the case of Kvernberget Site 1, the fireplace was believed to reflect repeated use. On Ormen Lange Site 48, several of the fireplaces were characterized as collections of sorted stones of medium size found within a matrix of black-brown sediments containing soot/charcoal, pebbles and gravel (see Fig. 4). From their appearance, and with references to Inuit fireplaces in Greenland (Odgaard 2003), it was suggested that they were fuelled with blubber rather than wood (Bjerck *et al.* 2008, p. 251). In some cases, layers of darkened sand underlying the fireplaces were recovered. These were believed to be remains of charred blubber oils that had been sucked up in the natural deposit below the base of the fireplace. In addition to these distinct fireplaces, a number of concentrations of firecracked artifacts without charcoal, or firecracked stones, are also taken to denote traces after bonfires (e.g., Ormen Lange Site 48 Units A, B, H and Hestvikholmane Site 2-2012).

The smallest fireplaces are 20-40 cm in diameter, and the largest are reported to cover more than 2 m^2. The majority has a diameter of about 1 m.

Several of the fireplaces are associated with distinct traces of dwellings. In some cases the fireplace is situated centrally on the floor (e.g., Ormen Lange 48 Unit N). However, many are located along the fringes of the artifact concentration or the ring of tent stones (e.g., Hestvikholmane Site 2, Kvernberget Site 1, Kvernberget Site 20), probably near what would have been the entrance, as suggested by Åstveit (2009). On Ormen Lange Site 48, the fireplaces were consistently found in connection with artifact concentrations. Similar situations were also recovered at Ormen Lange Site 76b and Kvernberget Site 24. As discussed above, it is likely that these concentrations are indirect traces of tent structures. Also, the fireplaces which are not associated with detectable dwelling remains may once have been situated inside a temporary dwelling.

This review suggests that distinct traces of dwelling structures are rather rare. There seems to be a connection between the size of excavated area and detection of features: dwelling remains are exclusively recovered on sites where large areas have been uncovered. However, the large Ormen Lange Site 48 exemplifies that there is no direct relation between site size and number of distinct dwelling remains recovered. Despite the infrequent detection of dwelling remains, we must assume that the erection and use of tents in most cases would have left little physical evidence. Season, weather conditions and duration of the stay may have influenced the chosen form of structure. It is also likely that certain stopovers would not require the use of tents or huts. Traces after fireplaces are found on almost half of the excavated sites. In many cases, the lack of fireplaces may be related to methodological issues (small areas excavated), but also on several extensively excavated sites traces of fireplaces are absent (e.g., Hestvikholmane Site 3, Ormen Lange Site 51 and Ormen Lange Site 62 Øvre). Like the dwelling structures, we may also here suggest that simple bonfires placed directly on the ground would have left few persistent traces. In some cases the need for fire may even not have been present.

Lithic tool tradition.

Due to poor preservation conditions for organic material, the EM tool technology is mostly distinguished by its lithic implements. Flint is by far the most dominant raw material on all sites in the region. Rock crystal, quartz and quartzite are by few exceptions (e.g., Vassdalen-Brekka and Uransbrekka) insignificant compared to the amount of flint. Red jasper has been identified on two sites (Kvernberget Site 20 and Vikamoen (2)). Another interesting observation is the presence of porphyry on the sites Hestvikholmane Site 2-2012 and Leira.

The EM tools are mainly manufactured on blades. The blades are detached from unifacial cores with one or two platforms with an acute striking angle, using soft, direct technique (Fuglestvedt 1999, Kutschera 1999). Small single-edged and tanged points, microliths, burins, retouched knives and scrapers are blade-tools that appear regularly in the inventory. These implements may also be made from flakes. Informal tools (flakes and blades with retouch and/or use-wear) are present on most sites. The techno-complex also includes adzes produced from cores (core-adzes) or large flakes (flake-adzes).

The adzes (flake-adzes and core-adzes) and projectiles (single-edged points, tanged points and microliths) are the most characteristic and diagnostic tool types in the EM inventory, and make up the largest categories in the region among the diagnostic tool types. An account of this material will be given in the following.

Flake-adzes and core-adzes.

Flake-adzes are made on large flakes. The adze is shaped by flaking, but one of the sides of the flake should be left unretouched and form the edge of the adze (Andersson *et al.* 1975, p. 16-18, Bjerck 1983, p. 17).

A number of 314 flake-adzes have been identified through our work, of which 283 displayed the typical and clear morphological traits, and the remaining examples were classified as possible flake-adzes or fragments of such.

The typical flake-adze from central Norway is small (the edge measuring around 4 cm) with a trapezoid outline where the edge is somewhat wider than the neck. The sides are straight or slightly convex. Only a few adzes have concave sides. The cross section varies from trapezoid or rectangular towards more oval shapes (Fig. 5).

The proximal end of the flake usually forms one of the sides of the adze. Here, the platform remains may provide a straight and even side that doesn't require any further preparation. The opposite side is most often shaped by sporadic and uneven flake removals.

The dorsal surface is often fully worked, while the ventral face is left untouched. The butt-end is little tended to, but a few adzes have fine retouch and/or use-wear and may have been used for scraping. The edge is, with few exceptions, straight and formed, or rejuvenated, by one or several blows from the side. On a small group, the edge has been formed by lengthwise blows, resulting in a hollow edge similar to what we find on core-adzes.

Traces of use-wear are identified on the majority of the flake-adzes. While the traces are commonly visible as small chippings scattered along the edge, some of the adzes display more distinct fractures: severe damages along the edge, a notch on the middle of the edge or on the corner. A group of adzes has scraper-like edges, and may have been partly retouched before use.

Except a few specimens made from finely grained quarts on the Vassdalen-Brekka site, the flake-adzes are made from flint.

50-60% of the EM sites in central Norway have yielded flake-adzes. Most commonly 1-2 adzes are found on each site. Two exceptional sites are Christies Minde and Ormen Lange Site 48 which held 14 and 54 flake-adzes, respectively. In the case of the latter, a large area was excavated, and repeated occupations was suggested from the depositional character of the over 70,000 artifacts (Bjerck *et al.* 2008, p. 218-256). Four of the eighteen identified occupation units contained 7-12 adzes each; otherwise 1-3 was normal. The 14 flake-adzes from Christies Minde were recovered through collection on a plowed field and a subsequent excavation comprising a small area and a few testpits. It was reported that the majority of the c. 900 artifacts were found within an area smaller than 4 m^2 (Rygh 1911). The descriptions do otherwise not provide details about artifact distribution or other intrasite patterns, but it is relevant to consider that the site of Christies Minde also have been visited several times. The same is suggested for the sites of Vassdalen-Brekka and Kvernberget Site 1, where 6 flake-adzes were recovered.

On this basis it may be suggested that one occupation event seldom resulted in more than 1-3 flake-adzes. But there are also quite a few sites without this tool. None of the six sites on Hestvikholmane contained flake-adzes despite the large areas uncovered and high amounts of artifacts collected. As such, there is no direct relationship between the number of adzes retrieved and the size of the area excavated.

The overall impression is still that flake-adzes is one of the most common tools found on the EM sites of this region.

Core-adzes are formed from cores or flakes where the surface is more or less fully worked. Unlike flake-adzes, the edge should be completely shaped by flaking (Andersson *et al.* 1975, p. 12-15; Bjerck 1983, p. 17).

A number of 80 core-adzes have been identified through our work, of which 64 displayed clear morphological traits, while the remaining were categorized as possible core-adzes or fragments of such.

The core-adzes in the region typically have straight or slightly convex sides that diverge from the butt to the edge. The butt is rounded and significantly narrower than the edge. The adzes are normally 5-7 cm long. The largest examples are 10-15 cm long, but the width seldom exceed 4-5 cm regardless of their length.

A substantial part of the adzes seem to be slightly modified unifacial cores with acute striking angle. The core platform on these adzes is transformed by one or several blows from the side or front, resulting in an edge that is characteristically convex and hollow. An opposing platform may be found in the butt-end; either slightly modified or unretouched. One or both of the sides are flaked in order to obtain a more even and symmetrical shape, and the cross section has a plano-convex appearance.

A small group of core-adzes are more elaborately worked, with careful trimming along the sides and the butt, and flaking over the whole surface. They tend to have a more even, oval cross section and are also larger than the other adzes. As opposed to the core-like adzes described above, these elaborate adzes seem to have been made with a specific shape in mind. Altogether they should be singled out as a different adze type.

Although hard to determine due to pronounced flaking, trimming and abrasion along the edge, use-wear is recorded on several of the adzes.

Core-adzes are found on 20-25% of the EM sites in the region. They are generally represented by one specimen on each of the sites, sometimes two or three. The Ulset site with its 6-10 core-adzes is quite exceptional. The 4000 artifacts recovered on this site are, however, collected over many years and originates from different parts of the farm property. It is thus quite likely that the adzes belong to different settlements.

Core-adzes thus seem to be far less common than the flake-adzes. A possible issue of source assessment may be their potential subsequent use as blade cores.

Single-edged points, tanged points and microliths.

Single-edged point is a type of tanged point. The term is applied to points where retouch runs along one complete side, and only in the base on the opposite side (Helskog *et al*. 1976, p. 25). The remaining varieties are classified generally as tanged points. Points of this type have a tang formed by retouch on both sides of the base, but the category otherwise cover a range of shapes (Waraas 2001, p. 38).

There are 606 identified points in the material of which 569 displayed clear morphological traits, while the remaining were more uncertain mainly due to fragmentation. The size of the points is usually in the range of 2-3 cm in length and around 1 cm in width.

Single-edged points dominate among the complete examples. The tip and tang are commonly formed by using micro burin technology. In some cases the facet is still visible, but usually it is retouched in the final stage of manufacture. On the larger part, the tip of the point is in the proximal end of the blade/flake.

Among the tanged points, a group is classified as "self-pointed" where both edges that forms the tip are left unretouched. Another group is described as microlith-like with elaborate bases. On the tanged points, the tip is frequently in the distal end of the blade/flake.

40-45 % of the sites in the region have yielded single-edged or tanged points. On nearly half of these sites, one single specimen is found. Also several of the excavated sites contain only one point. An exceptional case is Ormen Lange 48 which contained 101 points, and 127 point or tang fragments. The smaller units on this site, interpreted as single occupation events, held 1-6 points and point fragments, while some of the larger units contained over 30. Based on the estimated 30 occupations on the site (Bjerck *et al.* 2008, p. 251), an average of 4-8 points (including fragments) were deposited on each visit which is above the "normal" rate. Another remarkable case is the mountain site Reinsvatnet R1 with its 40 points. Here, c. 4500 artifacts were recovered from an area of c. 40 m^2 (Callanan 2006). From the character of the site, one occupation event was suggested, and the deposition rate is thus quite exceptional within a regional context.

Microliths.

The technological definition of a microlith is a point made from a blade, flake or bladelike flake on which the bulb is removed by microburin technology. It may be retouched more or less all around, or along one or both of the sides. Microliths are further divided into subcategories, mainly based on their shape (Helskog *et al*. 1976, p. 26-28).

A number of 286 microliths were identified within the material from central Norway, of which 258 displayed typical morphological traits, while the remaining were classified as uncertain, mainly due to fragmentation. The size is in the range of 2.5-6.5 cm in length, and 1-2 cm in width.

Morphologically, the microliths from the region appear as strikingly uniform: Over 90% of the determinable examples are classified as *lanceolates*. The majority are retouched only along the oblique/convex fraction that forms the tip, most often on the left side. On some examples the retouch continues along the side of the blade or even around the base. On quite a few examples, the base is fractured horizontally. Whether this was done intentionally in the production process or by damage through use is indeterminable.

A small portion of the microliths is classified as *rhombic*. These have a retouched fracture in the base, running parallel with the retouched tip. They otherwise hold the same features as the lanceolates, but tend to be smaller in size.

Some of the microliths seem to have use-wear near the base, probably from hafting. A few have fractures in the tip or along the edge.

30-35% of the central Norwegian sites contain microliths. On a majority of these sites, only one or two microliths are recovered. The large Ormen Lange Site 48 stands out as exceptional with its 61 microliths, but taking the suggested number of reoccupations into account, we are left with a far more modest deposition frequency of this tool. More noteworthy may be the case of Reinsvatnet R1 with its 21 microliths, probably deposited during one stay. Together with the 40 tanged points discussed above this makes an extraordinary case when it comes to production, use and deposition of projectiles.

Fig. 6 illustrates the distribution of artifact types across the central Norwegian landscape. It is evident that adzes mainly belong to the coastal settlements (Zones A-C). Two flake-adzes are identified on the mountain sites (Reinsvatnet R1 and Gjevilvatnet), otherwise no adzes are found in this zone (Zone D). Projectiles are found on almost all mountain sites (Zone D) and on half of the inner fjord sites (Zone C), while only about 1/3 of the sites in the outer coastal zone (Zones A and B) contain projectiles. It can thus be argued that the relative importance of projectiles decrease from the interior to the outer coastal areas of the region.

There does not seem to be any geographical tendencies in the use and deposition of the described tool types.

Discussion.

The abundance of mapped and excavated sites makes central Norway a very important region for EM research in northern Europe. Our record suggests that the region was colonized shortly after the Younger Dryas event, and occupied throughout the whole EM time span. As highlighted in a recent study (Breivik 2014), the environment and climate underwent severe changes during this period – from artic conditions, highly influenced by ice and meltwater, to sub-arctic conditions, with a subsequent immigration of a more temperate fauna. The coast was nevertheless rich with resources throughout the period, and the environmental shifts and variations were approached with a flexible mobility pattern which included frequent movements and a gradual orientation towards the increasingly stable and predictable marine habitats.

Without doubt, the isostatic uplift of the shorelines and a high level of research intensity have expanded the archaeological record in central Norway considerably. Yet, there is a strong possibility that the region was an EM hot spot, i.e., optimal relations between the population's subsistence strategies and the environmental characteristics of the region. Important factors might be a) exceptional productivity in the marine biotopes throughout the EM, including the presence of pinnipeds that are believed to be the cornerstone in the economic base, b) an extensive archipelagic coastal zone facilitating marine foraging and logistics, and c) fjords that facilitated the logistics of reindeer hunting on the close by mountain plateaus. This very close relation between the prosperous outer coast and rich mountain plateau reindeer pastures is not found neither in the adjacent areas north of the Trondheimsfjord, nor in western Norway immediately south of here. However, similar characteristics are found in Rogaland, which also is a region with a high number of EM settlements (e.g., Bang-Andersen 2012, this volume).

The present study has made even clearer the close relation between settlements and the prosperous outer coast, as 87% of the 244 sites are found here. With this, the marine oriented economical basis appears as distinct. Without doubt, and especially in Early Post-Glacial times, also reindeer could be hunted in coastal areas. But the high proportion of settlements on small islands in the outer archipelagos must reflect a heavy reliance on pinnipeds, probably together with other marine species. Nevertheless, there is a noticeable segment of sites in mountain areas that demonstrate the importance of reindeer hunting, and maybe also fox and hare. As noted by others (Svendsen 2007, Fuglestvedt 2012), the EM population had profound traditions in hunting the megafauna on the continental plains, and the social and cultural importance of the reindeer hunting should not be overlooked.

All in all, EM settlements are confined lithic scatters, usually accumulated in one or two clear concentrations, with occasional remains of dwellings and fireplaces (Nærøy 2000, Bjerck 2008, Bang-Andersen 2012). This pattern is documented on many sites in the region, and the Ormen Lange sites are typical in this respect. For the most part, these are lithic scatters that seem to be more or less congruent with tent floors, probably related to small, presumably family-based co-residing groups. Not only do the lithic scatters at Ormen Lange, Site 48 have similar size, they also seem to represent a standard composition of the tools produced and used. It is suggested that extensive use of boats may have evoked this pattern. The people arrived and left by boats that probably accommodated basic social units, as well as a consistent assortment of activities and tasks, tools and equipment that resulted in a certain standardization of the material imprint of the settlements (Bjerck *et al.* 2008). However, there are also good examples of sites that modify the repetitive pattern found on the Ormen Lange settlements, for example some of the sites documented through the Kvernberget and Hestvikholmane excavations. Evidently, the same coastal areas and sites were often visited repeated times. In sum, settlements mirror a high level of residential mobility, probably guided by fluctuations in climate, weather and resource situations, need for materials and maintaining social networks.

The tool tradition relied upon a wide variety of informal tools, hand-held flakes and blades used to cut, scrape and perforate (Callanan 2007). The blade industry was an important part of the lithic tradition, that also (along with flakes) was the basis of a repertoire of formal tools, such as single-edged points, tanged points, microliths, burins, scrapers, flake-adzes and core-adzes. These tool types constitute the distinct typological imprint of the EM Fosna tradition. Flake-adzes and single-edged/tanged points are the most frequently occurring formal tool categories in the region. With very few exceptions, adzes are produced and used on settlements in coastal environments, and are probably one way or another related to marine resources. Butchering of seals and procurement of blubber have been suggested (Havstein 2012). The relative importance of projectiles, on the other hand, seems to increase from coast to mountain. Considering that the mountain settlements, partly due to their environmental context, are understood as special purpose camps where reindeer were hunted, the abundance of projectiles in this zone is hardly surprising. An ongoing study (Breivik and Callanan *in prep*.) that explores the relationship between mountain and coastal sites finds no evidence of any variation in projectiles size and form across the ecozones. Yet, a higher frequency of microliths in the projectile inventories from mountain sites is evident, perhaps denoting the use of different arrow types in this zone. All in all, the lithic inventory must be characterized as general, including a range of tool implements that was suited to meet the various environmental, topographic and climatic conditions found in Norway during the EM.

Conclusions.

The vast archaeological record of central Norway largely builds up under previous notions and theories about EM lifestyles. The large amount of sites recorded and the increasing number of extensive excavations has left us with a very good foundation to conclude upon; yet there is still need for more surveys and excavations in the fjord and mountain zones. Although the settlements in these zones seem to be part of a mobility pattern that was based on the coast, numerous questions could be asked about the relation between these sites and the role they play within this system. Likewise, the well-documented sites, resulting from the last fifteen years of archaeological activity, have the potential to answer complex questions about settlement structure and activity patterns. As we now have quite a few settlements that are considered to be more or less completely excavated, and the data about the depositional patterns, features and artifact inventory of these sites is detailed and widely accessible, there are great opportunities to perform, for example, technological and functional analyses as well as refittings of artifacts –within and across regions. From this we may be able to learn more about social organization, both at group level and in an over-regional context. Finally, there is a need for better dated data. The few radiocarbon datings, together with shore-displacement curves, give us a good indication of the speed and timing of the initial colonization of Norway, but as we are now starting to grasp the details of the climatic fluctuations and environmental changes within the EM timespan, a more precise age determination of archaeological sites would be very welcome.

References.

Alterskjær, K., and Pettersen, K., 1975. Utgravning av steinalderlokalitet på Ulset, Tingvoll, Møre og Romsdal. Report. *Rapport Arkeologisk serie* 1975:1. DKNVS, Unversity of Trondheim.

Andersson, S., *et al.*, 1975. Sorteringsschema för kärn- och skivyxor av flinta. *Antikvarisk arkiv* 58, Kungliga Vitterhets Historie och Antikvitets Akademien. Uddevalla: Bohusläningens AB.

Asprem, F., and Skow, S., 2002. *Arkeologisk rapport fra utgraving 2002*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Bang-Andersen, S., 2012. Colonizing contrasting landscapes. The pioneer coast settlement and inland utilization in southern Norway 10,000–9500 years before present. *Oxford Journal of Archaeology* 31 (2), 103-120.

Bang-Andersen, S. this volume. The first one thousand years: Colonization and differentiated landscape use in southwestern Norway 10,000 to 9000 years BP.

Barlindhaug, S., 1996. *Hvor skal vi bygge og hvor skal vi bo? En analyse av lokaliseringsfaktorer i tidlig steinalder i Troms*. Thesis (Master). University of Tromsø.

Berg-Hansen, I.M., 2009. *Steinalderregistrering. Metodologi og forskningshistorie i Norge 1900-2000 med en feltstudie fra Lista i Vest-Agder*. Varia 75, Museum of Cultural History, University of Oslo.

Berglund, B., ed. 2001. «Gassprosjektet» - Arkeologiske undersøkelser på Tjeldbergodden, Aure kommune, Møre og Romsdal fylke i forbindelse med bygging av metanolanlegg. *Rapport arkeologisk serie*: 2001:1. Trondheim: NTNU University Museum.

Bergsvik, K.A., 1991. Ervervs- og bosetningsmønstre på kysten av Nordhordland i steinalder, belyst ved funn fra Fosnstraumen. Unpublished thesis (Mag. Art.). University of Bergen.

Bergsvik, K.A., 1995. Bosetningsmønstre på kysten av Nord-Hordland i steinalder. En geografisk analyse. *Arkeologiske skrifter* 8, University of Bergen, 111-130.

Bjerck, H.B., 1983. Kronologisk og geografisk fordeling av mesolitiske element i Vest- og Midt-Norge. Unpublished thesis (Mag. Art.). University of Bergen.

Bjerck, H.B., 1989. *Forskningsstyrt kulturminneforvaltning på Vega, Nordland. En studie av steinaldermenneskenes boplassmønstre og arkeologiske letemetoder*. Gunneria 61, Trondheim: NTNU University Museum.

Bjerck, H.B., 2008. Norwegian Mesolithic Trends: A review. *In*: G. Bailey and P. Spikins, eds. *Mesolithic Europe*. Cambridge University Press, 60-106.

Bjerck, H.B., and Callanan, M., 2005. *Brannhaugen.* Unpublished archaeological report. NTNU University Museum, Trondheim.

Bjerck, H.B., ed. 2008. *NTNU Vitenskapsmuseets arkeologiske undersøkelser Ormen Lange Nyhamna*. Trondheim: Tapir Akademisk Forlag.

Brede, A., 2012. *Arkeologisk undersøkelse i forbindelse med utbyggingsplaner for Hestvikholmane industriområde, Averøy kommune, Møre og Romsdal, 2012. Lokalitet 1 og 2*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Breivik, H.M., 2014. Palaeo-oceanographic development and human adaptive strategies in the Pleistocene–Holocene transition: A study from the Norwegian coast. *The Holocene* 24 (II), 1478-1490.

Breivik, H.M., and Ellingsen, E.G., 2014. 'A Discovery of Quite Exceptional Proportions': Controversies in the Wake of Anders Nummedal's Discoveries of Norway's First Inhabitants. *Bulletin of the History of Archaeology* 24:9. DOI: http://dx.doi.org/10.5334/bha.249

Breivik, H.M., and Callanan, M., in prep. Hunting high and low: Post-glacial colonization strategies in Central Norway between 9500-8000 BC.

Bronk Ramsey, C., 2009. Bayesian analysis of radiocarbon dates. *Radiocarbon* 51 (1), 337-360

Callanan, M., 2006. *Reinsvatnet*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Callanan, M., 2007. On the edge – A survey of Early Mesolithic informal tools from central Norway. Unpublished thesis (Master). NTNU University of Trondheim.

Dahl, B., and Bergsvik, T., 2001. *Arkeologisk rapport fra utgraving 2001*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Foosnæs, K., and Stenvik, L.S., 2010. *Vassdragsundersøkelser i Midt-Norge. Historisk oversikt over arkeologiske registreringer og undersøkelser i vassdrag som har blitt utbygd eller vurdert for utbygging av vasskraft*. Trondheim: NTNU. Available at: http://www.riksantikvaren.no/filestore/06-01985-36Historiskoversikt-1354297.pdf

Fretheim, S.E., 2007. *Arkeologisk undersøkelse i forbindelse med regulering av Hestvikholmane industriområde, Averøy kommune, Møre og Romsdal, sommeren 2006. Lokalitet 1 og 2*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Fretheim, S.E., 2008. *Arkeologisk undersøkelse i forbindelse med utviding av Kristiansund lufthavn, Kvernberget. Kristiansund kommune, Møre og Romsdal, 2007. Lokalitet 1*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Fretheim, S.E., *et al.* 2015. Tent, hut or house? A discussion on Early Mesolithic dwellings emanating from the site Mohalsen 2012-II, Vega, Northern Norway. *In this volume*.

Fuglestvedt, I., 1999. The Early Mesolithic site at Stunner, Southeast Norway: A discussion of Late Upper Palaeolithic/Early Mesolithic chronology and cultural relations in Scandinavia. *In*: J. Boaz, ed. The Mesolithic of Central Scandinavia. *Universitetets oldsaksamlings skrifter, Ny rekke* 22, 189-202.

Fuglestvedt, I., 2012. The Palaeolithic Condition on the Scandinavian Peninsula: the last frontier of a 'Palaeolithic way' in Europe. *Norwegian Archaeological Review* 45(1): 1-29.

Gjessing, H., 1945. *Norges steinalder*. Oslo: A.W. Brøggers Boktrykkeri A/S.

Gustafson, L., 1985. *Undersøkelse av steinalderlokalitet 23.-24. juli 1981*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Haug, A., 2003. På sporet av den eldste bosetningen i Kristiansund. *Årbok for Nordmøre 2003*. Kristiansund: Nordmøre Historielag, 8-49.

Havstein, J.A., 2012. Skiveøksene fra Ormen Lange Nyhamna. Morfologi, framstilling og funksjon. Unpublished thesis (Master). NTNU University of Trondheim.

Helskog, K., Indrelid, S., and Mikkelsen, E., 1976. Morfologisk klassifisering av slåtte steinartefakter. *Universitetets Oldsaksamling Årbok* 1972-1974, 9-40.

Indrelid, S., 2009. *Arkeologiske undersøkelser i vassdrag: faglig program for Sør-Norge*. Oslo: Riksantikvaren.

Johansen, K., 1990. En teknologisk og kronologisk analyse av tidligmesolittiske steinartefakter. Unpublished thesis (Cand. Mag.). University of Oslo.

Johansen, K., 1991. *Utgravning på Tøvikmyra, Averøy kommune, Møre og Romsdal, juli-august 1991*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Kalseth, J., in prep. *Arkeologisk utgravning av Lokalitet 1, Vikansvingen, Hitra, Sør-Trøndelag*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Kalseth, J., and Callanan, M., 2003. *Arkeologisk rapport fra utgraving 2003*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Kutschera, M., 1999. Vestnorsk tidligmesolitikum i et nordvesteuropeisk perspektiv. In: I. Fuglestvedt, T. Gansum, and A. Opedal, eds. Et hus med mange rom. Vennebok til Bjørn

Myhre på 60-årsdagen. *Ams-Rapport* 11A, Museum of Archaeology, University of Stavanger, 43-52.

Lindblom, I., 1984. Former for økologisk tilpasning i Mesolitikum. *Universitetets Oldsaksamling Årbok*, (1982/1983), 43-86.

Møllenhus, K.R., 1977. *Mesolitiske boplasser på Møre- og Trøndelagskysten*. Trondheim: Det Kongelige Norske Videnskabers Selskap.

Narmo, L.E., 1993. Steinalder på Romsdalskysten. *Årbok, Romsdalsmuseet, fiskerimuseet på Hjertøya*, 9-34.

Nummedal, A.J., 1914. Et bosted fra den yngre stenalder i «Allanenget» i Kristiansund. *Oldtiden,* IV, 9-23.

Nummedal, A.J., 1924. Om flintpladsene. *Norsk geologisk tidsskrift* VII (2), 89-141.

Nummedal, A.J., 1933. Kan det finnes flintplasser på kyststrekningen mellom Kristiansand og Ålesund? *Naturen* 1933, 227-244.

Nærøy, A. J., 2000. *Stone Age Living Spaces in Western Norway*. Oxford: BAR International Series 857.

Odgaard, U., 2003. Hearth and home of the Palaeo-Eskimos. *Études/Inuit/Studies* 27 (1-2), 349-374.

Odner, K., 1964. Erhverv og bosetning i Komsakulturen. *Viking* 28, 117-128.

Pettersen, K., 1975: Utgravning av steinalderlokaliteter på Stabblandet, Tustna, Møre og Romsdal. Report. *Rapport Arkeologisk serie* 1975:1. DKNVS, University of Trondheim.

Pettersen, K., 1994. *Registrering av steinalderlokaliteter i Bremsnes-området, Averøy, 1984*. Unpublished archaeological report. Sør-Trøndelag fylkeskommune.

Pettersen, K., 1995. *Rapport om arkeologiske testgravinger, Bremsens, Averøy 1985*. Unpublished archaeological report. Sør-Trøndelag fylkeskommune.

Pettersen, K., and Scheen, R., 1985. *Uransbrekka. Et mesolittisk fangststed*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Rygh, K., 1911. Oldsagsamlingens tilvækst i 1910. *DKNVS Skrifter* nr. 10.

Sandmo. A.K., 1986. Råstoff og redskap – mer enn teknisk hjelpemiddel: Om symbolfunksjoner som et aspekt ved materiell kultur; skisse av etableringsforløpet i en nordeuropeisk kystsone 10.000–9.000 BP. Unpublished thesis (Mag. Art.). University of Tromsø.

Sauvage, R., 2007a. *Arkeologiske undersøkelser. Hestvikholmane industriområde Lok 4 og 5, boplass fra eldre steinalder*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Sauvage, R., 2007b. *Arkeologiske undersøkelser. Hestvikholmane industriområde Lok 6, boplass fra eldre steinalder*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Sauvage, R., 2007c. *Arkeologisk undersøkelse i forbindelse med reguleringsplan for Kvennbergmyran, Kristiansund kommune, Møre og Romsdal, 2007. Lokalitet 1*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Shetelig, H., 1922. *Primitive tider i Norge: En oversigt over stenalderen*. Bergen: John Griegs Forlag.

Sjøstrand, O., Eikje, L.L., and Myrholt, E., 2004. *Arkeologisk rapport fra utgraving 2004*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Sjøvold, T., 1970. *Arkeologisk registrering ved Grytten kraftanlegg, Rauma kommune*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Strøm, I.O., and Breivik, H.M., 2008. *Arkeologiske undersøkelser. Reguleringsplan Kvernberget lufthavn. Lokalitet 20. Aktivitetsområde fra eldre steinalder*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Svendsen, F., 2007. Lokaliteter og landskap i tidlig mesolittisk tid. En geografisk analyse fra Nordvest-Norge. Unpublished thesis (Master). NTNU University of Trondheim.

Svendsen, F., 2008. *Arkeologiske undersøkelser. Reguleringsplan Kvernberget Lufthavn. Lok 24, boplass fra Tidlig Mesolittisk tid*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Svendsen, F., 2009. *Arkeologiske undersøkelser i forbindelse med utvidelse av Leka Vannverk mot Engan og Vågan over Vassdalen og Brekka. Lokalitet 1, boplass- og aktivitetsområde fra Tidlig Mesolittisk tid*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Svendsen, J.I., and Mangerud, J., 1987. Late Weichselian and Holocene sea-level history for a cross-section of Western Norway. *Journal of Quaternary Science* 1987 (2), 113-132.

Wammer, E.U., 2006. *Arkeologiske undersøkelser av lokalitet 3 i forbindelse med utvidelse av Hestvikholmane industriområde på Averøya, sommeren 2006*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Waraas, T.A., 2001. Vestlandet i tidleg Preboreal tid. Fosna, Ahrensburg eller vestnorsk tidlegmesolitikum? Unpublished thesis (Master). University of Bergen.

Ødegaard, Ø., 2001. *Arkeologiske undersøkelser av steinalderlokalitetene R2 og R3 i forbindelse med omregulering til industriområde Orvikan-Øygarden, Kristiansund kommune, Møre og Romsdal*. Unpublished archaeological report. NTNU University Museum, Trondheim.

Årskog, H.B., 2009. *Steinalderlokaliteter i tid og rom. en undersøkelsevbasert på Ormen Lange-registreringene på Nordvestlandet*. Thesis (Master). University of Oslo. Available at:

https://www.duo.uio.no/bitstream/handle/10852/23213/Steinalderlokaliteterxixtidxogxrom.pdf?sequence=1

Åstveit, L.I., 2009. Different ways of building, different ways of living: Mesolithic house structures in western Norway. *In*: S. McCartan, R. Schulting, G. Warren and P. Woodman, eds. *Mesolithic Horizons*, Papers presented at the Seventh International Conference on the Mesolithic in Europe, Belfast 2005. Oxford: Oxbow Books, 412-419.

Figure captions.

Fig. 1: Map of central Norway with place names and sites mentioned in the text.

Fig. 2: Sea-level dated sites in central Norway, based on the assumption that the sites were shore-bound and positioned near the contemporaneous water margin.

Fig. 3: Distribution of sites in central Norway, with zones A-D marked. 87 % of the sites are situated in the outer archipelago Zone A) and 8 % are positioned around fjord heads or channels (Zone B). Only 2 % of the sites are found in the inner fjord areas, and 3 % in mountain context.

Fig. 4: Illustration of fireplace and tent-ring recovered on Ormen Lange Site 48, Unit G (Bjerck *et al*. 2008, p. 243, Figure 3.250).

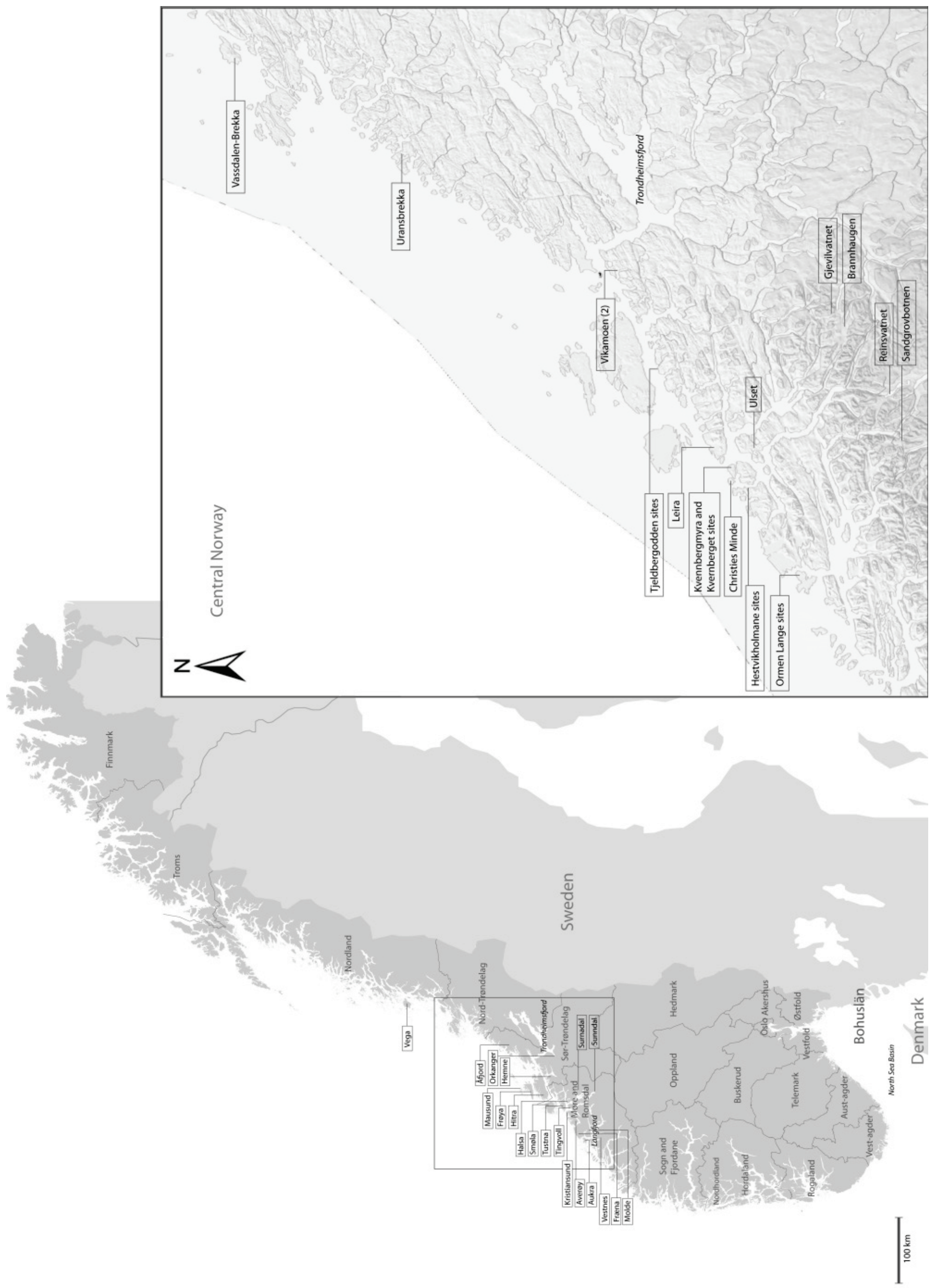
Fig. 5: Representative selection of flake-adzes and single-edged/tanged points from Ormen Lange Site 48 (Bjerck *et al*. 2008, p. 225-226, Figures 3.220 and 3.222).

Fig. 6: Distribution of tool categories across the landscape. Adzes are almost exclusively found on the coast, while the relative importance of projectiles seem to increase towards the inner coastal areas and mountain zone.

Table captions.

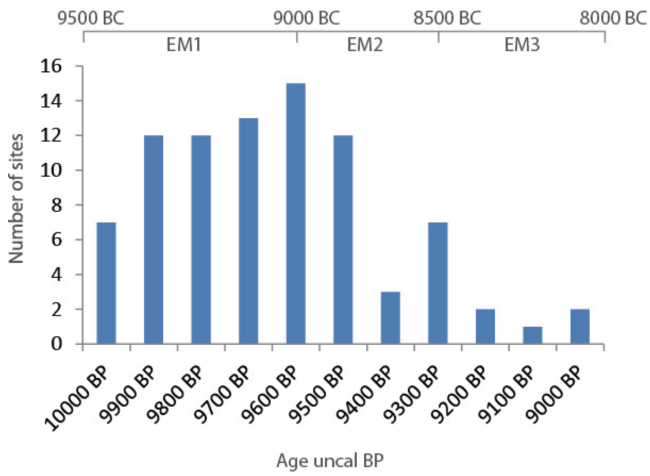
Table 1: List of dated EM sites. All datings are calibrated with OxCal version 4.2, calibration curve IntCal 13 (Bronk Ramsey 2009).

Table 2: List of excavated sites in central Norway with information on features and datings. The isobase values for the sites were retrieved from Svendsen and Mangerud's map (Svendsen and Mangerud 1987:115, Figure 2). Shore-displacement curves were then calculated by using a program designed by David Simpson (SeaLevelCurveSunm-STrondelag_v2.xls, 2003).



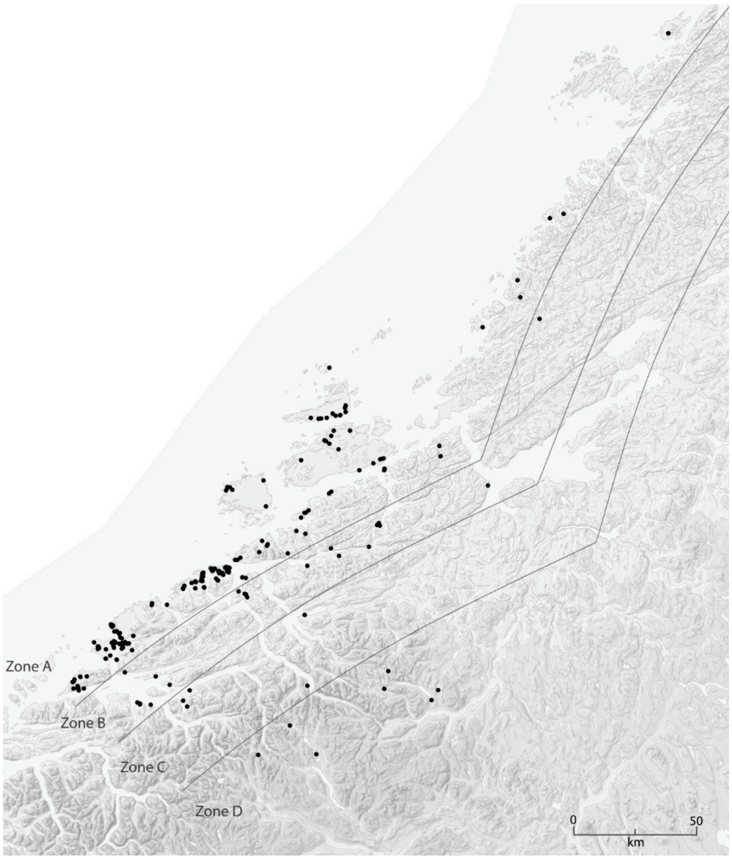
Central Norway
Vassdalen-Brekka
Uransbrekka
Trondheimsfjord
Vikamoen (2)
Ulset
Gjevilvatnet
Brannhaugen
Reinsvatnet
Sandgrovbotnen
Tjeldbergodden sites
Leira
Kvennbergmyra and Kvennberget sites
Christies Minde
Hestvikholmane sites
Ormen Lange sites
N
Finnmark
Troms
Nordland
Sweden
Nord-Trøndelag
Sør-Trøndelag
Møre and Romsdal
Hedmark
Oppland
Buskerud
Telemark
Oslo Akershus
Østfold
Vestfold
Aust-agder
Vest-agder
Rogaland
Hordaland
Nordhordland
Sogn and Fjordane
Bohuslän
Denmark
North Sea Basin
Vega
Åfjord
Orkanger
Hemne
Mausund
Frøya
Hitra
Halsa
Smøla
Tustna
Tingvoll
Surnadal
Sunndal
Kristiansund
Averøy
Aukra
Vestnes
Fræna
Molde
100 km

Fig.1



9500 BC
9000 BC
8500 BC
8000 BC
EM1
EM2
EM3
Number of sites
16
14
12
10
8
6
4
2
0
10000 BP
9900 BP
9800 BP
9700 BP
9600 BP
9500 BP
9400 BP
9300 BP
9200 BP
9100 BP
9000 BP
Age uncal BP

Fig.2



Zone A
Zone B
Zone C
Zone D
0
50
km

Fig. 3

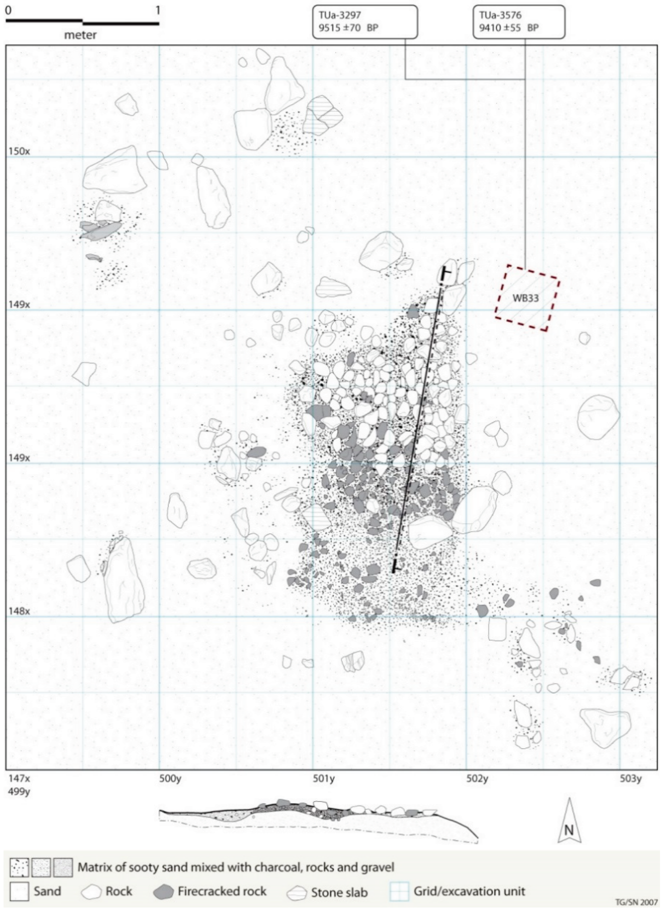

0
1
meter
TUa-3297
9515 ±70 BP
TUa-3576
9410 ±55 BP
150x
149x
WB33
149x
148x
147x
499y
500y
501y
502y
503y
N
Matrix of sooty sand mixed with charcoal, rocks and gravel
Sand
Rock
Firecracked rock
Stone slab
Grid/excavation unit
TG/SN 2007

Fig.4

Fig.5

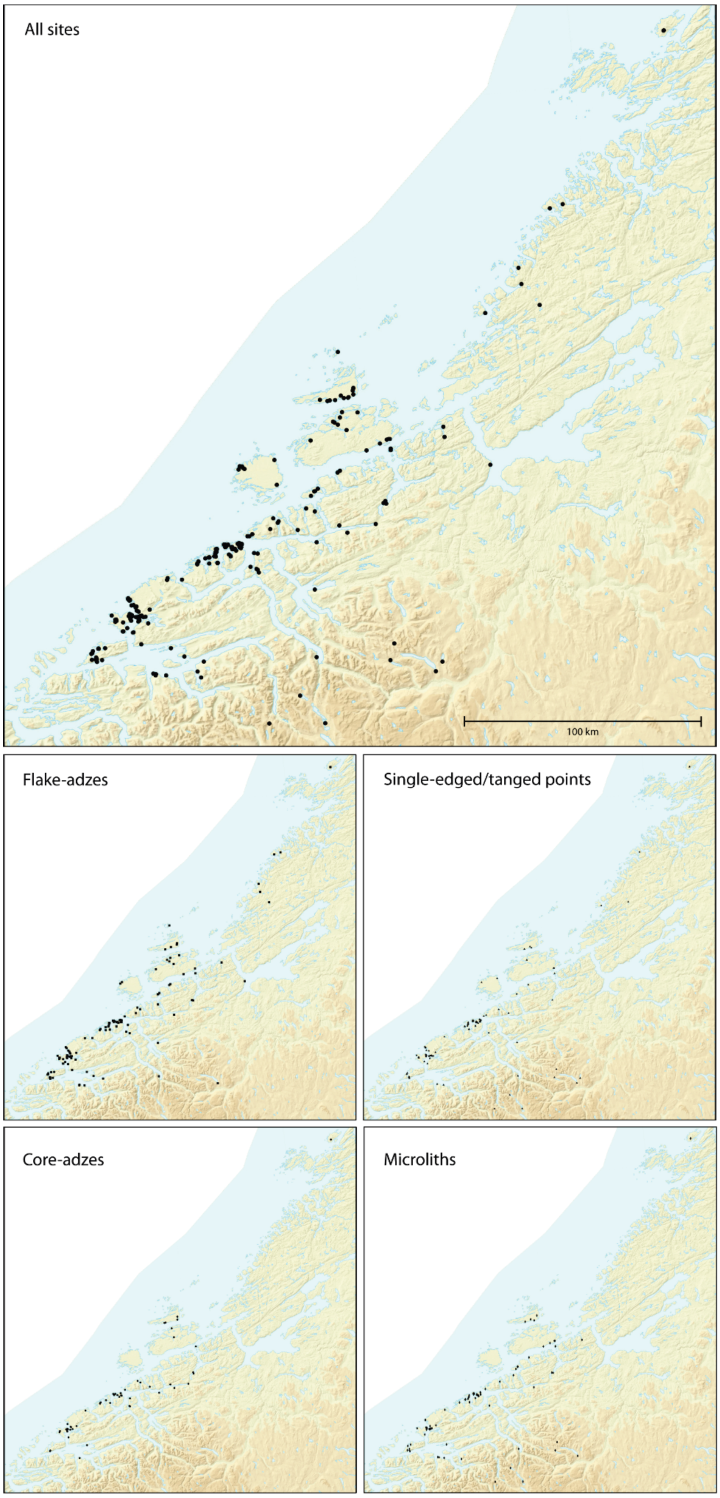

All sites
100 km
Flake-adzes
Single-edged/tanged points
Core-adzes
Microliths

Fig.6

Site name	Material	BP	Cal. BC, 2 sigma	Lab.no
Kvennbergmyra	Birch (*Betula*)	9395±50	8795-8555	TUa-6947
Kvennbergmyra	Birch (*Betula*)	9320±55	8740-8350	TUa-6948
Kvernberget Site 1	Birch (*Betula*)	9220±55	8596-8297	TUa-7147
Ormen Lange Site 48, Unit C	Birch (*Betula*)	9475±150	9251-8352	T-17183
Ormen Lange Site 48, Unit E	Birch (*Betula*)	9075±50	8432-8224	T-17185
Ormen Lange Site 48, Unit E	Birch (*Betula*)	9660±70	9260-8824	TUa-4605
Ormen Lange Site 48, Unit F	Birch (*Betula*), Pine (*Pinus*)	9135±135	8722-7964	T-16604
Ormen Lange Site 48, Unit F	Birch (*Betula*)	9460±60	9125-8606	TUa-4550
Ormen Lange Site 48, Unit F	Birch (*Betula*)	9520±150	9276-8472	T-16975
Ormen Lange Site 48, Unit G		9410±55	9101-8495	TUa-3576
Ormen Lange Site 48, Unit G	Birch (*Betula*)	9515±70	9155-8639	TUa-3297
Ormen Lange Site 48, Unit I	Birch (*Betula*)	9445±130	9221-8353	T-16928
Ormen Lange Site 48, Unit J	Birch (*Betula*)	9480±125	9233-8479	T-17186
Ormen Lange Site 48, Unit K	Birch (*Betula*)	9145±150	8791-7882	T-16929
Ormen Lange Site 48, Unit M	Birch (*Betula*)	9620±70	9239-8798	TUa-4549
Ormen Lange Site 48, Unit M	Birch (*Betula*)	9695±95	9301-8797	T-16973
Ormen Lange Site 48, Unit N	Birch (*Betula*)	9415±70	9120-8481	TUa-4787
Ormen Lange Site 48, Unit N	Birch (*Betula*)	9390±95	9122-8347	T-16974
Ormen Lange Site 48, Unit O	Birch (*Betula*)	9335±105	9115-8295	T-16930
Ormen Lange Site 48, Unit Q	Birch (*Betula*), Bird cherry (*Prunus*), Rowan (*Sorbus*), Pine (*Pinus*)	9310±50	8713-8349	T-17184
Ormen Lange Site 72, Unit X	Birch (*Betula*), Hazel (*Corylus*), Pine (*Pinus*)	9485±110	9221-8553	T-17001
Ormen Lange Site 72, Unit Y	Birch (*Betula*), Hazel (*Corylus*)	9380±70	9110-8354	TUa-4589
Ormen Lange Site 72, Unit Y	Birch (*Betula*), Hazel (*Corylus*), Pine (*Pinus*)	9480±125	9233-8479	T-17002
Ormen Lange Site 76	Birch (*Betula*), Willow (*Salix*), Aspen (*Populus*)	9440±70	9154-8555	TUa-4429
Ormen Lange Site 76	Willow (*Salix*), Aspen (*Populus*)	9155±65	9551-8270	TUa-4428
Ormen Lange Site 76b	Birch (*Betula*)	9415±65	9117-8487	TUa-4851
Reinsvatnet R1	Birch (*Betula*)	9495±65	9140-8631	TUa-6248

Table 1

Site information	**Features and dating**
Allanenget I, II, VI Kristiansund, Møre og Romsdal Excavated 1913-14, 1917, 1921 (Nummedal 1914) Excavated area: n/a Estimated site size: 75 x 30 m Number of artifacts: Over 2000 M asl: 27-30	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age**: 9600-9700 (shore-displacement curve, isobase 45, 27-30 m asl.).
Allanenget III, IV Kristiansund, Møre og Romsdal Excavated 1914, 1915, 1917 (Nummedal 1914) Excavated area: n/a Estimated site size: 25 x 10 m Number of artifacts: at least 13,000 M asl: 20-21	**Dwelling structures**: - **Fireplaces**:2 *Fireplace 1*: Circular, 1.6 m in diameter, collection of c. 200 medium-sized, firecracked stones. Ash and charcoal scattered between the stones. A pit filled with charcoal and ash, measuring up to 50 cm in diameter and 15 cm in thickness, was revealed centrally in the stone packing *Fireplace 2:* A square area, c. 1 m^2, covered with large stones and a layer of ash and charcoal similar to Fireplace 1. Situated next to a large slab stone. Both fireplaces were located centrally within a lithic concentration. **Radiocarbon dating: -** **Probable age:** 9300 BP (shore-displacement curve, isobase 45, 20-21 m asl.).
Brannhaugen Oppdal, Sør-Trøndelag Excavated 2001 (Bjerck and Callanan 2005) Excavated area: 8.25 m^2 (manually) Estimated site size: 10-18 m^2 Number of artifacts: 918 M asl: 650	**Dwelling structures**: - **Fireplaces:** 1 *Fireplace*: Stone packing with charcoal found on survey in 1995. (Charcoal of pine (*pinus*), possibly of younger age than the settlement) **Radiocarbon dating: -** **Probable age:** 10,000-9000 BP (dated typologically).
Brunsvika, Sommerfjøsdalen, Kristiansund, Møre og Romsdal Excavated 1910 (Rygh 1911) Excavated area: 3 x 4 m (manually) Estimated site size: n/a Number of artifacts: c. 600 M asl: c. 20	**Dwelling structures: -** **Fireplaces:** (1) *Possible fireplace*: A thin layer (c. 1 m in diameter) of decomposed charcoal found between some of the larger rocks. Only small stones of which none were firecracked. **Radiocarbon dating**: - **Probable age**: 9300 BP (shore-displacement curve, isobase 45, 20 m asl.).
Bytningsvik Aukra, Møre og Romsdal Excavated 1920, 1921, 1931, 1937 Excavated area: n/a Estimated site size: c. 5 m^2 Number of artifacts: c. 1000 M asl: 15-17; 24	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9900 BP (shore-displacement curve, isobase 22, 15 m asl.; 24 m asl. is probably too high as it generates a date of 10,500 BP).
Christies Minde Kristiansund, Møre og Romsdal Excavated 1909-13 (Rygh 1911) Excavated area: n/a Estimated site size: n/a Number of artifacts: c. 900 M asl: 44	**Dwelling structures: -** **Fireplaces:** (1) *Possible fireplace*: Collection of burnt stones and charcoal found in disorder, not *in situ*. **Radiocarbon dating**: - **Probable age**: 10,300 BP (shore-displacement curve, isobase 45, 44 m asl.).
Dunkersundet Kristiansund, Møre og Romsdal Excavated 1918, 1919 Excavated area: n/a Estimated site size: n/a Number of artifacts: Over 1500 M asl: c. 18-20	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9300-9400 BP (shore-displacement curve, isobase 45, 18 m asl.).

E-R5, Vollen Snillfjord, Sør-Trøndelag Excavated 2000-2004 (Dahl and Bergsvik 2001; Asprem and Skow 2002; Kalset and Callanan 2003; Sjøstrand *et al*. 2004) Excavated area: 33 m² (manually) Estimated site size: c. 100 m² Number of artifacts: 10,752 M asl: 65-70	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9600-9800 BP (shore-displacement curve, isobase 90, 65-70 m asl.).
Geitvika III Midsund, Møre og Romsdal Excavated 1956 (Møllenhus 1977) Excavated area: 72 m² (manually) Estimated site size: n/a Number of artifacts: Over 1000 M asl: 17-21	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9900-10,100 BP (shore-displacement curve, isobase 25, 17-21 m asl.).
Gjermundnes, Leikarnes (Legernes) Vestnes, Møre og Romsdal Excavated 1924 Excavated area: n/a Estimated site size: n/a Number of artifacts: c. 250 M asl: 45	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9800 BP (shore-displacement curve, isobase 60, 45 m asl.).
Gjermundnes, Saltkjelviken Vestnes, Møre og Romsdal Excavated 1924 Excavated area: n/a Estimated site size: n/a Number of artifacts: c. 250 M asl: 30	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9300 BP (shore-displacement curve, isobase 60, 30 m asl.).
Golma Aure, Møre og Romsdal Excavated 1910, 1914 (Rygh 1911) Excavated area: n/a Estimated site size: n/a Number of artifacts: over 1100 M asl: c. 30	**Dwelling structures:** - **Fireplaces:** (1) Possible fireplace: A horse-shoe-shaped (c. 1 m in diameter) collection of large stones, surrounded by charcoal. **Radiocarbon dating**: - **Probable age**: 9500 BP (shore-displacement curve, isobase 55, 30 m asl.).
Grønbukt/Løken (R12-84) Averøy, Møre og Romsdal Excavated 1984, 1986 (Pettersen 1994) Excavated area: n/a Estimated site size: 12 x 20 m Number of artifacts: 30 M asl: 30-35	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9700-9900 BP (shore-displacement curve, isobase 45, 30-35 m asl.).
Gråmyra Midsund, Møre og Romsdal Excavated 1963 (Møllenhus 1977) Excavated area: 111 m² (manually) Estimated site size: Number of artifacts: c. 2700 M asl: 14-20	**Dwelling structures:** - **Fireplaces:** 2 (both radiocarbon dated to the Pre-Roman Age) *Fireplace 1*: A ring (0.5 m in diameter) of medium-sized rocks surrounding carboniferous sediments. *Fireplace 2*: Circular concentration (0.5 m in diameter) of medium-sized stones, resting on a foundation of smaller pebbles. The fireplace contained a few flint artifacts. **Radiocarbon dating**: - **Probable age**: 9600-9800 BP (shore-displacement curve, isobase 30, 14-20 m asl.).

Hestvikholmane, Site 1 and 2 Averøy, Møre og Romsdal Excavated 2006 (Fretheim 2007) Excavated area: 715 m² (unearthed)	**Dwelling structures:** 1-2 **Fireplaces:** 2 **Radiocarbon datings**: -
Site 1 Estimated site size: n/a Number of artifacts: 11,837 M asl: 30-33	**Dwelling structures:** (1) *Possible tent floor (S14)*: An oblong area (4 x 3 m) covered by small stones measuring 5-10 cm. The area was the most even and dry spot on the site, the stones may have been deposited with this function in mind. Few artifacts were found within the floor area, but flint was deposited around on the outside. The structure was particularly dense within an area of 2 x 2 m. **Fireplaces:** 1 *Fireplace (S12)*: Concentration (0.9 x 0.45 m) of stones measuring 5-17 cm in size. Some of the stones were firecracked. The charcoal was mainly found between the stones. Some charcoal was found underneath the stone concentration in one half of the structure. Red ochre was also found here. Otherwise no pronounced charcoal layer under the stone concentration. Situated near the possible tent floor (S14). **Radiocarbon dating: -** **Probable age**: 9700-9800 BP (shore-displacement curve, isobase 47, 30-33 m asl.).
Site 2 Estimated site size: 10 m² Number of artifacts: 1665 M asl: c. 30	**Dwelling structures:** 1 *Tentring (S10)*: A circle (c. 3 m in diameter) of c. 40 stones measuring 10-60 cm. The inside was partly cleared of stones, and contained a high density of artifacts. The fireplace (S11) was situated on the inside, close to the tent stones. **Fireplaces:** 1 *Fireplace (S11)*: A concentration of charcoal, firecracked stones and flint artifacts. **Radiocarbon dating: -** **Probable age**: 9700 BP (shore-displacement curve, isobase 47, 30 m asl.).
Hestvikholmane, Site 3 Averøy, Møre og Romsdal Excavated 2006 (Wammer 2006) Excavated area: n/a Estimated site size: n/a Number of artifacts: 3956 M asl: 31-33	**Dwelling structures:** 1-2 *Tentring (Feature I)*: A more or less circular stone setting (3 m in diameter) of twelve stones measuring up to 50 cm in size. Most of the artifacts are found within the structure. The living space contained a fireplace (Feature VIII). *Possible tentring (Feature III)*: A ring (2-3 m in diameter) of c. 10 stones measuring up to 50-60 cm in size. No artifacts and no fireplaces found in connection with the structure. **Fireplaces**: (1) *Possible fireplace (Feature VIII)*: A concentration of charcoal (0.5 m in diameter) positioned centrally within Feature I. The feature reached a depth of 1-1.5 cm and was surrounded by eroded rocks. **Radiocarbon dating: -** **Probable age**: 9700 BP (shore-displacement curve, isobase 47, 31-33 m asl.).
Hestvikholmane, Site 4/5 Averøy, Møre og Romsdal Excavated 2006 (Sauvage 2007a) Excavated area: 715 m² (unearthed), 52 m² (manually excavated) Estimated site size: n/a Number of artifacts: 3829 M asl: 32-33	**Dwelling structures**: - **Fireplaces**: 2-3 *Fireplace (S15)*: An area (0.35-0.45 m) of turfy sand with scattered pieces of charcoal, surrounded by a concentration of medium-sized stones. The layer was c. 2 cm thick. Burnt flint artifacts were found nearby. *Possible fireplace (S16)*: An area (0.2-0.3 m) with a thin layer of dark brown sandy soil with specks of soot and charcoal, as well as medium-sized stones. The layer was 2-3 cm thick. Burnt flint artifacts were found in connection with the structure *Possible fireplace*: Stones, charcoal and burnt flint artifacts, dispersed within the excavation unit. **Radiocarbon dating: -** **Probable age**: 9800 BP (shore-displacement curve, isobase 47, 32-33 m asl.).
Hestvikholmane, Site 6 Averøy, Møre og Romsdal Excavated 2006 (Sauvage 2007b) Excavated area: 81 m² (unearthed), 26 m² (manually excavated) Estimated site size: n/a Number of artifacts: 248 M asl: 28	**Dwelling structures**: 1 *Cleared area*: Circular area (c. 2 m in diameter) partly cleared of rocks, interpreted as tent floor. The extension of the floor coincided with the lithic distribution. A fireplace (#7) was situated away from the lithic concentration. **Fireplaces**: 1 *Fireplace (#7)*: A collection of stones (c. 0.3-0.4 m in diameter) and charcoal with unclear outline. The charcoal was found in a layer of 7-9 cm in thickness. The rocks seemed burnt/eroded. **Radiocarbon dating: -** **Probable age**: 9600 BP (shore-displacement curve, isobase 47, 28 m asl.).

Hestvikholmane, Site 2-2012 Averøy, Møre og Romsdal Excavated 2012 (Brede 2012) Excavated area: 651.4 m² (unearthed), 36,5 m² (manually excavated) Estimated site size: c. 45 m² Number of artifacts: 3568 M asl: 39-40	**Dwelling structures:** 1 *Cleared area*: A circular area (c. 2 m in diameter) cleared of stones and with clearly different sediments than the surrounding was interpreted as traces of dwelling structure. The dwelling floor also contained a very high density of artifacts. Possible traces of two fireplaces were found near the dwelling. **Fireplaces**: (2) *Two possible fireplaces*: Recognized by concentrations of firecracked artifacts only. **Radiocarbon dating: -** **Probable age**: 9900-10,000 BP (shore-displacement curve, isobase 47, 39-40 m asl.).
Kjørsvik (1) Fræna, Møre og Romsdal Excavated 1917 Excavated area: n/a Estimated site size: 40 x 35 m Number of artifacts: c. 400 M asl: 14,5-22	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9600-9900 BP (shore-displacement curve, isobase 30, 14.5-22 m asl.).
Korsvika II Midsund, Møre og Romsdal Excavated 1929, 1939, 1955, 1962 (Møllenhus 1977) Excavated area: 45 m² Estimated site size: n/a Number of artifacts: Over 1200 M asl: 23,5-27,5	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 10,000-10,200 BP (shore-displacement curve, isobase 30, 23.5-27.5 m asl.).
Kvennbergmyra Kristiansund, Møre og Romsdal Excavated 2007 (Sauvage 2007c) Excavated area: 413 m² (unearthed), 17 m² (manually excavated) Estimated site size: 10-15 m² Number of artifacts: 327 M asl: 30	**Dwelling structures**: - **Fireplaces**: 1 *Fireplace (K1)*: An oval concentration (c. 0.55 x 0.8 m) of firecracked, flat stones (10-20 cm) and fine-grained sand with a high density of charcoal. The fireplace was associated with an artifact concentration of 3-4 m in diameter. **Radiocarbon dating:** 9395±50 BP (TUa-6947) (K1); 9320±55 BP (TUa-6948) (K1) **Probable age**: 9300-9400 BP
Kvernberget Site 1 Kristiansund, Møre og Romsdal Excavated 2007 (Fretheim 2008) Excavated area: 1468 m² (unearthed), 363 m² (manually excavated) Estimated site size: c. 500 m² Number of artifacts: 15,428 M asl: 35,5-41	**Dwelling structures**: 1-2 *House structure* (S14): A rounded/oblong structure (3 x 3.5 m) distinguished by a "cultural layer" containing decomposed organic material and eroded pebbles. The artifact distribution coincided with the extension of the dwelling floor. What was interpreted as the wall was in some places seen as a darker shade in the soil. *Possible living space/tent floor*: A circular artifact concentration (4 m in diameter) may be the indirect traces of a light dwelling structure. The fireplace S8 was situated amidst the concentration. **Fireplaces**: 3-6 *Fireplace (S2)*: Concentration (c. 0.65 m in diameter) of stones measuring under 10 cm in size, many of them firecracked. The sandfill held several thin layers of charcoal. A more substantial layer of soot and charcoal, 3 cm thick, was found in the bottom. The layer rested on small eroded stones. The fireplace was situated nearby the wall of S14. Probably used multiple times. *Fireplace (S3)*: A concentration (0.9 x 0.7 m) of small stones (5-10 cm), many of them eroded/firecracked, within a dark, sooty layer with organic contents measuring 10 cm in thickness. Some pieces of charcoal were found between the stones. Surrounded by c. eight larger stones (20-30 cm) and partly placed directly on bedrock. Situated right outside the floor of S14, and interpreted as contemporaneous with the dwelling. *Fireplace (S8)*: A layer of charcoal/sooty sediments (c. 0.7 x 1.4 m), 1-4 cm thick, with irregular shape, found between several larger rocks (75 cm at the most). Seemingly placed directly on the ground. Situated nearby an artifact concentration interpreted as a possible living space/tent floor. *Three possible fireplaces (S4, S9, S10)*. *S4* was a 0.7 x 0.45 m area of sooty sand with pieces of charcoal and small to medium-sized stones, of which some were firecracked. *S9* appeared as a 0.9 x 0.4 m concentration of dark, sooty sand. S 10: an oval concentration (0.85 x 0.35 m) of stones and some charcoal. **Radiocarbon dating:** 9220±55 BP (TUa-7147) (S2) **Probable age**: 9600-9700 BP, the upper parts of the site may have been in use even earlier

Kvernberget, Site 20 Kristiansund, Møre og Romsdal Excavated 2007 (Strøm and Breivik 2008) Excavated area: 24.75 m² (manually) Estimated site size: n/a Number of artifacts: 753 M asl: 40-45	**Dwelling structures**: 1 *Tentring (Feature 3)*: The feature appeared as a semi-circle (c. 2 m in diameter) of six stones, 20-30 cm in size. Three additional stones of the same size found nearby, were potentially part of the structure. **Fireplaces**: 1 *Fireplace (Feature 1)*: Circular fireplace (1.10 m in diameter at the most) distinguished by specks of charcoal and soot in grey silty sand, 4-6 cm thick. Firecracked stones of 3-5 cm were observed within the structure. 4-5 stones surrounded the fireplace. Found near the tent stones, within the tentring (Feature 3). **Radiocarbon datings:** - **Probable age**: 9800-10,000 BP (shore-displacement curve, isobase 52, 40-45 m asl.).
Kvernberget, Site 24 Kristiansund, Møre og Romsdal Excavated 2007 (Svendsen 2008) Excavated area: 3 m² (manually) Estimated site size: 857 m² Number of artifacts: 4340 M asl: 42	**Dwelling structures:** - **Fireplaces**: 1 *Fireplace (Feature 1)*: Concentration of stones of medium and large size, of which several were firecracked. Insignificant amounts of charcoal. Marked decrease in artifact density towards the center of the structure. **Radiocarbon datings:** - **Probable age**: 9800 BP (shore-displacement curve, isobase 52, 42 m asl.).
Leithegården 2 Kristiansund, Møre og Romsdal Excavated 2001 (Ødegaard 2001; Haug 2003) Excavated area: 23 m² (manually) Estimated site size: n/a Number of artifacts: 638 M asl: 35,5	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon datings:** - **Probable age:** 9700 BP (shore-displacement curve, isobase 50, 35,5 m asl.).
Ormen Lange Lokalitet 31 Aukra, Møre og Romsdal Excavated 2003-2004 (Bjerck *et al*. 2008) Excavated area: 100 m² (unearthed), 78 m² (manually excavated) Estimated site size: 110-200 m² Number of artifacts: 1955 M asl: 14	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9500 BP (shore-displacement curve, isobase 30, 14 m asl.).
Ormen Lange, Site 48, Units A-R Aukra, Møre og Romsdal Excavated 2003-2004 (Bjerck *et al*. 2008) Excavated area: 1962 m² (unearthed), 572 m² (manually excavated) M asl: 19-21	**Dwelling structures**: 2-6 **Fireplaces**:13-23 **Radiocarbon datings**: 17 **Probable age:** 9400-9600 BP
Unit A Estimated unit size: 20 m² Number of artifacts: 11,020	**Dwelling structures**: - **Fireplaces:** (2) *Possible traces of two fireplaces*: Two concentration of burnt flint artifacts **Radiocarbon dating:** - **Probable age:** 9400-9600 BP
Unit B Estimated unit size: 25 m² Number of artifacts: 8653	**Dwelling structures**: - **Fireplaces:** (2) *Possible traces of two fireplaces*: Two concentrations of burnt flint artifacts – one of them very marked and quite likely traces of a fireplace. **Radiocarbon dating:** - **Probable age:** 9400-9600 BP
Unit C Estimated unit size: 25 m² Number of artifacts: 7626	**Dwelling structures**: - **Fireplaces:** 1 *Fireplace (S5)*: Figure-eight-shaped feature (1.7 x 0.6 m). Brown sand with pockets of gravel and a concentration of small and larger stones (2-5 / 8-12 cm in size). Mixed with charcoal/sooty sediments. Two pits were visible in section. Situated within the largest concentration of artifacts. Probably used twice. **Radiocarbon dating:** 9475±150 BP (T-17183) (S5) **Probable age:** 9400-9600 BP

Unit D Estimated unit size: 25 m^2 Number of artifacts: 6455	**Dwelling structures**: - **Fireplaces:** 1 *Fireplace (S4)*: Oval shape (0.3 x 0.6 m). Brown sand and sooty sediments with pieces of charcoal, sorted stones of medium size – burnt, but not firecracked. Placed between a loose ring of earthfast stones. The density of artifacts was highest around these stones. Placed directly on the surface. **Radiocarbon dating:** - **Probable age:** 9400-9600 BP
Unit E Estimated unit size: 25 m^2 Number of artifacts: 5400	**Dwelling structures**: - **Fireplaces:** 1-2 *Fireplace (S3)*: Rounded structure (c. 1 m in diameter) filled with brown sand, charcoal/sooty sediments and medium-sized rocks. No large pieces of charcoal. Centrally placed within the artifact concentration. A depression filled with charcoal/sooty sediments appeared under the stones. The structure was probably used several times. *Possible traces of a fireplace*: A concentration of burnt artifacts 1 m south of the main concentration may denote a second fireplace. **Radiocarbon datings:** 9075±50 BP (T-17185) (S3); 9660±70 BP (TUa-4605) (S3). The oldest date interpreted as the most reliable. **Probable age:** 9400-9600 BP
Unit F Estimated unit size: 27 m^2 Number of artifacts: 2887	**Dwelling structures**: - **Fireplaces:** 1 *Fireplace (S2)*: Circular. Sorted stones of medium-size, in a matrix of brown, sand with charcoal/soot, gravel and pebbles. Half of the stones were burnt – some of the firecracked. Deposited directly on the surface. Placed centrally within the lithic concentration. **Radiocarbon datings:** 9135±135 BP (T-16604) (S2); 9460±60 BP (TUa-4550) (S2); 9520±150 BP (T-16975) (S2). The oldest date interpreted as the most reliable. **Probable age:** 9400-9600 BP
Unit G Estimated unit size: 27 m^2 Number of artifacts: 9366	**Dwelling structures**: 1 *Tentring (S1)*: A diffuse ring (4.5 x 3.75 m) of seven stones (15-30 cm). The ring contained a central fireplace (S1) associated with an artefact concentration. **Fireplaces:** 1 *Fireplace (S1)*: More or less rectangular shape (1 x 2 m). Medium-sized stones within a layer of charcoal/sooty sediments were found in one part of the structure. Two small depressions were identified in the section - probably used twice. Centrally placed within the artifact concentration/tent ring. **Radiocarbon datings:** 9410±55 BP (TUa-3576) (S1); 9515±70 BP (TUa-3297) (S1) **Probable age:** 9400-9600 BP
Unit H Estimated unit size: 22 m^2 Number of artifacts: 2941	**Dwelling structures**: (1) *Possible tentring*: Stones with possible tent ring function were recovered in connection to the artefact concentration. **Fireplaces**: (1) *Possible traces of a fireplace*: A concentration of firecracked flint artifacts. **Radiocarbon dating:** - **Probable age:** 9400-9600 BP
Unit I Estimated unit size: 10 m^2 Number of artifacts: 2631	**Dwelling structures**: - **Fireplaces:** 1 *Fireplace (S6)*: Rounded, irregular shape. Sediments mixed with charcoal and soot, stones in varied size and gravel/eroded stone. Placed directly on the surface. Some stones scattered around the structure may have been part of the fireplace. Placed centrally within the lithic concentration. **Radiocarbon dating:** 9445±130 BP (T-16928) (S6) **Probable age:** 9400-9600 BP
Unit J Estimated unit size: 8 m^2 Number of artifacts: 853	**Dwelling structures**: (1) *Possible tentring*: Stones with possible tent ring function were recovered in connection to the artefact concentration **Fireplaces:** 1 *Fireplace (S7)*: Oval shape (1.2 x 0.8 m). Sand with high concentration of soot/charcoal, gravel particles from firecracked/eroded rocks, and stones of medium size. The largest stones were found along the fringes of the structure. The sooty layer was 1-2 cm thick. Placed directly on the ground, centrally within the lithic concentration. Blubber fuelling suggested. **Radiocarbon dating:** 9480±125 BP (T-17186) (S7) **Probable age:** 9400-9600 BP

Unit K Estimated unit size: 10 m² Number of artifacts: 2227	**Dwelling structures**: 1 *Tentring*: A diffuse stone ring (stone size 20-30 cm). The ring contained two fireplaces (S14 and S13) and an artefact concentration. **Fireplaces:** 2 *Fireplace (S14)*: Circular concentration (c. 1 m in diameter) of eroded/firecracked stones in a matrix of gravel, charcoal and sooty sediments. Diffuse outline. The layer was up to 13 cm thick. Found nearby a lithic concentration. Blubber fuelling suggested. *Traces of a fireplace (S13)*: A concentration, covering an area of 3.5-4 m, of stones in different sizes and gravel in a matrix of sandy sediments with contents of charcoal. Connected to S14 through a layer of charcoal/sooty sediments. **Radiocarbon dating:** 9145±150 BP (T-16929) (S14) **Probable age:** 9400-9600 BP
Unit L Estimated unit size: 7 m² Number of artifacts: 1014	**Dwelling structures**: - **Fireplaces:** (1) *Possible traces of a fireplace*: Concentration of burnt artifacts within the lithic concentration may be the traces of a fireplace. **Radiocarbon dating: -** **Probable age:** 9400-9600 BP
Unit M Estimated unit size: 15 m² Number of artifacts: 1850	**Dwelling structures**: - **Fireplaces:** 1 *Fireplace (S8)*: Concentration (0.8 x 1.2 m) of sooty sediments with charcoal and sand, firecracked stones (2-4 cm) and gravel from eroded rocks. A line of burnt stones were found within the center. A depression, up to 5 cm thick, visible on one side of the fireplace. Centrally placed within the artifact concentration. **Radiocarbon datings:** 9620±70 BP (TUa-4549) (S8); 9695±95 BP (T-16973) (S8) **Probable age:** 9400-9600 BP
Unit N Estimated unit size: 16 m² Number of artifacts: 2347	**Dwelling structures**: (1) *Possible tentring*: A diffuse stone ring (stone size 20-30 cm). The ring contained two fire places (S11 and S12) and an artefact concentration. **Fireplaces:** 2 *Fireplace (S12)*: Concentration (2 x 2.5 m) of sooty sediments/charcoal, mixed with gravel, eroded/firecracked stones and pebbles (1-3 cm). The layer was 2-8 cm thick. A collection of larger stones was found in one end of the structure. Placed directly on the ground. Central within the lithic concentration. *Fireplace (S11)*: Circular (0.7 m in diameter). Charcoal mixed with gravel and firecracked stones. Placed directly on the surface. **Radiocarbon datings:** 9415±70 BP (TUa-4787) (S12); 9390±95 BP (T-16974) (S11) **Probable age:** 9400-9600 BP
Unit O Estimated unit size: 12 m² Number of artifacts: 2623	**Dwelling structures**: (1) *Possible tentring*: Stones with possible tent ring function were recovered in connection to the artefact concentration **Fireplaces:** 1 *Fireplace (S9)*: Oval (1.4 x 1.0 m). Sand and gravel mixed with charcoal, sooty sediments and firecracked stones (1-2 cm in size). Seven larger stones (8-20 cm) were found within the structure – two of them firecracked. The fireplace was deposited directly on the ground and near a collection of six stones. Central within the main concentration of artifacts. **Radiocarbon dating:** 9335±105 BP (T-16930) (S9) **Probable age:** 9400-9600 BP
Unit P Estimated unit size: 9 m² Number of artifacts: 559	**Dwelling structures**: - **Fireplaces:** (1) *Possible traces of a fireplace*: A small concentration of burnt artifacts may be the traces of a fireplace. **Radiocarbon datings:** - **Probable age:** 9400-9600 BP
Unit Q Estimated unit size: 10 m² Number of artifacts: 955	**Dwelling structures**: - **Fireplaces:** 1 *Fireplace (S10)*: Rounded, rhomboidal shape (1.9 x 1.2 m). Thin layer of sooty sediments and charcoal, mixed with gravel from eroded/firecracked stones. It also contained firecracked stones of medium size and larger, unburnt rocks. A stone setting in one end may be a structural part of the fireplace. Placed directly on the ground. **Radiocarbon dating:** 9310±50 BP (T-17184) (S10) **Probable age:** 9400-9600 BP

Unit R Estimated unit size: 16 m² Number of artifacts: 1349	**Dwelling structures**: - **Fireplaces:** (1) *Possible traces of a fireplace*: A small concentration of burnt artifacts may be the traces of a fireplace. **Radiocarbon datings:** - **Probable age:** 9400-9600 BP
Ormen Lange Lokalitet 49 Aukra, Møre og Romsdal Excavated 2003-2004 (Bjerck *et al*. 2008) Excavated area: 736 m² (unearthed), 52.5 m² (manually excavated) Estimated site size: n/a Number of artifacts: 3218 M asl: 10-11	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9400-9500 BP (shore-displacement curves, isobase 30, 10-11 m asl.).
Ormen Lange, Lokalitet 51 Aukra, Møre og Romsdal Excavated 2003-2004 (Bjerck *et al*. 2008) Excavated area: c. 900 m² (unearthed), 109 m² (manually excavated) Estimated site size: c. 100 m² Number of artifacts: 1485 M asl: 22	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9900 BP (shore-displacement curve, isobase 30, 22 m asl.).
Ormen Lange, Site 62 Øvre Aukra, Møre og Romsdal Excavated 2003-2004 (Bjerck *et al*. 2008) Excavated area: c. 450 m² (unearthed), 33 m² (manually excavated) Estimated site size: 30 m² Number of artifacts: 5026 M asl: 17	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9600 BP (shore-displacement curve, isobase 30, 17 m asl.).
Ormen Lange, Site 72, Units X-Y Aukra, Møre og Romsdal Excavated 2003 (Bjerck *et al*. 2008) Excavated area: 995.5 m² (unearthed), 54 m² (manually excavated) M asl: 18,5	**Dwelling structures**: 2 **Fireplaces:** 2 **Radiocarbon dates:** 3 **Probable age:** 9400-9600 BP
Unit X Estimated unit size: c. 20 m² Number of artifacts: 1742	**Dwelling structures**: 1 *Tent floor (S1)*: A concentration (3.8 x 2 m) of sorted stones (3-7 cm in size). The stone floor was partly delineated by a row of larger stones interpreted as part of a wall structure. A ditch surrounded a larger part of the dwelling floor. The structure contained a fireplace with an associated concentration of artefacts. **Fireplaces:** 1 Fireplace (S1): A concentration (0.7 x 0.4 m) of charcoal and sooty sediments. Covered by the stone floor. **Radiocarbon dating:** 9485±110 BP (T-17001) (S1) **Probable age:** 9400-9600 BP
Unit Y Estimated unit size: c. 14 m² Number of artifacts: 511	**Dwelling structures**: 1 *Tent floor (S2)*: A concentration (at least 2 x 3 m) of stones, clearly distinguished from the surrounding sediments. The structure was situated in relation to a fireplace with an associated artefact concentration. 6-7 large stones, situated 1-2 m away from the floor structure, may also have been a part of a dwelling construction. **Fireplaces:** 1 Fireplace (S2): Oval concentration (1.25 x 0.7 m) of sand and gravel with charcoal. **Radiocarbon dating:** 9380±70 BP (TUa-4589) (S2); 9480±125 BP (T-17002) (S2) **Probable age:** 9400-9600 BP

Ormen Lange, Lokalitet 73 Aukra, Møre og Romsdal Excavated 2003-2004 (Bjerck *et al*. 2008) Excavated area: 1536 m² (unearthed), 24 m² (manually excavated) Estimated site size: 50-75 m² Number of artifacts: 2078 M asl: 15-18	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9500-9600 BP (shore-displacement curve, isobase 30, 15-18 m asl.).
Ormen Lange, Site 76 and 76b Aukra, Møre og Romsdal Excavated 2003 (Bjerck et al. 2008) Excavated area: 2461 m² (unearthed) M asl: 14-16	**Dwelling structures**: - **Fireplaces:** 3 **Radiocarbon datings**: 3 **Probable age**: 9300-9500 BP
Site 76 Excavated area: 50.25 m² (manually) Estimated site size: 10 m² Number of artifacts: 1076	**Dwelling structures**: - **Fireplaces:** 2 *Fireplace (S1)*: An oval depression with stones and specks of charcoal. *Fireplace (S2)*: Oval collection of medium- sized stones embedded in compact, sooty sand with pieces of charcoal. **Radiocarbon datings:** 9440±70 BP (TUa-4429) (S1); 9155±65 BP (TUa-4428) (S2) **Probable age**: 9300-9500 BP
Site 76b Excavated area: 6.75 m² (manually) Estimated site size: 10 m² Number of artifacts: 193	**Dwelling structures**: - **Fireplaces:** 1 *Fireplace*: 8-10 medium-sized stones in sooty sand with pieces of charcoal. Surrounded by artifacts. **Radiocarbon dating:** 9415±65 BP (TUa-4851) (Fireplace) **Probable age**: 9300-9500 BP
Reinsvatnet, R1 Sunndal, Møre og Romsdal Excavated 2006, 2009 (Callanan 2006) Excavated area: 35 m² (manually) Estimated site size: c. 40 m² Number of artifacts: 4521 M asl: 890	**Dwelling structures**: - **Fireplaces:** 1 *Fireplace*: An uneven layer of charcoal/sooty sediments. **Radiocarbon dating:** 9495±65 BP (TUa-6248) (Fireplace) **Probable age**: 9500 BP
Sandgrovbotnen Nesset, Møre og Romsdal Excavated 1967, 1970 (Sjøvold 1970) Excavated area: 28 m² (manually) Estimated site size: 6 m² Number of artifacts: 898 M asl: 1070	**Dwelling structures:** 1 *Cleared area*: Oblong area (3.3 x 1.8 m) cleared of stones. The artifacts were concentrated in the eastern part of this clearing. Charcoal was found scattered within the area. **Fireplaces**: - **Radiocarbon dating: -** **Probable age**: 10,000-9000 BP (typologically dated).
Smedneset (R5) Aure, Møre og Romsdal Excavated 1974, 1975 (Pettersen 1975) Excavated area: 50 m² (manually) Estimated site size: 250-300 m² Number of artifacts: n/a M asl: c. 25	**Dwelling structures**: - **Fireplaces**: - **Radiocarbon dating: -** **Probable age:** 9100 BP (shore-displacement curve, isobase 62, 25 m asl.).
Sprikletjørnin Oppdal, Sør-Trøndelag Excavated 1980-1981 (Gustafson 1985) Excavated area: 3 m² (manually) Estimated site size: c. 10 m² Number of artifacts: c. 250 M asl: 870-880	**Dwelling structures**: - **Fireplaces**: - **Radiocarbon dating: -** **Probable age:** 10,000-9000 BP (typologically dated).

Tjeldbergodden, Kalvheiane 2a and 2b Aure, Møre og Romsdal Excavated 1992-1994 (Berglund 2001) M asl: 44-50	**Dwelling structures**: 2 **Fireplaces:** 4-9 **Radiocarbon datings:** - **Probable age:** 9500-9700 BP (shore-displacement curve, isobase 70, 44-50 m asl.).
Kalvheiane 2a Excavated area: c. 80 m² (manually) Estimated site size: n/a Number of artifacts: c. 37,500	**Dwelling structures**: 1 *Tentring (Construction I)*: Circular feature (c. 6 m in diameter). Floor of even-sized stones. Contained a high density of artifacts. **Fireplaces:** 1-4 *Fireplace (Construction A)*: Concentration of firecracked stones in a matrix of dark brown organic sediments, deposited on a layer of sand and clay. *Three possible fireplaces (Constructions B, C and E)*: Similar to Construction A. Construction C had stones along the outline of the feature. **Radiocarbon datings:** - **Probable age:** 9500-9700 BP (shore-displacement curve, isobase 70, 44-50 m asl.).
Kalvheiane 2b Excavated area: c. 77 m² (manually) Estimated site size: n/a Number of artifacts: c. 53,000	**Dwelling structures**: 1 *Tentring (Construction 1, 1994)*: Circular feature (c. 3 m in diameter). Stones measuring 10-15 cm in diameter. Two fireplaces and quite a few artifacts were found on the inside. Dwelling foundation: a wall formation with an internal stone paving. Few artifacts inside compared to around. **Fireplaces:** 3-5 *Fireplace (Construction 8, 1993)*: A ring (c. 40 cm in diameter) of four stones measuring 15-20 cm. A layer of charcoal in the bottom. *Fireplace (Construction 2, 1994)*: A ring of four firecracked stones. *Fireplace (Construction 4, 1994)*: A ring of large, firecracked stones within light sediments mixed with pieces of charcoal. *Possible fireplace (Construction 1, 1993)*: A concentration (c. 0.75 m in diameter) of firecracked stones encircled by larger stones. *Possible fireplace (Construction 6, 1993)*: A ring (0.5 m in diameter) of five stones measuring 15-20 cm. **Radiocarbon datings:** - **Probable age:** 9500-9700 BP (shore-displacement curve, isobase 70, 44-50 m asl.).
Tjeldbergodden, Kalvheiane 5 Aure, Møre og Romsdal Excavated 1993-1994 (Berglund 2001) Excavated area: 32 m² (manually) Estimated site size: n/a Number of artifacts: c. 10,000 M asl: 52	**Dwelling structures**: - **Fireplaces:** (3) *Three possible fireplaces (Construction A, B, C)*: Stone circles. Construction C measured 2 m in diameter. **Radiocarbon datings:** - **Probable age**: 9800 BP (shore-displacement curve, isobase 70, 52 m asl.).
Tjeldbergodden, Seterbekken 3 Aure, Møre og Romsdal Excavated 1995 (Berglund 2001) Excavated area: 90 m² (unearthed), 23 m² (manually excavated) Estimated site size: n/a Number of artifacts: 1067 M asl: 60	**Dwelling structures**: - **Fireplaces:** 1 *Fireplace*: Circle (c. 1.20 m in diameter) of firecracked stones, measuring up to 40 cm. No charcoal preserved. **Radiocarbon datings:** - **Probable age**: 10,000 BP (shore-displacement curve, isobase 70, 60 m asl.).
Trøhaugen I (R3) Aure, Møre og Romsdal Excavated 1974, 1975 (Pettersen 1975) Excavated area: 15 m² (manually) Estimated site size: 15 x 15 m Number of artifacts: c. 500 M asl: c. 25	**Dwelling structures**: - **Fireplaces**: - **Radiocarbon dating: -** **Probable age:** 9100 BP (shore-displacement curve, isobase 62, 25 m asl.).
Tøvikmyra Averøy, Møre og Romsdal Excavated 1991 (Johansen 1991) Excavated area: 75 m² (manually) Estimated site size: n/a Number of artifacts: 1303 M asl: 25-28	**Dwelling structures**: - **Fireplaces:** (2) *Possible traces of two fireplaces*: Two accumulations of firecracked flint, each associated with an artifact concentration **Radiocarbon datings:** - **Probable age**: 9700-9800 BP (shore-displacement curve, isobase 39, 25-28 m asl.)

Ulset Tingvoll, Møre og Romsdal Excavated 1924, 1975-76 (Alterskjær and Pettersen 1975) Excavated area: 17 m^2 (manually) Estimated site size: n/a Number of artifacts: Over 4000 M asl: 35-40	**Dwelling structures**: - **Fireplaces**: - **Radiocarbon dating: -** **Probable age:** 9300-9400 BP (shore-displacement curve, isobase 68, 35-40 m asl.).
Uran / Uranbrekka Flatanger, Nord-Trøndelag Excavated 1978 (Pettersen and Scheen 1985; Johansen 1990) Excavated area: 165 m^2 (manually) Estimated site size: n/a Number of artifacts: c. 3000 M asl: 80-84	**Dwelling structures**: - **Fireplaces**: - **Radiocarbon dating: -** **Probable age:** 9200-9000 BP (shore-displacement curve, isobase 80-84 m asl.).
Vassdalen-Brekka, Lokalitet 1 Leka, Nord-Trøndelag Excavated 2008 (Svendsen 2009) Excavated area: 63.25 m^2 Estimated site size: n/a Number of artifacts: 7557 M asl: 87-91	**Dwelling structures**: - **Fireplaces**: - **Radiocarbon dating: -** **Probable age:** 9300-9500 BP (shore-displacement curve, isobase 87-91 m asl.).
Vikansvingen, Lokalitet 1 Hitra, Sør-Trøndelag Excavated 2009 (Kalseth in prep.) Excavated area: n/a Estimated site size: n/a Number of artifacts: n/a M asl: c. 25	**Dwelling structures**: - **Fireplaces**: - **Radiocarbon dating: -** **Probable age:** 9100 BP (shore-displacement curve, isobase 60, 25 m asl.).
Voldvatnet II Kristiansund, Møre og Romsdal Excavated 1909, 1910, 1912 (Rygh 1911) Excavated area: n/a Estimated site size: n/a Number of artifacts: Over 2000 M asl: 37-43	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9800-10000 BP (shore-displacement curve, isobase 50, 37-43 m asl.).
Øvrevågens reperbane I Kristiansund, Møre og Romsdal Excavated 1910-12, 1917 (Rygh 1910) Excavated area: 3-4 m^2 (manually) Estimated site size: n/a Number of artifacts: Over 800 M asl: 25-30	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9500-9700 BP (shore-displacement curve, isobase 45, 25-30 m asl.).
Øvrevågens reperbane II (søndenfor reperbanen) Kristiansund, Møre og Romsdal Excavated 1910, 1917 (Rygh 1910) Excavated area: 5-6 m^2 (manually) Estimated site size: n/a Number of artifacts: c. 500 M asl: 25-30	**Dwelling structures**: - **Fireplaces**:- **Radiocarbon dating: -** **Probable age:** 9500-9700 BP (shore-displacement curve, isobase 45, 25-30 m asl.).

Table 2

Paper 3

Breivik, H.M. (2014)

Palaeo-oceanographic development and human adaptive strategies in the Pleistocene–Holocene transition: A study from the Norwegian coast.

Research paper

The Holocene
1–13

Reprints and permissions:
sagepub.co.uk/journalsPermissions.nav
DOI: 10.1177/0959683614544061
hol.sagepub.com
SAGE

Palaeo-oceanographic development and human adaptive strategies in the Pleistocene–Holocene transition: A study from the Norwegian coast

Heidi Mjelva Breivik

Abstract

The human colonization of Norway occurred in the Pleistocene–Holocene transition – one of the most abrupt and severe climatic shifts in human history. For 1500 years (9500–8000 BC), the whole coast was occupied by mobile, marine-oriented hunter-gatherers. This paper explores dynamic relations between human adaptation and marine environmental variations in this period. An updated record of archaeological sites and palaeo-oceanographic data suggests a correlation between marine productivity and site distribution and density. The data further demonstrate spatial and temporal differences in the environment. A cooling pulse at 9300–9200 BC (the Preboreal Oscillation) with widespread ecological consequences must have been noticeable to humans occupying Norwegian landscapes. A more gradual shift occurred around 8800 BC when the arctic climate gave way to warmer conditions: The Norwegian Atlantic current stabilized, all fjord systems became ice-free, and animal diversity increased. In the northernmost region, the impact of Atlantic water was less severe, and Polar conditions with more sea ice seem to have lingered throughout the period. Variations in the site pattern may be related to these fluctuations in the resource situation. Variations in the lithic industry, on the other hand, seem to be connected to technological choices or local traditions, rather than environmental dissimilarities. The archaeological record indicates that the lifestyle, which developed under arctic conditions, was maintained through a flexible mobility pattern and a versatile tool technology, but the Norwegian coast also provided a good base to uphold such a lifestyle.

Keywords

archaeological site patterns, Early Holocene, environmental changes, marine productivity, Norway, paleo-oceanography

Received 4 March 2014; revised manuscript accepted 1 June 2014

Introduction

The Pleistocene–Holocene transition marks one of the most abrupt and severe climatic shifts in human history. In Scandinavia, the terrestrial ice sheet melted away, sea levels fluctuated, vegetation appeared, and arctic animals were partly replaced by a more temperate fauna. The human colonization of Norway (Figure 1) also occurred during this transition phase, and for 1500 years, the whole coast was occupied by mobile, marine-oriented hunter-gatherers. The archaeological record from the Early Mesolithic Period (Table 1) give the impression of a well-established lifestyle that was maintained throughout severe climatic changes.

The post-glacial natural history of Norway is well incorporated in the archaeological discourse (e.g. Anundsen, 1996; Bang-Andersen, 1996, 2003, 2012; Fuglestvedt, 2009; Indrelid, 1975). However, the discussion about human adaptations in changing environments largely revolves around terrestrial data: fluctuations in ice cover, air temperature, and vegetation. With an Early Mesolithic location pattern that is clearly oriented toward the coast and marine resources, the paleo-oceanographic development may be even more relevant to bring into discussion: How did the climatic changes affect the *marine* environment and resource situation? How does the archaeological record relate to *this* trajectory? The Scandinavian Peninsula is one of the few regions in the world where Preboreal coastlines are situated above the present sea level (Fischer, 1996; Kindgren, 1996) and where the dynamic relation between the very first marine foragers and their fluctuating oceanic surroundings can be illuminated (Bjerck, 2009). This paper explores these topics, by including archaeological and paleo-oceanographic data, and thus shed light on a part of the human–environment discussion that is less known in the European context.

Several archaeologists have taken a marine environmental approach in understanding the Norwegian Mesolithic. Of particular interest are the following studies from different parts of the country, which are based on topographical observations and physical oceanography. Nygaard (1987) points to the highly productive aquatic environment found on the *west coast* today, suggesting that a mixing of polar and subpolar water masses would create

NTNU University Museum, Norway

Corresponding author:
Heidi Mjelva Breivik, NTNU University Museum, N-7491 Trondheim, Norway.
Email: heidi.breivik@ntnu.no

Table 1. Chronological terms and calibrations used in this paper, after Bjerck et al. (2008: 82). All dates in the text are provided in calibrated years BC. Dates that are presented as ^{14}C years in the original publication are calibrated by the author using the online program Oxcal version 4.2, calibration curve IntCal 13 (Bronk Ramsey, 2009).

Geological phase	Vegetational/climatic phase	Archaeological phase	Age BC	^{14}C years
Mid-Holocene	Atlantic	Late Mesolithic	6500–4000	7700–5200
Early Holocene	Boreal	Middle Mesolithic	8000–6500	9000–7700
	Preboreal	Early Mesolithic	9500–8000	10,000–9000

extra favorable conditions for plankton productivity in the Preboreal period. Bergsvik (1991, 1995, 2001) has studied Mesolithic settlement patterns on the west coast in relation to tidal currents. Here, the production of zooplankton is at its highest, something that attracts marine predators from all trophic levels. These locations should also be sought out by marine foragers. Bjerck (Bjerck, 2007, 2008, 2009; Bjerck and Breivik, 2012; Bjerck and Zangrando, 2013 and Bjerck et al., 2008) has drawn attention to what he terms *fjord–skerry coastal landscapes*. In these seascapes, which are prominent along the Norwegian coast, mixing of water with different salinities, temperatures, and nutrient levels provides a desirable and stable environment for a diverse marine fauna. He points to several features that enhance the productivity in *central Norway* and relates them to the high density of sites in this region. Svendsen (2007) also emphasizes the sum of several beneficial factors on the coast of central Norway in his study of Early Mesolithic location patterns. Moreover, and referring to modern characterizations, he regards the archipelago as a more productive ecozone than the fjords also in Preboreal times. In his interpretation of the Målsnes I site in *northern Norway*, Blankholm (2008) describes a productive environment with freshwater runoff from the river systems meeting the tidal currents of the salty fjords – ideal for fish, marine mammals, and sea fowl.

These studies, which propose that there is a connection between specific features, marine productivity and archaeological site location, give rise to the question:

1. *Is there a relation between marine productivity and the spatial distribution of Early Mesolithic sites in Norway?*

Paleo-oceanographic data, resulting from increased aquatic research in recent years, give us the opportunity to study productive habitats and dynamics in the Early Holocene marine conditions more closely. The following review will not only reveal spatial differences in the marine resource base but will also demonstrate that the environment changes quite severely over time. This evokes a second question:

2. *Does the archaeological record reflect temporal variations recognized in the Early Holocene marine environment?*

The environmental bases for this paper are mainly published analyses of sediment cores from the Nordic Seas. The cores are relatively scattered and few in number, and the available data are most suited to give an over-regional review of the conditions. The distribution and location of Early Mesolithic sites in Norway make out the archaeological basis for the paper. Currently, the most detailed distribution maps exist on a local or regional scale – primarily in unpublished theses (e.g. Barlindhaug, 1996; Bjerck, 1983, 1995; Dugstad, 2007; Granados, 2011; Lindblom, 1984; Svendsen, 2007; Waraas, 2001; Westli, 2009). To improve the empirical situation, an updated compilation of Early Mesolithic sites is presented in this study. The discussion will furthermore be informed by additional archaeological material.

Figure 1. Map with names of places mentioned in the text.

The Early Mesolithic sites of Norway

As a result of poor preservation conditions, the Early Mesolithic sites of Norway are identified by stone artifacts and the traces of temporary dwellings only. The temporary dwellings are recognized by tentrings, cleared areas, or simply aggregations of lithic scatters. The artifact assemblage includes several typological indicators: flake adzes, core adzes, single-edged and tanged arrow points, microliths, microburins, and unifacial platform cores with acute striking angle. Other projectile and core types, along with edge burins and large irregular blades, are also common (e.g. Bjerck, 1986; Indrelid, 1975; Lindblom, 1984; Nærøy, 1999; Olsen, 1994; Woodman, 1993). The technocomplex has its roots in the south Scandinavian and northern European Hensbacka and Ahrensburgian traditions (Fischer, 1996; Fuglestvedt, 1999, 2009; Kindgren, 1996; Kutschera, 1999; Schmitt, 1994, 1999; Waraas, 2001).

Only a few radiocarbon datings are retrieved from Early Mesolithic contexts in Norway (Bang-Andersen, 2012; Bjerck, 1995; Blankholm, 2008; Kleppe, 2014). However, the isostatic rebound recorded along the coast offers us an alternative dating method: A long tradition of research has left us with comprehensive knowledge about the nature of land uplift and sea-level fluctuations in the Late Pleistocene–Early Holocene period (e.g. Hafsten, 1983;

Figure 2. The islands of Vega and Søla in Nordland county: Typical surroundings in which Early Mesolithic sites are located. Photo: Hein B. Bjerck, NTNU University Museum.

Møller, 1986; Svendsen and Mangerud, 1987). The assumption that the coastal sites were situated close to the contemporary water margin hence gives a good idea of the earliest possible age.

Previous studies highlight that most of the sites are recovered in the coastal zone, frequently on islands, and are positioned close to good natural harbors (Figure 2; Bang-Andersen, 1996; Bergsvik, 1995; Bjerck, 1990, 1995; Odner, 1964; Svendsen, 2007; Westli, 2009). In a recent analysis that includes 57 Early Mesolithic sites from different parts of the country, Nyland (2012) concludes that 89.5% of the sites are situated on islands, 3.5% in fjord areas, and 7% on mountain plateaus. The distribution of sites in north Norway expresses a somewhat different pattern: The sites are commonly situated by fjords or channels – most often on isthmuses and sometimes on headlands and islets (Barlindhaug, 1996). An orientation toward marine resources is proposed for all regions.

A search through literature and databases, supplemented with information provided by colleagues (see acknowledgements), has resulted in the updated distribution map presented in Figure 3.

The map displays 778 sites, with 527 that are dated to the Early Mesolithic by a combination of typology and sea-level curves or radiocarbon dates. The number includes both stray finds, test-pitted sites, and excavated sites that hold one or more of the typological indicators presented above. The last 251 sites lack typological markers, but are sea level–dated and contain raw materials, and in many cases technological traits, associated with the Early Mesolithic period (Table 2).

In line with previous research, two trends are visible from the distribution map:

1. The sites are not evenly distributed topographically: Early Mesolithic sites are mainly situated in the coastal zone: 747 sites (*c.* 96%) are coastal, while only 30 sites (*c.* 4%) are situated in the mountain zone.
2. The sites are not evenly distributed geographically: A particularly high concentration of sites is found in central Norway (267/319). Concentrations are also found in the southwest coast (142/163 sites), in southeast (39/128 sites), and in northernmost Norway (63/147 sites). Some areas lack traces of Early Mesolithic settlements.

In order to discuss how the distribution pattern relates to the Early Holocene marine environment, we need to evaluate the validity of these topographical and geographical trends: Which sources of errors are associated with the distribution map?

Validity of the distribution map

Topographical distribution: coast versus inland. Mappings of Early Mesolithic sites in Norway started in the early 20th century, when Anders Nummedal – a geologist with an interest in archaeology – investigated post-glacial, elevated shorelines visible as beach gravel on dry land. On numerous occasions, he found flint artifacts close to these geological deposits that would prove to be traces of shore-bound Early Mesolithic sites (Breivik and Ellingsen, 2014). In the wake of Nummedal's first discoveries, search for early sites was exclusively performed along elevated Preboreal shorelines. The dominance of sites in the coastal zone known at this time was thus a result of the survey methods. During the last 50 years, however, large archaeological mapping projects in mountain and forest zones have been conducted. In south and central Norway, over 1000 Stone Age sites from the inland have been mapped and surveyed, yet few can be dated to the Early Mesolithic (Foosnæs and Stenvik, 2010; Indrelid, 2009). Likewise, the majority of the sites detected in connection with development of hydroelectric power plants in northern Norway were from younger periods (Foosnæs and Stenvik, 2010; Amundsen, 2010). Finally, recent surveys with trenching and test pitting over vast areas generally support the view that the archipelagic zone and marine resources were indeed attractive to the first settlers (e.g. Bang-Andersen, 1996, 2012; Bergsvik, 1995, 2001; Bjerck, 1995, 2007, 2008, 2009; Blankholm, 2008; Lindblom, 1984; Odner, 1964; Pettersen, 1999; Svendsen, 2007). The new distribution map (Figure 3) is therefore likely a representative illustration of the topographical distribution pattern of Early Mesolithic sites.

Geographical distribution: site absence and site concentrations. In a discussion of sea-level fluctuations and glacio-isostatic uplift, Nummedal (1933) advocated that Early Mesolithic sites on the coast of west and south Norway must have been damaged by the later Tapes transgression. This would be the reason for the evident absence of sites in this part of the country. Sites that later were discovered on the southwest coast spoke for a more complex development with regional differences. With updated

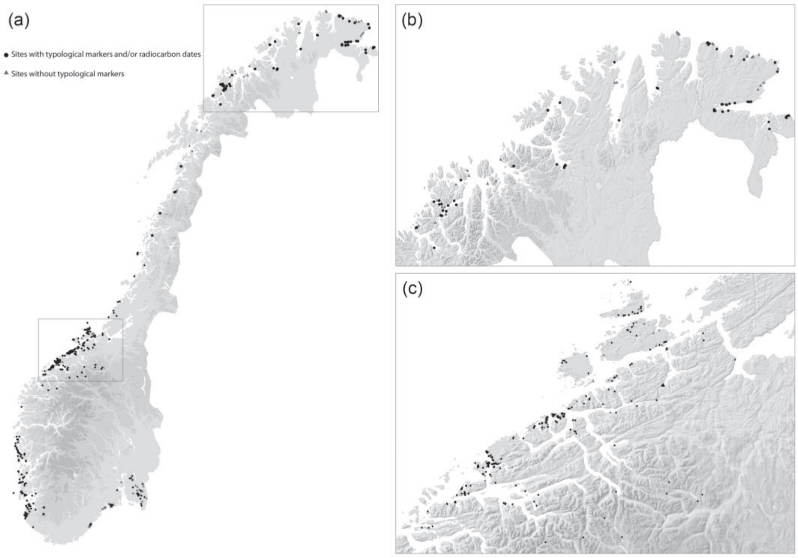


Figure 3. (a) The distribution of Early Mesolithic sites in Norway, with the present shore line. Sites which are dated by a combination of typological markers, sea-level curves and/or radiocarbon datings are indicated by black dots. Sites which lack typological markers, but are sea-level dated and contain raw materials and/or technological traits associated with the Early Mesolithic period are indicated by gray triangles. (b) Section showing the distribution of Early Mesolithic sites in northernmost Norway. (c) Section showing the distribution of Early Mesolithic sites in central Norway.

Table 2. Number of Early Mesolithic sites in Norway, sorted by counties. The left column presents sites that are dated by a combination of sea-level curves, typological markers, and/or radiocarbon dates. The middle column presents additional sites that are dated by sea-level curves, but lack typological markers. The right column sums up the total number of sites.

County	Sites with typological markers and/or radiocarbon datings	Sites without typological markers	Total	Comments to the sites and artifacts
Østfold	20	28	48	Southeast Norway: Large surveys in the recent decade have resulted in many new sites. A considerable amount of the new sites only contain flint flakes and must be regarded as uncertain, although they are situated on elevations that can be sea level–dated to the Early Mesolithic phase. Few sites are excavated.
Akershus	3		3	
Vestfold	11	46	57	
Telemark	1	2	3	
Aust-Agder	4	13	17	
Rogaland	69	14	83	Southwest Norway: A few larger survey projects in the recent decade have resulted in new sites. Some of these sites lack typological markers but contain artifacts with technological attributes associated with the Early Mesolithic period.
Hordaland	73	7	80	
Sogn og Fjordane	1		1	
Møre og Romsdal	221	40	261	Central Norway: Many of the sites are the result of targeted investigations in the early 20th century. A few large survey projects in the recent decade have resulted in new sites. Some of these sites are without typological markers, but most contain artifacts with technological attributes associated with the Early Mesolithic period. Assemblages from Nordmøre and Romsdal, Trøndelag, and southern Nordland are examined by the author.
Sør-Trøndelag	46	12	58	
Nord-Trøndelag	3		3	
Nordland	12	5	17	
Troms	17	23	40	Northernmost Norway: Several of the sites were discovered and collected in the early 20th century. Most of the sites from Finnmark are recovered and mapped by Hans Peter Blankholm (in preparation) and included here with his kind permission. Most of the sites without typological markers contain artifacts with technological attributes and raw materials associated with the Early Mesolithic period.
Finnmark	46	61	107	
Total	527	251	778	

information on archaeological sites and sea-level fluctuations, Bjerck (1983, 1986, 1995) more specifically ascribed the lack of sites in Sogn and Fjordane and adjacent areas to the Tapes transgression. Studies have also shown that transgressions have greatly affected Preboreal shorelines in southern and northernmost Norway (Hafsten, 1983; Møller, 1986), resulting in eroded or superimposed sites from this period.

Another potential contributor to the regional differences is archaeological survey intensity. Bjerck (1983) particularly stresses the significance of Nummedal's thorough mappings of central Norway. However, Nummedal also conducted surveys in northernmost and southeast Norway and investigated parts of the west coast. Moreover, systematic surveys in more recent decades have revealed Preboreal sites in Hordaland (Bergsvik, 1991), Nordland (Bjerck, 1990; Hauglid, 1993), Troms (Sandmo, 1986), and Finnmark (Blankholm, in preparation; Kleppe, 2010). Yet, none of the regions can demonstrate the same site density as central Norway.

Finally, Pettersen emphasizes the excessive land upheaval in Nord-Trøndelag, Nordland, and around the Oslofjord, which has resulted in Preboreal shorelines situated well above the cultivated areas. Only a few attempts have been made to locate the high-lying sites in these regions (Pettersen, 1999). During the last decade, however, archaeological mappings and excavations in connection with large industrial projects have resulted in improved knowledge about Early Mesolithic sites in southeast Norway, in particular (e.g. Jaksland, 2012a, 2012b).

The new distribution map (Figure 3) demonstrates the geographical differences discussed above: The 'empty' stretches along the coast are likely because of the transgression scenarios referred to above (Bjerck, 1995). The absence of sites on the exposed parts of the north coast may also be a consequence of the transgression. When it comes to site density, differences in archaeological survey frequency may have biased the distribution pattern somewhat. Nevertheless, the high concentrations of sites, particularly in central Norway, testify to greater activity in some regions during the Early Holocene.

Development and productivity in the Early Holocene marine environment

Marine productivity basically depends on the presence of phytoplankton and picoplankton (Huston and Wolverton, 2009). Phytoplankton attracts both fish and sea mammals, and its distribution can be used as a guideline to environments and habitats marine foragers would have sought. As plankton requires sunlight, carbon dioxide, and nutrients to grow, its productivity varies according to the influence of current systems, presence of ice, and differences in light, nutrients, and sea temperatures. These factors will be regarded in order to characterize spatial and temporal trends in the Early Holocene marine environment.

Temperatures and ice

The Preboreal period can be described as a rapid transition phase from a cold to a warm climate. Air temperatures increased by up to 5°C throughout the period, and ended in mean summer temperatures of about 10–14°C and winter temperatures of about −8 to −4°C (Birks et al., 2005b). The temperature rise caused the terrestrial ice sheet, which covered most of the land in the Late-glacial period, to diminish rapidly. Large parts of north, central, and southwest Norway were ice-free already at the start of the Holocene (Andersen, 2000), and by about 8800 BC, the ice had retreated from the fjords (Faulkner and Hunt, 2009; Forwick and Vorren, 2002; Gyllencreutz, 2005; Mangerud et al., 2013; Rise et al., 2006).

In the beginning of Preboreal, there was an abrupt transition from cool sea surface temperatures (SSTs) to temperatures similar or warmer than today. Analyses from the Vøring plateau and southward show summer SSTs at around 10–13°C and cool but ice-free conditions with winter SSTs of about 5–8°C (Birks et al., 2005b). In northernmost Norway, Early Holocene summer SSTs were *c.* 9–11°C. Analyses from a core off the coast of Finnmark indicate that the ice cover in the southwest Barents Sea extended further south than today. Seasonal freezing is suggested, mainly ascribed to diminished ocean heat transport due to a reduced strength of the westerly wind forcing and subsequently reduced ocean mixing (Risebrobakken et al., 2010). Similar refreezing scenarios are likely for the fjord systems in the Early Preboreal – particularly in the glaciated fjords – as low saline water from glacial input zones enhances stratification, which in turn enhances sea ice formation (Statham et al., 2008).

Estimates based on marine diatoms suggest that the SSTs in the Norwegian Sea decreased by 1°C during the Preboreal Oscillation (PBO), a cold event occurring *c.* 300 years after the onset of the Holocene (Björck et al., 1997). A high-resolution record from the Vøring plateau suggests that there were in fact two cooling pulses at 9300 and 9200 BC; the former was the most severe with a drop of 2°C (Berner et al., 2010). The event is recognized on land in large parts of Europe – mainly by decreasing pine and birch pollen and increasing values of herbs, grasses, and shrubs. In Sweden, decreased carbon values imply a lower biological production in lakes, perhaps as a result of longer seasons of ice cover, and in southwest Norway, glacial readvances are connected to the PBO (Björck et al., 1997).

Current systems

Ocean currents distribute nutrients and oxygen and are important for circulating water with different qualities. In Norwegian waters, the northernmost extension of the Gulf Stream – the Norwegian Atlantic current – is the most important contributor, as it transports warm and saline water masses along the coast. The current has had varying influence on the Nordic Seas. After a period of decreased influence in the Late-glacial period, it became well established along the coast during the Early Holocene – probably within 1000 years after the end of Younger Dryas (YD) (Birks et al., 2005b). On the Vøring plateau, the impact of the Atlantic current is demonstrated by a gradual increase in diatom fluxes in 9500–8800 BC, indicating higher surface ocean productivity (Berner et al., 2010). In north Norway, freshwater influx prior to 9000 BC and strong stratification of the water column throughout Early Holocene testify to a weaker inflow of Atlantic water (Risebrobakken et al., 2010).

Of great significance are also tidal currents that mix and transport coastal water to fjords and sounds. Simulations from the northwest European shelf estimate larger tidal amplitudes in the Late Pleistocene and Early Holocene time span – also for the western seaboard of Norway (Uehara et al., 2006). The tides would have been important for bringing warm, salty water masses to inner coast areas as the Atlantic current became more influential toward the Mid-Preboreal.

Archipelago and fjord

According to Koç et al. (1993), stronger inflow of Polar water and greater seasonality (warmer summers and colder winters) in the Early Holocene resulted in active mixing and highly productive surface water conditions in the Nordic Seas. The large amounts of meltwater that would drain from the receding ice could have had a similar effect on Norwegian coastal waters: Glacial runoff stimulates plankton growth in adjacent coastal waters as the nutrient content of high-latitude, previously ice-covered soils is typically high (Huston and Wolverton, 2009; Statham et al., 2008). During the meltdown of the Scandinavian ice sheet, nutritious sediments would have been transported to the coast via the fjords. In southeast Norway, freshwater influx from the draining Baltic Ice Lake and Yoldia Sea would have distributed additional nutrients into the saltier water masses in the Early Preboreal (Gyllencreutz, 2005). However, the high concentrations of silt- and clay-sized particles from glacial runoff can cause light attenuation close to the outlets (Statham et al., 2008). This, in addition to glaciated and seasonally frozen fjord bottoms and the weak influence of the Norwegian Atlantic current in the Early Preboreal, should have resulted in a mixing of different water masses closer to the fjord mouth and archipelagic zone than today.

Lou Schmitt (in press) has recently pointed to the beneficial marine biological conditions created by expanded phytoplankton populations around islands. The idea is based on a biophysical model that investigates the development of phytoplankton blooms along vortex streets in island wakes (Hasegawa et al., 2009). The model shows that upwelled and vertically mixed nitrate-rich water masses entrain into the ambient flow, creating a connected band of high productivity in the lee of the island. From this, Schmitt (in press) suggests that the great influx of melting water from the Vänern basin in Sweden, and the Norwegian fjords, would have enhanced the phytoplankton production in the skerry zone.

Kelp forests and coral reefs: highly productive ecosystems

Kelp forests are found along shallow, rocky coasts in cold-water habitats. The diversity of marine organisms associated with the kelp forests makes it one of the most diverse and productive ecosystems of the world (Lorentsen et al., 2010; Steneck et al., 2002). The Norwegian continental shelf provides good growing conditions for kelps today. *Laminaria hyperborea*, the dominant species, grows in the northeast Atlantic with optimal conditions on the coast of central Norway (63–65°N; Sjøtun et al., 1995). They grow on rocky substratum in shallow (<30 m) and wave-exposed areas with good light conditions (Bekkby et al., 2009). A study performed on several *Laminaria* species showed that they generally had optimal growth in the 10–15°C range (Bolton and Lüning, 1982). Remembering that the SST established at 10–13°C during the Preboreal period, the coast of Norway would have been good for kelps, given sufficient nutrients and sunlight.

Other highly productive underwater environments are coral reefs. Cold-water corals in the northeast Atlantic typically dwell at 350–1200 m depth and thrive at 5.5–12°C in nutrient-enriched and current-dominated settings. The Norwegian shelf comprises some of the most prolific and widespread coral populations today. Here, the reefs grow exclusively within the Atlantic current on the shelf up to 72°N and in fjords with inflow from this current (López Correa et al., 2012). A map of the current distribution of *Lophelia* coral reefs, compiled by Fosså et al. (2002: 3; Figure 1), interestingly shows concentrations in southwest and central Norway similar to the Early Mesolithic site map presented in Figure 3. Recent studies have dated living coral reefs (*Lophelia pertusa*) in Stjernsundet to 8900–7400 BC as the minimum age. The formation of the coral ecosystem hence took place rapidly, within *c.* 750 years after the YD termination, and *c.* 370 years after the PBO (López Correa et al., 2012), and most likely corresponds to the stabilization of the Norwegian Atlantic current system referred to above.

Marine fauna

As osteological remains are rare from Preboreal contexts in Norway, the fauna has to be reconstructed on the basis of climatic data. A few collections from older, Late-glacial layers in caves and some stray finds show an arctic fauna, similar to what we find on Svalbard or Greenland today (Hufthammer, 2001). Cold-tolerant pioneer animals were still a part of the earliest post-glacial fauna: skeletal remains of a bearded seal (*Erignathus barbatus*) from Malvik in the Trondheimsfjord in central Norway are recently dated to Early Preboreal (Jørgen Rosvold, NTNU University Museum, 2013, personal communication). Additionally, we can assume that ringed seal (*Phoca hispida*), harp seal (*Phoca groenlandica*), walrus (*Odobenus rosmarus*), and polar bear (*Ursus maritimus*) were present (Hufthammer, 2001). Faunal remains suggest that most of these species were frequent in the Kattegat–Skagerrak area until terminal Pleistocene (Aaris-Sørensen, 2009).

Ice-obligate species – polar bears, walruses, bearded seals, and ringed seals (Moore and Huntington, 2008) – would have been pushed northward during the Early Holocene as the temperatures increased, but areas with seasonal sea ice (see above) may still have provided good winter/spring habitats. At the same time, gray seal (*Halichoerus grypus*) probably immigrated. Faunal records from Denmark and Sweden document the presence of this species already from the beginning of Early Holocene. Harbor seal seems to have migrated into northern Europe at a later stage (Aaris-Sørensen, 2009; Sommer and Benecke, 2003).

Faunal remains retrieved from various Ice Age contexts show a diverse coastal avian fauna: fulmar (*Fulmarus glacialis*), eiders (*Somateria* spp.), puffin (*Fratercula arctica*), guillemots (*Uria* sp. and *Cepphus grylle*), razorbill (*Alca torda*), little auk (*Alle alle*), gulls (*Larus canus* and *Pagophila eburnea*), geese (*Branta/Anser*), scoters (*Melanitta* spp.), and kittiwake (*Rissa tridactyla*; Hufthammer, 2006; Valen et al., 1996). These are species that most probably inhabited the coast in the Preboreal period.

Several fish species would also be present. Cold-tolerant species able to handle low salinity would be the first to arrive. Analyses from an inlet on the west coast of Canada show that few fish were present during the initial meltdown of the terrestrial ice sheet when the ocean received large quantities of glacial outwash. A pronounced spike of plankton occurs just before fish associated with low saline water appear. A greater diversity and abundance appear when the conditions are warmer and drier (Tunnicliffe et al., 2001). A similar scenario can be pictured for Norway. Cod (*Gadidae*), polar cod (*Boreogadus saida*), bull-heads (*Cottidae*), and cusk (*Brosme brosme*) are examples of species associated with arctic conditions (Hufthammer, 2001). Alpine charr (*Salvelinus* sp.), capelin (*Mallotus villosus*), herring (*Clupea morhua*), whiting (*Merlangius merlangus*), and ling (*Molva molva*) are known from Late-glacial contexts on the Swedish west coast (Jonsson, 1995). A greater diversity of fish species is expected from the Mid-Preboreal when the Atlantic current establishes.

The increased seasonality recorded in the early phase implies that an arctic fauna may have been present during winter months and a more temperate fauna could have migrated during the summer months.

Spatial trends: marine productivity and archaeological site distribution patterns

The review suggests that the outer coast was the most productive zone in the Preboreal time. In the early phase, the combination of reduced westerly wind forcing, a weaker Norwegian Atlantic current, and runoff from melting glaciers via the fjords could have resulted in a mixing of different water masses where the fjords meet the archipelago. Great meltwater discharge would create phytoplankton blooms in the wake of islands, and nutritious sediments transported from former ice-covered land would have created an even more productive environment than we find along the coast today. The Norwegian Atlantic current that established around the Mid-Preboreal brought new nutritious water along the coast and created livable conditions for new species. In this fruitful archipelagic zone, we find most of the Early Mesolithic sites.

A close relation between productive marine habitats and site location pattern is demonstrated in central Norway where the sites are typically oriented toward the zone where the primary production would be high: on the exposed islands, facing the ocean rather than the mainland (Figure 3c). Many sites are also located around the channels that connect the open ocean with the fjord mouths where the tidal amplitudes would create vertical mixing of different water masses. Cold-water corals and kelp populations, which have good growing conditions in the region today, could have established already in Early Holocene. These ecosystems would have provided extra beneficial conditions for marine organisms on certain places. The paleo-oceanographic data seem to support that the high density of sites in this region is connected to a particularly productive marine environment, created by the combination of several beneficial factors. A similar environmental characterization is valid for southwest coast – another region with a high concentration of Early Mesolithic sites.

In northernmost Norway, we find a different situation. Here, the Norwegian Atlantic current had less influence, and arctic conditions with severe seasonal freezing prevailed in the Preboreal phase. Mammals dependent on sea ice would have lingered longer than further south. It may also be relevant to discuss whether polynyas – areas of open water surrounded by ice – could have been present. Recurring polynyas (those that occur at the same time and place each year) are particularly important because migrating or overwintering birds and mammals depend on their existence when the sea is largely ice-covered (Stirling, 1997). These circumstances would have resulted in a different and more restricted distribution of nutrients, plankton, and marine species that feed on them. A large part of the sites in north Norway are situated around fjord heads and sheltered sounds – locations that were less appreciated farther south (Figure 3b). The data thus suggest that the somewhat different approaches to the landscape may have been closely related to the different resource situations.

Resource availability in different seascapes

Marine mammals have been lifted forward as a significant prey for early marine foragers in many parts of the world (e.g. Bjerck, 1995; Erlandson et al., 2007; Grønnow et al., 2011; Orquera and Piana, 2009a; Schmitt et al., 2006; Yesner, 2004). In northern Norway, the arctic mammals (walrus, harp seal, ringed seal, and bearded seal) would appear frequently. Even today, harp seals and ringed seals enter the large fjords in this region: Harp seals often feed in or near the pack ice, but migrate into the Varangerfjord during spring. Ringed seals are found in largest numbers during winter and early spring and prefer the shore-fast ice of the inner fjord (Hodgetts, 1999: 108–110). The species would distribute farther south in the Early Preboreal. The presence of ringed seal in the Baltic Sea, at least from the end of YD until today (Schmölcke, 2013), speaks of suitable conditions in this region, and it is likely that the species lingered in the Oslofjord throughout the first half of Preboreal. The physical evidence of a bearded seal in the Trondheimsfjord likewise shows that arctic species were at this latitude in the same period. Winter/spring hunting of these ice-obligate artic marine mammals was likely performed in connection to frozen water, and it is plausible to think of the many fjord sites in north Norway as camps related to this activity. Also recurring polynyas could have provided predictable hunting grounds in frozen seascapes: Polynyas are known as fowling sites in the Baltic Sea (Nuñez and Gustavsson, 1995) and as important walrus-hunting grounds for Thule Inuits in northeast Greenland (Grønnow et al., 2011).

Gray seals, on the other hand, commonly breed along rocky coasts and offshore islands (Hodgetts, 1999: 111; Schmölcke, 2008). The present Norwegian population form large, stationary groups in September–December and April–May in relation to breeding and molting (Hodgetts, 1999: 111). After the breeding season, they disperse and migrate widely, often in pelagic waters (Schmölcke, 2008). The highly productive archipelago along the western seaboard would provide desirable habitats throughout most of the year, but hunting may have been most efficient and predictable during spring and autumn/winter. In these seasons, gray seals could be hunted on and around land in great numbers. These operations would require sea-going vessels – at least for transport of hunters and prey.

Birds must have been another resource of importance. While seals provided meat, blubber, skin, and sinew, birds provided down, feathers and hollow bones, as well as eggs, and were highly valued among coastal hunter-gatherers (e.g. Moss and Erlandson, 2013; Tivoli and Zangrando, 2011). Osteological data picture a wide range of water fowl already during the Late-glacial phase, and more species would follow as the temperature rose. The greatest diversity would appear during summer time when migratory birds found their way to the Scandinavian archipelago. The outer coast would thus be quite desirable for marine foragers throughout most of the year.

The presented data suggest that there are correlations between the distribution of Early Mesolithic sites and productive marine habitats, and the spatial variations in settlement density and location patterns speak for a consciousness toward different environments and resource situations. This gives rise to the second question: Does the archaeological record also reflect temporal variations recognized in the Early Holocene marine environment? As the distribution map is not sufficient to shed light on this, the question will be explored bringing in additional archaeological data.

Temporal trends: human adaptive strategies in a shifting environment

The palaeo-oceanographic review draws a picture of a marine environment that underwent large changes during the Early Holocene time span. From being greatly influenced by ice and meltwater in the earliest phase, a gradual but comprehensive shift seems to occur midway through the Preboreal phase (*c.* 8800 BC), when the arctic climate gave way to warmer conditions. For a period of time, central Norway, and maybe also regions farther south, may have been occupied with arctic species during wintertime and a more temperate fauna during the summer months. As all fjord systems turned ice-free, cold-tolerant animals would be pushed northward and other marine species would settle in permanently. The Norwegian Atlantic current stabilized along the coast, and the oceanic circulation regime became more like the present. Terrestrial data suggest presence of tree stands, in a landscape dominated by low vegetation, in most regions at the same time (Birks et al., 2005a), with a subsequent growing number of animal species. The palaeo-environmental data thus speak for an increasingly productive environment, with a greater faunal diversity from the Mid-Preboreal. The Late Preboreal phase would have been characterized by increased stability in the marine conditions – consequently with more constant habitats for fish and sea mammals and hence a more predictable resource situation for human predators.

In addition to the gradual shift outlined above, a more abrupt event occurred at 9300–9200 BC. The PBO had widespread ecological consequences that must have been noticeable to humans occupying Norwegian landscapes: air and sea temperatures decreased, vegetation diminished, and terrestrial ice sheet readvanced. It may also have caused longer lasting seasonal ice covers in sheltered waters and fjords. The changes would have affected the dispersal and composition of animals, as their habitats were rapidly changing.

Human response to a changing environment is a widely investigated topic in archaeological research. Due to absence of datable material, this subject is less treated in Norwegian Early Mesolithic studies, but case studies from northern Europe show correlations between food abundance and hunter-gatherer population sizes (Tallavaara and Seppä, 2011), between climatic events and technological changes (Riede, 2009a), and between environmental changes and distribution of settlements (Crombé et al., 2011). If the PBO cold event had a sudden and severe effect on the economic basis of the marine foragers of Norway, we should look for a decline in site density and maybe even a subsequent change or loss in technology after 9300–9200 BC. Changes in hunting strategies and site location patterns might have occurred as the ice retreated and animal species found new suitable habitats during the second half of the Preboreal.

Material from central Norway, which holds almost half of the presented sites, is appropriate to test these hypotheses. As radiocarbon dates from Preboreal contexts are rare, we have to rely on shore displacement curves in order to study temporal trends. There are great differences in the rebound effect within the region, and the oldest Early Mesolithic sites are today situated from 20 m a.s.l. in the southwest archipelago to *c.* 160 m a.s.l. in the inner fjord areas. The sea-level 'drop' of up to 60 m during the Preboreal period gives us good age control as long as we know the elevation of the site. However, as the sites may have been positioned in various distances to the contemporaneous water margin, the method only provides us with the oldest possible date (Helskog, 1978; Lindblom, 1984; Årskog, 2009). Consequently, sea-level-dated sites are only adequate to illuminate general trends over time.

In all, 86 of the examined assemblages with typological markers from central Norway have sufficient mapping information to be dated by sea-level curves.

Site density and location patterns

Figure 4 illustrates changes in site density through the Preboreal period. The final stages of the period are hampered by non-cultural factors as the relatively low elevations on which the youngest sites are found may be affected by the Tapes transgression. Moreover, the transition to a Middle Mesolithic tool industry may have left us with fewer sites with typological markers toward the end of the Early Mesolithic. The strong declining trend must therefore be considered with caution. That being said, the curve does not demonstrate the predicted tendency: An argument for a decrease in site number in relation to the PBO cannot be sustained. From this we can suggest that the cold event did not have a dramatic effect on the marine food abundance, and that the environmental conditions were sufficient to uphold the human population through this period.

A tendency toward a less exposed location pattern oriented toward inland in the Late Preboreal phase has been advocated on the basis of regional studies from south Norway (Nyland, 2012; Waraas, 2001). The 86 sea-level–dated sites from central Norway show a similar trend (Figure 5): A higher percentage of sites with a retracted location, in fjord basins or sheltered sounds connected to the mainland, are found in the second half of the period. It has been argued that changes in settlement patterns – both location and duration – during the Middle and Late Mesolithic phases express alterations in the subsistence strategy that partly can be connected to environmental changes (e.g. Bergsvik, 1995; Bjerck, 1990; Indrelid, 1978; Lindblom, 1984; Nygaard, 1990; Olsen, 1992). Considering the results from the environmental review, it is plausible that this cultural development has its roots in the gradual stabilization of the marine environment, along with the terrestrial changes, that seems to occur in the Late Preboreal. Implementation of new species and new habitats may have started already toward the end of this period.

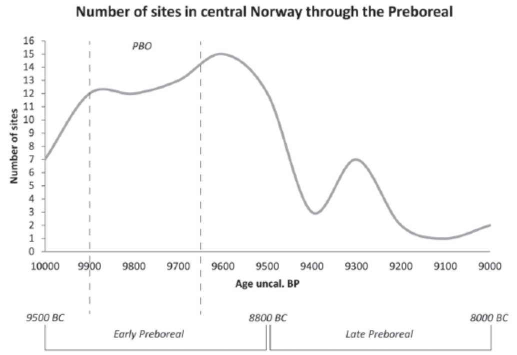


Figure 4. Changes in site density through the Early Mesolithic period, based on 86 sea-level-dated sites from central Norway.

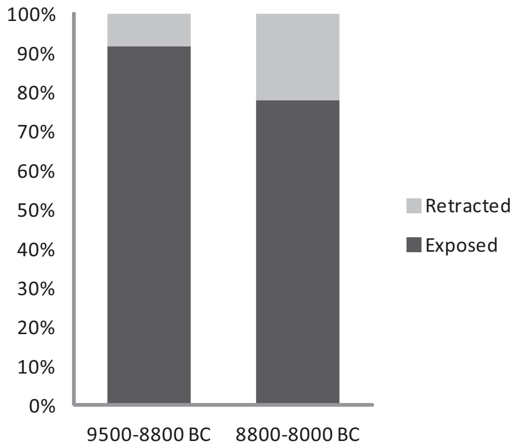


Figure 5. The percentage of sites with retracted and exposed location in the first and second half of the Early Mesolithic period, based on 86 sea-level-dated sites from central Norway (9500-8800 BC: N = 59; 8800-8000 BC: N = 27).

Technology

The Early Mesolithic technocomplex is distinguished by the use of direct striking technique and includes several specific artifacts that seem to appear on most sites (see above). As such, a technological continuity is already established for the period. However, a small change has been detected in the Mid-Preboreal (Bjerck and Ringstad, 1985; Fuglestvedt, 1999; Kutschera, 1999; Waraas, 2001). Based on Early Mesolithic sites from southwest Norway, Kutschera (1999) finds that while tanged points are common in the earliest phase, there are sites with few tanged points or none in the latest phase. Instead, lancet microliths become more common. It is not suggested how these artifacts relate to the use of resources, and currently, we know little about the function of these tools: Microliths have been used as projectiles (Aaris-Sørensen and Petersen, 1986; Larsson and Sjöström, 2011) as well as for cutting tools (Finlayson and Mithen, 1996). The points, which in size and shape equal the small tanged Ahrensburg points, are, on the other hand, certainly connected to the use of bows and arrows (Riede, 2009b, 2010). A decreasing number of tanged points could thus testify to a changeover in hunting strategies. Either way, if the technological shift in Mid-Preboreal is related to the parallel changes in the resource situation, we could expect a similar development in central Norway.

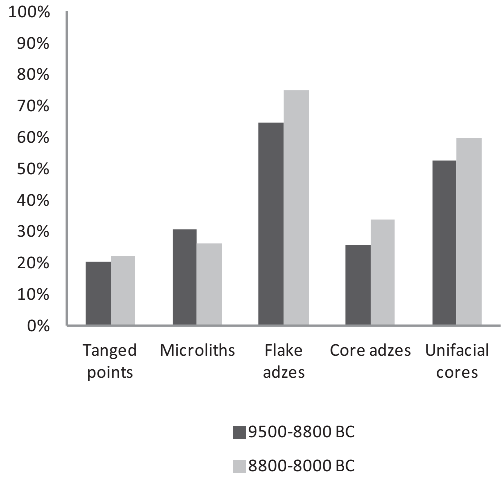


Figure 6. The percentage of sites with tanged points, microliths, flake adzes, core adzes, and unifacial cores in the first and second half of the Early Mesolithic period. The calculations are based on 86 sea-level-dated sites from central Norway (9500-8800 BC: N = 59; 8800-8000 BC: N = 27).

Among the 86 sea-level–dated sites from central Norway, tanged points seem to be just as common in the late phase as in the early phase (Figure 6). Microliths show a slight declining trend, but are more common than tanged points throughout the period. The technological shift identified in the southwest Norwegian material is thus not evident in the present material from central Norway, nor is it recognized in excavated material from Slettnes and Melkøya in Finnmark (Ramstad, 2009). This may imply that it is a regional trend, perhaps connected to cultural choices rather than to environmental changes. It should also be noted here that a similar technological development is documented in Bohuslän in west Sweden (Kindgren, 1996), reflecting close relations between south Norwegian and Scandinavian groups throughout the Preboreal.

Taking other artifact categories into consideration, we see that flake adzes, core adzes, and unifacial cores tend to increase in frequency from the first to the second half of the period. This gives the impression of a well-functioning lifestyle that could be maintained despite changing environments. This was also the conclusion of a study based on environmental and archaeological data from north Norway (Blankholm, 2009; Hald and Blankholm, 2009).

Conclusion: the coast as a fruitful ecozone

The paleo-oceanographic review of the Early Holocene marine environment in Norway demonstrates interesting spatial and temporal trends:

1. The outer coast was the most fruitful ecozone; vertical mixing of different water qualities would occur in the transition zone between fjords and archipelago; phytoplankton blooms would occur in the wake of islands.
2. In northernmost Norway, arctic conditions with severe seasonal ice cover and a cold-tolerant fauna lingered throughout the Preboreal; the rest of the country experienced gradually warmer oceanic conditions with a subsequent immigration of a more temperate fauna.
3. A cold event, referred to as the PBO, influenced the climate at 9300–9200 BC by decreased temperatures, glacial readvance, and longer seasonal ice cover.
4. In the Mid-Preboreal, around 8800 BC, an environmental shift occurred. From being greatly influenced by ice and meltwater in the earliest phase, the oceanic conditions now became more likely present as the Norwegian Atlantic current stabilized along the coast and glaciers withdrew from the fjords.

The archaeological site distribution corresponds with the paleo-oceanographic data on many levels:

1. Concentrations of sites are found in ecozones and regions with good marine productivity.
2. Regions with different paleo-oceanographic characterizations display different location preferences.
3. The settlement pattern seems to change over time as the resource situation stabilizes.

The analysis thus implies that variations in the marine environment and resource situation have influenced the early marine foragers' approach to the Norwegian seascapes. The tool kit, on the other hand, seems to be less influenced by the environmental changes. The technological shift detected in southwest Norway (less tanged points and more lancet microliths) is not recognized in central Norway – a region with a similar paleo-environmental development – and cannot be related directly to a change in the resource situation. The fact that the same range of tools is found also on mountain sites supports this line of reasoning. Human adaptive strategies in Early Holocene are thus archaeologically visible through varying location patterns rather than changed tool technologies.

Several ecological and cultural factors must have been significant in order to sustain a lifestyle in a cold, fluctuating environment. First, the productive Norwegian coast provided a good base to uphold a hunter-gatherer lifestyle. Traditionally, coastal environments and marine resources have caught less attention than terrestrial societies in hunter-gatherer studies. Within the framework of ecological and optimal foraging theories, marine resources are low in the scales of preferred foods (Bailey and Parkington, 1988), and their initial exploitation has frequently been discussed in light of demographic stress or environmental changes (e.g. Binford, 2001; Glassow et al., 1988; Johnson, 2014; Osborn, 1977). During the last decade, however, there has been an increased focus on marine resources as attractive, and the role of coastlines in human migration is emphasized (e.g. Bailey, 2004; Bjerck, 2007, 2008, 2009; Dixon, 2001; Erlandson, 2001, 2010; Erlandson et al., 2007; Orquera and Piana, 2009b; Schmitt et al., 2006, 2009). High-latitude oceans are pointed out as one of the richest niches on the globe (Huston and Wolverton, 2009). The present study likewise depicts the Norwegian coast as a bountiful environment that could supply foragers with food and necessary materials around the year.

Another advantage is that marine resources can withstand higher cropping rates than many terrestrial mammals because of high annual net recruitment rates (Yesner, 1980). An economy based on marine resources would thus be better suited to withstand environmental fluctuations and hunting pressure. A focus on the coastal 'megapatch' (see Beaton, 1991) may thus have been the key to a successful adaptation to the Norwegian landscape.

However, an efficient exploitation of the marine resources required both proper knowledge and technological investment. The rocky and skerried seascape was very different from the continental plains from which the colonists originally had their roots. Only with a knowledge base customized toward a marine environment, the colonists would have been equipped to meet the conditions (Kelly, 2003). The Swedish west coast has been lifted forward as a potential region for the development of such knowledge. The marine resources along this productive coastal stretch may have been gradually incorporated in the subsistence base of continental hunter-gatherer groups at the close of the Late-glacial period (Kindgren, 1996; Schmitt, 1995). Bjerck (1995, 2007, 2008, 2009) argues that this area, located in the transition zone between the European plain and the Scandinavian archipelago, was essential in the development of an advanced marine technology, seaworthy boats in particular, which allowed for an efficient colonization and exploitation of the Norwegian coast. Although the marine foragers were now moving into pristine land, they found themselves in a familiar landscape with the same resources available. The present study underlines that the initial occupation of Norway was carried out by conscious movements toward certain habitats grounded in knowledge about marine productivity and animal behavior.

Finally, the lifestyle was maintained through a flexible mobility pattern. Mobility is one of the main behavioral strategies by which human hunter-gatherers adapt to the temporal and spatial distribution of resource in their environment (Binford, 1980; Kelly, 1995; Perrault and Bantingham, 2011). To deal with fluctuating environments and move according to changing resource situations must have been a well-incorporated part of the cultural tradition, based on many generations of experience. Within this social system, the climatic shifts that developed over time may even have been less significant than the year-to-year, or even seasonal, changes.

Acknowledgements

The following people have provided data to the distribution map: Hein B Bjerck, Martin Callanan (NTNU University Museum, Trondheim), Kristian Pettersen (Sør-Trøndelag County Authority), Inger Marie Berg-Hansen, Lasse Jaksland, Håkon Glørstad, Steinar Solheim (Museum of Cultural History, University of Oslo), Astrid J Nyland (Department of Archaeology, Conservation and History, University of Oslo), Knut F Eskeland (Aust-Agder County Authority), Tor Arne Waraas (University Museum of Bergen), Leif I. Åstveit (University Museum of Bergen, Section for Cultural Heritage Management), Sveinung Bang-Andersen, Åsa Dahlin Hauken (Museum of Archaeology, University of Stavanger), Sigrid A Dugstad (Rogaland County Authority), Hans Peter Blankholm, Bryan Hood (Department of Archaeology and Social Anthropology, University of Tromsø), Anja R Niemi (Department of Cultural Sciences, University of Tromsø), Ragnhild Myrstad (Troms County Authority), and Jan Ingolf Kleppe (Finnmark County Authority). Thanks to Hein B Bjerck, Hans Peter Blankholm, Jørgen Rosvold, and Bjørg Risebrobakken for thorough reading and useful comments on the manuscript. Thanks to two anonymous reviewers for comments that greatly improved my manuscript.

Funding

This paper is a contribution within the Marine Ventures project which is owned by NTNU University Museum and funded with support from the Research Council of Norway, Latin America program (project no. 208828).

References

Aaris-Sørensen K (2009) Diversity and dynamics of the mammalian fauna in Denmark throughout the last glacial–interglacial cycle, 115–0 kyr BP. *Fossils and Strata* 57: 1–60.

Aaris-Sørensen K and Petersen EB (1986) The Prejlerup aurochs – An archaeozoological discovery from boreal Denmark. In: Königsson LK (ed.) *Nordic Late Quaternary Biology and Ecology* (Striae, vol. 24). Uppsala: Societas Upsaliensis pro Geologia Quaternaria, pp. 111–117.

Amundsen HR (2010) *Faglig program for vassdrag. Historisk oversikt og kunnskapsstatus for vassdragsundersøkelser i Finnmark, Troms og Nordland*. Report. Oslo: NIKU. Available at: http://www.riksantikvaren.no/filestore/06-01985-34ManusFagligprogramvassdragnordNIKU2010.pdf353496.PDF.

Andersen BG (2000) *Istider i Norge*. Oslo: Universitetsforlaget.

Anundsen K (1996) The physical conditions for earliest settlement during the last deglaciation in Norway. *Acta Archaeologica Lundensia*, Series in 8(24): 207–217.

Årskog HB (2009) *Steinalderlokaliteter i tid og rom. en undersøkelse basert på Ormen Lange-registreringene på Nordvestlandet*. MA Thesis, University of Oslo.

Bailey G and Parkington J (1988) The archaeology of prehistoric coastlines: An introduction. In: Bailey G and Parkington J (eds) *The Archaeology of Prehistoric Coastlines*. Cambridge: Cambridge University Press, pp. 1–10.

Bailey GN (2004) World prehistory from the margins: The role of coastlines in human evolution. *Journal of Interdisciplinary Studies in History and Archaeology* 1(1): 39–50.

Bang-Andersen S (1996) The colonization of Southwest Norway. An ecological approach. *Acta Archaeologica Lundensia*, Series in 8(24): 219–234.

Bang-Andersen S (2003) Southwest Norway at the Pleistocene/Holocene transition: Landscape development, colonization, site types, settlement patterns. *Norwegian Archaeological Review* 36(1): 5–25.

Bang-Andersen S (2012) Colonizing contrasting landscapes. The pioneer coast settlement and inland utilization in southern Norway 10,000–9500 years before present. *Oxford Journal of Archaeology* 31(2): 103–120.

Barlindhaug S (1996) *Hvor skal vi bygge og hvor skal vi bo? En analyse av lokaliseringsfaktorer i tidlig steinalder i Troms*. MA Thesis, University of Tromsø.

Beaton JM (1991) Colonizing continents: Some problems from Australia and the Americas. In: Dillehay TD and Meltzer DJ (eds) *The First Americans: Search and Research*. Boca Raton, FL: CRC Press, pp. 209–230.

Bekkby T, Rinde E, Erikstad L et al. (2009) Spatial predictive distribution modelling of the kelp species *Laminaria hyperborea. ICES Journal of Marine Science* 66: 2106–2115.

Bergsvik KA (1991) *Ervervs- og bosetningsmønstre på kysten av Nordhordland i steinalder, belyst ved funn fra Fosnstraumen*. MA Thesis, University of Bergen.

Bergsvik KA (1995) Bosetningsmønstre på kysten av Nordhordland i steinalder. En geografisk analyse. *Arkeologiske skrifter* 8: 111–130.

Bergsvik KA (2001) Sedentary and mobile hunter-fishers in Stone Age western Norway. *Arctic Anthropology* 38(1): 2–26.

Berner KS, Koç N and Godtliebsen F (2010) High frequency climate variability of the Norwegian Atlantic Current during the early Holocene period and a possible connection to the Gleissberg cycle. *The Holocene* 20(2): 245–255.

Binford LR (1980) Willow smoke and dogs' tails: Hunter–gatherer settlement systems and archaeological site formation. *American Antiquity* 45: 4–20.

Binford LR (2001) *Constructing Frames of Reference. An Analytical Method for Archaeological Theory Building Using Ethnographic and Environmental Data Sets*. Oakland, CA: University of California Press.

Birks HH, Larsen E and Birks HJB (2005a) Did tree-Betula, Pinus and Picea survive the last glaciation along the west coast of Norway? A review of the evidence, in light of Kullman (2002). *Journal of Biogeography* 32: 1461–1471.

Birks HH, Kristensen DK, Dokken TM et al. (2005b) Exploratory comparisons of quantitative temperature estimates over the last deglaciation in Norway and the Norwegian Sea. *Geophysical Monograph Series* 158: 341–355.

Bjerck HB (1983) *Kronologisk og geografisk fordeling av mesolitiske element i Vest- og Midt-Norge*. Cand. Mag. Thesis, University of Bergen.

Bjerck HB (1986) The Fosna–Nøstvet Problem. A consideration of archaeological units and chronozones in the South Norwegian Mesolithic period. *Norwegian Archaeological Review* 2: 103–121.

Bjerck HB (1990) Mesolithic site types and settlement patterns at Vega, Northern Norway. *Acta Archaeologica* 60: 1–32.

Bjerck HB (1995) The North Sea Continent and the pioneer settlement of Norway. In: Fischer A (ed.) *Man and Sea in the Mesolithic*. Oxford: Oxbow Books, pp. 131–143.

Bjerck HB (2007) Mesolithic coastal settlements and shell middens in Norway. In: Milner N, Craig OE and Bailey GN (eds) *Shell Middens in Atlantic Europe*. Oxford: Oxbow Books, pp. 5–30.

Bjerck HB (2008) Norwegian Mesolithic Trends: A review. In: Bailey G and Spikins P (eds) *Mesolithic Europe*. Cambridge: Cambridge University Press, pp. 60–106.

Bjerck HB (2009) Colonizing seascapes: Comparative perspectives on the development of maritime relations in Scandinavia and Patagonia. *Arctic Anthropology* 46(1–2): 118–131.

Bjerck HB and Breivik HM (2012) Off shore pioneers: Scandinavian and Patagonian lifestyles compared in the Marine Ventures project. *Antiquity* 86. Available at: http://antiquity.ac.uk/projgall/bjerck333/ (accessed 9 July 2013).

Bjerck HB and Ringstad B (1985) *De kulturhistoriske undersøkelsene på Tjernagel, Sveio*. Report, Arkeologiske rapporter 9. Bergen: Historisk Museum, Universitetet i Bergen.

Bjerck HB and Zangrando AF (2013) Marine ventures: Comparative perspectives on the dynamics of early human approaches to the seascapes of Tierra del Fuego and Norway. *Journal of Island and Coastal Archaeology* 8(1): 79–90.

Bjerck HB, Åstveit LI, Gundersen J et al. (2008) *NTNU Vitenskapsmuseets arkeologiske undersøkelser Ormen Lange Nyhamna*. Trondheim: Tapir Academic Press.

Björck S, Rundgren M, Ingólfsson Ó et al. (1997) The Preboreal oscillation around the Nordic Seas: Terrestrial and lacustrine responses. *Journal of Quaternary Science* 12(6): 455–465.

Blankholm HP (2008) *Målsnes 1. An Early Post-Glacial Coastal Site in Northern Norway*. Oxford: Oxbow Books.

Blankholm HP (2009) Pionertiden i det nordlige Fennoskandia. Motivasjon, innflytting, tilpasning. *Oral presentation on the conference: Pionerer i nytt landskap*, NTNU University Museum, Trondheim, 19–20 March.

Blankholm HP (in preparation) Fifty-nine sites in six days: Macro-level predictive modelling of early Stone Age pioneer settlement locations in Varanger, Norway.

Bolton JJ and Lüning K (1982) Optimal growth and maximal survival temperatures of Atlantic Laminaria species (Phaeophyta) in culture. *Marine Biology* 66: 89–94.

Breivik HM and Ellingsen EG (2014) 'A discovery of quite exceptional proportions': Controversies in the wake of Anders Nummedal's discoveries from Norway's first inhabitants. *Bulletin of the History of Archaeology* 24(9): 1–13.

Bronk Ramsey C (2009) Bayesian analysis of radiocarbon dates. *Radiocarbon* 51(1): 337–360.

Crombé P, Sergant J, Robinson E et al. (2011) Hunter-gatherer responses to environmental change during the Pleistocene–Holocene transition in the southern North Sea basin: Final Palaeolithic–Final Mesolithic land use in northwest Belgium. *Journal of Anthropological Archaeology* 30: 454–471.

Dixon EJ (2001) Human colonization of the Americas: Timing, technology and process. Beringian Paleoenvironments: Festschrift in honor of David M. Hopkins. *Quaternary Science Reviews* 20(1–3): 277–299.

Dugstad SA (2007) *Hushold og teknologi. En studie av tidlig preboreale lokaliteter i Rogaland*. MA Thesis, University of Bergen.

Erlandson JM (2001) The archaeology of aquatic adaptations: Paradigms for a new millennium. *Journal of Archaeological Research* 9(4): 287–350.

Erlandson JM (2010) Food for thought: The role of coastlines and aquatic resources in human evolution. In: Cunnane SC and Stewart KM (eds) *Human Brain Evolution: The Influence of Freshwater and Marine Food Resources*. Hoboken, NJ: John Wiley & Sons, Inc., pp. 125–136.

Erlandson JM, Graham MH, Bourque BJ et al. (2007) The Kelp Highway hypothesis: Marine ecology, the coastal migration theory, and the peopling of the Americas. *Journal of Island and Coastal Archaeology* 2: 161–174.

Faulkner TL and Hunt CO (2009) Holocene deposits from Neptune's Cave, Nordland, Norway: Environmental interpretation and relation to the deglacial and emergence history of the Velfjord–Tosenfjord area. *Boreas* 38: 691–704.

Finlayson B and Mithen S (1996) The microwear and morphology of microliths from Gleann Mor. In: Knecht H (ed.) *Projectile Technology*. New York: Plenum Press, pp. 107–130.

Fischer A (1996) At the border of human habitat. The Late Palaeolithic and Early Mesolithic in Scandinavia. In: Larsson L (ed.) *The Earliest Settlement of Scandinavia* (Acta Archaeologica Lundensia, Series in 8, no. 24). Stockholm: Almquist & Wiksell International, pp. 157–176.

Foosnæs K and Stenvik LS (2010) *Vassdragsundersøkelser i Midt-Norge. Historisk oversikt over arkeologiske registreringer og undersøkelser i vassdrag som har blitt utbygd eller vurdert for utbygging av vasskraft*. Trondheim: NTNU. Available at: http://www.riksantikvaren.no/filestore/06-01985-36Historiskoversikt-1354297.pdf

Forwick M and Vorren TO (2002) Deglaciation history and post-glacial mass movements in Balsfjord, northern Norway. *Polar Research* 21(2): 259–266.

Fosså JH, Mortensen PB and Furevik DM (2002) The deep-water coral *Lophelia pertusa* in Norwegian waters: Distribution and fishery impacts. *Hydrobiologia* 471: 1–12.

Fuglestvedt I (1999) The Early Mesolithic site at Stunner, South-east Norway: A discussion of Late Upper Palaeolithic/Early Mesolithic chronology and cultural relations in Scandinavia. In: Boaz J (ed.) *The Mesolithic of Central Scandinavia* (Universitetets oldsaksamlings skrifter, Ny rekke 22). Oslo: Universitetets oldsaksamlings, pp. 189–202.

Fuglestvedt I (2009) *Phenomenology and the Pioneer Settlement on the Western Scandinavian Peninsula*. Lindome: Bricoleur Press.

Glassow MA, Wilcoxon LR and Erlandson J (1988) Cultural and environmental change during the Early Period of Santa Barbara Channel prehistory. In: Bailey G and Parkington J (eds) *The Archaeology of Prehistoric Coastlines*. Cambridge: Cambridge University Press, pp. 64–77.

Granados TJ (2011) *Skiveøkser frå Vest-Noreg: Ein analyse av teknikk, klassifikasjon og distribusjon*. MA Thesis, University of Bergen.

Grønnow B, Gulløv HC, Jakobsen BH et al. (2011) At the edge: High Arctic walrus hunters during the 'Little Ice Age'. *Antiquity* 85: 960–977.

Gyllencreutz R (2005) Late Glacial and Holocene paleoceanography in the Skagerrak from high-resolution grain size records. *Palaeogeography, Palaeoclimatology, Palaeoecology* 222(3–4): 344–369.

Hafsten U (1983) Shore-level changes in South Norway during the last 13,000 years traced by biostratigraphical methods and radiocarbon datings. *Norsk geografisk tidsskrift* 37: 63–79.

Hald M and Blankholm HP (2009) Kunsten å overleve klimaendringer (feature article). *Nordlys*, 18 September 2009, p. 5.

Hasegawa D, Lewis MR and Gangopadhyay A (2009) How islands cause phytoplankton to bloom in their wakes. *Geophysical Research Letters* 36(20): L20605.

Hauglid M (1993) *Mellom Fosna og Komsa. En preboreal «avslagsredskapskultur» i Salten, Nordland*. Cand. Mag. Thesis, University of Tromsø.

Helskog K (1978) Late Holocene sea-level changes seen from prehistoric settlements. *Norsk Geologisk Tidsskrift* 32: 111–119.

Hodgetts LM (1999) *Animal bones and human society in the late younger stone age of arctic Norway* (Durham E-Theses Online). Doctoral Thesis, Durham University. Available at: http://etheses.dur.ac.uk/4491/.

Hufthammer AK (2001) The Weichselian (*c*. 115,000–10,000 B.P.) vertebrate fauna of Norway. *Bollettino Della Societa Paleontologica Italiana* 40(2): 201–208.

Hufthammer AK (2006) The vertebrate fauna of eastern Norway – From the Ice Age to the Middle Ages. *Kulturhistorisk Museum Skrifter* 4: 191–202.

Huston MA and Wolverton S (2009) The global distribution of net primary production: Resolving the paradox. *Ecological Monographs* 79(3): 343–377.

Indrelid S (1975) Problems in relation to the Early Mesolithic settlement of Southern Norway. *Norwegian Archaeological Review* 8(1): 1–18.

Indrelid S (1978) Mesolithic economy and settlement patterns in Norway. In: Mellars PA (ed.) *The Early Postglacial Settlement of Northern Europe*. London: Duckworth, pp. 147–176.

Indrelid S (2009) *Arkeologiske undersøkelser i vassdrag: faglig program for Sør-Norge*. Oslo: Riksantikvaren.

Jaksland L (ed.) (2012a) *E18 Brunlanesprosjektet Bind II. Undersøkte lokaliteter fra tidligmesolitikum* (Varia 80). Oslo: 07 Gruppen AS.

Jaksland L (ed.) (2012b) *E18 Brunlanesprosjektet Bind III. Undersøkte lokaliteter fra tidligmesolitikum og senere* (Varia 81). Oslo: 07 Gruppen AS.

Johnson AL (2014) Exploring adaptive variation among hunter-gatherers with Binford's frames of reference. *Journal of Archaeological Research* 22(1): 1–42.

Jonsson L (1995) Vertebrate fauna during the Mesolithic on the Swedish west coast. In: Fischer A (ed.) *Man and Sea in the Mesolithic*. Oxford: Oxbow Books, pp. 147–160.

Kelly RL (1995) *The Foraging Spectrum: Diversity in Hunter–Gatherer Lifeways*. Washington, DC: Smithsonian Institution Press.

Kelly RL (2003) Colonization of new land by hunter-gatherers. Expectations and implications based on ethnographic data. In: Rockman M and Steele J (eds) *Colonization of Unfamiliar Landscapes: The Archaeology of Adaptation*. London: Routledge, pp. 44–58.

Kindgren H (1996) Reindeer or seals? Some Late Palaeolithic sites in central Bohuslän. In: Larsson L (ed.) *The Earliest Settlement of Scandinavia* (Acta Archaeologica Lundensia, Series in 8, no. 24). Stockholm: Almquist & Wiksell International, pp. 191–205.

Kleppe JI (2010) Klubbvik 1. Tidlig bosetning og klima i Varangerfjorden i lys av nye undersøkelser nær Mortensnes, Nesseby kommune. *Varanger årbok* 2010: 71–78.

Kleppe JI (2014) Desolate landscapes or shifting landscapes? Late glacial/early post-glacial settlements of northernmost Norway in the light of new data from eastern Finnmark. In: Riede F and Tallavaara M (eds) *Lateglacial and Postglacial Pioneers in Northern Europe* (BAR International Series 2599). Oxford: Archaeopress, pp. 121–146.

Koç N, Jansen E and Haflidason H (1993) Paleoceanographic reconstructions of surface ocean conditions in the Greenland, Iceland and Norwegian seas through the last 14 kyr based on diatoms. *Quaternary Science Reviews* 12(2): 115–140.

Kutschera M (1999) Vestnorsk tidligmesolitikum i et nordvesteuropeisk perspektiv. In: Fuglestvedt I, Gansum T and Opedal A (eds) *Et hus med mange rom. Vennebok til Bjørn Myhre på 60-årsdagen. Ams-Rapport, Bind A*. Stavanger: Arkeologisk museum, Universitetet i Stavanger, pp. 43–52.

Larsson L and Sjöström A (2011) Early Mesolithic flint-tipped arrows from Sweden. *Antiquity* 85(330), Project gallery, December 2011. Available at: http://antiquity.ac.uk/projgall/larsson330/ (accessed 9 July 2013).

Lindblom I (1984) *Former for økologisk tilpasning i Mesolitikum*. Østfold: Universitetets Oldsaksamling Årbok (1982/1983), pp. 43–86.

López Correa M, Montagna P, Joseph N et al. (2012) Preboreal onset of cold-water coral growth beyond the Arctic Circle revealed by coupled radiocarbon and U-series dating and neodymium isotopes. *Quaternary Science Reviews* 34: 24–43.

Lorentsen S-H, Sjøtun K and Grémillet D (2010) Multi-trophic consequences of kelp harvest. *Biological Conservation* 143(9): 2054–2062.

Mangerud J, Goehring BM, Lohne ØS et al. (2013) Collapse of marine-based outlet glaciers from the Scandinavian Ice Sheet. *Quaternary Science Reviews* 67: 8–16.

Møller JJ (1986) Holocene transgression maximum about 6000 years BP at Ramså, Vesterålen, North Norway. *Norsk Geografisk Tidsskrift* [Norwegian Journal of Geography] 40(2): 77–84.

Moore SE and Huntington HP (2008) Arctic marine mammals and climate change: Impacts and resilience. *Ecological Applications* 18(2): S157–S165.

Moss ML and Erlandson JM (2013) Waterfowl and lunate crescents in Western North America: The archaeology of the Pacific flyway. *Journal of World Prehistory* 26(3): 173–211.

Nærøy AJ (1999) The Norwegian Stone Age in south Scandinavian and northwest European context. *AmS Rapport* 12B: 463–488.

Nummedal AJ (1933) Kan det finnes flintplasser på kyststrekningen mellom Kristiansand og Ålesund? *Naturen* 1933: 227–244.

Nuñez M and Gustavsson K (1995) Prehistoric man and ice conditions in the Åland archipelago 7000–1500 years ago. In: Robertsson AM, Hicks S, Åkerlund A et al. (eds) *Landscapes and Life: Studies in Honour of Urve Miller*. Strasbourg: Conseil de l'Europe, pp. 233–244.

Nygaard SE (1987) Socio-economic developments along the southwestern coast of Norway between 10,000 and 4,000 BC. In: Rowly-Conwy P, Zvelebil M and Blankholm HP (eds) *Mesolithic Northwest Europe: Recent Trends*. Sheffield: University of Sheffield, pp. 147–154.

Nygaard SE (1990) Mesolithic Western Norway. In: Vermeersch PM and Van Peer P (eds) *Contributions to the Mesolithic in Europe*. Leuven: Leuven University Press, pp. 227–237.

Nyland AJ (2012) Lokaliseringsanalyse av tidligmesolittiske pionerboplasser. In: Glørstad H and Kvalø F (eds) *HAVVIND – Paleogeografi og arkeologi – Archaeological Report*. Oslo: Norwegian Maritime Museum, Museum of Cultural History, pp. 70–96.

Odner K (1964) Erhverv og bosetning i Komsakulturen. *Viking* 28: 117–128.

Olsen AB (1992) *Kotedalen – en boplass gjennom 5000 år, bind 1. Fangstbosetning og tidlig jordbruk i Vestnorsk steinalder: Nye funn og nye perspektiver*. Bergen: University of Bergen.

Olsen B (1994) *Bosetning og samfunn i Finnmarks forhistorie*. Oslo: Universitetsforlaget.

Orquera LA and Piana EL (2009a) Sea nomads of the Beagle Channel in southernmost South America: Over six thousand years of coastal adaptation and stability. *Journal of Island and Coastal Archaeology* 4: 61–81.

Orquera LA and Piana EL (2009b) The southern top of the world. The first peopling of Patagonia and Tierra del Fuego, and the cultural endurance of the Fuegian sea-nomads. *Arctic Anthropology* 46(1–2): 103–117.

Osborn AJ (1977) Strandloopers, mermaids and other fairy tales: Ecological determinants of marine resource utilization – The

Peruvian case. In: Binford LR (ed.) *For Theory Building in Archaeology: Essays on Faunal Remains, Aquatic Resources, Spatial Analysis, and Systemic Modeling*. New York: Academic Press, pp. 157–205.

Perrault C and Bantingham PJ (2011) Mobility-driven cultural transmission along the forager–collector continuum. *Journal of Anthropological Archaeology* 30(1): 62–68.

Pettersen K (1999) The Mesolithic in Southern Trøndelag. In: Boaz J (ed.) *The Mesolithic of Central Scandinavia* (Universitetets oldsaksamlings skrifter, Ny rekke 22). Oslo: Universitetets oldsaksamlings, pp. 153–166.

Ramstad M (2009) Oppsummering: Materiell kultur og bosetning på Melkøya gjennom forhistorisk tid. In: Hesjedal A, Ramstad M and Niemi AR (eds) *Undersøkelsene på Melkøya: Melkøyaprosjektet – kulturhistoriske registreringer og utgravninger 2001 og 2002*. Tromsø: Tromsø University Museum, pp. 379–436.

Riede F (2009a) Climate and demography in early prehistory: Using calibrated 14C dates as population proxies. *Human Biology* 81(2–3): 309–337.

Riede F (2009b) The loss and re-introduction of bow-and-arrow technology: A case study from the Southern Scandinavian Late Palaeolithic. *Lithic Technology* 34: 27–45.

Riede F (2010) Hamburgian weapon delivery technology: A quantitative comparative approach. *Before Farming* 2010: Article 1.

Rise L, Bøe R, Sveian H et al. (2006) The deglaciation history of Trondheimsfjorden and Trondheimsleia, Central Norway. *Norsk Geologisk Tidsskrift* 86: 419–438.

Risebrobakken B, Moros M, Ivanova EV et al. (2010) Climate and oceanographic variability in the SW Barents Sea during the Holocene. *The Holocene* 20(4): 609–621.

Sandmo AK (1986) *Råstoff og redskap – mer enn teknisk hjelpemiddel: Om symbolfunksjoner som et aspekt ved materiell kultur; skisse av etableringsforløpet i en nordeuropeisk kystsone 10.000–9.000 BP*. Cand. Mag. Thesis, University of Tromsø.

Schmitt L (1994) The Hensbacka: A subsistence strategy of continental hunter-gatherers, or an adaptation at the Pleistocene–Holocene boundary? *Oxford Journal of Archaeology* 13(3): 245–263.

Schmitt L (1995) The West Swedish Hensbacka: A maritime adaptation and a seasonal expression of the North-Central European Ahrensburg? In: Fischer A (ed.) *Man and Sea in the Mesolithic*. Oxford: Oxbow Books, pp. 161–170.

Schmitt L (1999) Comparative points and relative thoughts: The relationship between the Ahrensburgian and Hensbacka assemblages. *Oxford Journal of Archaeology* 18(4): 327–337.

Schmitt L (in press) Early colonization, glacial melt water, and island mass effect in the archipelago of western Sweden: A case history. *Oxford Journal of Archaeology*.

Schmitt L, Larsson S, Burdukiewicz J et al. (2009) Chronological insights, cultural change, and resource exploitation on the west coast of Sweden during the Late Palaeolithic/Early Mesolithic transition. *Oxford Journal of Archaeology* 28(1): 1–27.

Schmitt L, Larsson S, Schrum C et al. (2006) Why they came: The colonization of the coast of Western Sweden and its environmental context at the end of the last glaciation. *Oxford Journal of Archaeology* 25(1): 1–28.

Schmölcke U (2008) Holocene environmental changes and the seal (Phocidae) fauna of the Baltic Sea: Coming, going and staying. *Mammal Review* 38(4): 231–246.

Schmölcke U (2013) A short history of seals and seal populations in northern European waters. In: Grimm O and Schmölcke U (eds) *Hunting in Northern Europe Until* AD *1500. Old Traditions and Regional Developments, Continental Sources and Continental Influences*. Neumünster: Wachholtz, pp. 91–99.

Sjøtun K, Fredriksen S, Rueness J et al. (1995) Ecological studies of the kelp Laminaria hyperborea (Gunnerus) Foslie in Norway. In: Skjoldal HR, Hopkins C, Erikstad KE et al. (eds) *Ecology of Fjords and Coastal Waters*. Amsterdam: Elsevier Science, pp. 525–536.

Sommer R and Benecke N (2003) Post-Glacial history of the European seal fauna on the basis of sub-fossil records. *Beitraege zur Archaeozoologie und Praehistorischen Anthropologie* 6: 16–28.

Statham PJ, Skidmore M and Tranter M (2008) Inputs of glacially derived dissolved and colloidal iron to the coastal ocean and implications for primary productivity. *Global Biogeochemical Cycles* 22: GB3013.

Steneck R, Graham MH, Bourque BJ et al. (2002) Kelp forest ecosystems: Biodiversity, stability, resilience and future. *Environmental Conservation* 29(4): 436–459.

Stirling I (1997) The importance of polynyas, ice edges, and leads to marine mammals and birds. *Journal of Marine Systems* 10(1–4): 9–21.

Svendsen F (2007) *Lokaliteter og landskap i tidlig mesolittisk tid. En geografisk analyse fra Nordvest-Norge*. MA Thesis, University of Trondheim.

Svendsen JI and Mangerud J (1987) Late Weichselian and Holocene sea-level history for a cross-section of Western Norway. *Journal of Quaternary Science* 2: 113–132.

Tallavaara M and Seppä H (2011) Did the mid-Holocene environmental changes cause the boom and bust of hunter-gatherer population size in eastern Fennoscandia? *The Holocene* 22(2): 215–225.

Tivoli AM and Zangrando AFJ (2011) Subsistence variations and landscape use among maritime hunter-gatherers. A zooarchaeological analysis from the Beagle Channel (Tierra del Fuego, Argentina). *Journal of Archaeological Science* 38: 1148–1156.

Tunnicliffe V, O'Connell JM and McQuoid MR (2001) A Holocene record of marine fish remains from the Northeastern Pacific. *Marine Geology* 174: 197–210.

Uehara K, Scourse JD, Horsburgh KJ et al. (2006) Tidal evolution of the northwest European shelf seas from the Last Glacial Maximum to the present. *Journal of Geophysical Research* 111: C09025.

Valen V, Mangerud J, Larsen E et al. (1996) Sedimentology and stratigraphy in the cave Hamnsundhelleren, western Norway. *Journal of Quaternary Science* 11(3): 18–201.

Waraas TA (2001) *Vestlandet i tidleg Preboreal tid. Fosna, Ahrensburg eller vestnorsk tidligmesolitikum?* MA Thesis, University of Bergen.

Westli C (2009) *Å slå seg ned: En regional analyse av tidligmesolittisk lokalisering med utgangspunkt i Østfold*. MA Thesis, University of Oslo.

Woodman P (1993) The Komsa culture. A re-examination of its position in the Stone Age of Finnmark. *Acta Archaeologica* 63: 57–76.

Yesner DR (1980) Maritime hunter-gatherers: Ecology and prehistory. *Current Anthropology* 21(6): 727–750.

Yesner DR (2004) Prehistoric maritime adaptations of the Subarctic and Subantarctic zones: The Aleutian/Fuegian connection reconsidered. *Arctic Anthropology* 41(2): 76–97.

Paper 4

Breivik, H.M. and Callanan, M. (in press)

Hunting High and Low: Postglacial Colonization Strategies in Central Norway between 9500 and 8000 cal BC.

European Journal of Archaeology 2016, 1–25

Hunting High and Low: Postglacial Colonization Strategies in Central Norway between 9500 and 8000 cal BC

HEIDI M. BREIVIK AND MARTIN CALLANAN

Department of Archaeology and Cultural History, NTNU University Museum, Trondheim, Norway

In this article, we examine aspects of the Postglacial colonization processes that took place in central Norway during the Early Mesolithic (c. 9500–8000 cal BC). The distribution of sites from this period shows that the colonizers approached and exploited two very different landscapes and resource situations—from archipelagic to alpine. Based on twelve artefact assemblages from central Norway we investigate how colonizing populations met the challenge posed by varying ecozones. Did they organize their settlements and technologies in similar ways or did they modify sites and activities in relation to the different locations? The aspects studied are site organization, artefact composition, projectiles, and lithic raw material use. It appears that the sites are of a similar size and structure across ecozones. Apart from some variations in tool composition, there is no evidence in the lithic material for any technical adaptation towards specific ecozones. We conclude that using a standard, generalized lithic technology, combined with high mobility and small group size, enabled the colonizing groups to overcome the risks and difficulties associated with settling and seeking out resources in new and unknown landscapes.

Keywords: Norway, Early Mesolithic, coastal and mountain environments, generalized adaptation

INTRODUCTION

Colonization processes—the movement and development of human populations into and in new lands—are a constant feature of prehistory and history. These processes are of great interest and value to a range of disciplines, including archaeology and anthropology. Examining past colonization processes offers the opportunity to focus on a broad spectrum of issues such as technology, mobility, ethnicity, settlement structure, risk management, and ecological knowledge, to mention but a few. In this paper, we use the term colonization to describe the period of significant and persistent human presence in Norway that started roughly around 9500 BC and continued for 1500 years. The archaeological record of this period, as it appears to us today, probably includes evidence of early 'landfall' events as well as more regular and habitual settlement. However, neither the technical nor the chronological resolution is currently sufficient to confidently separate one from the other. Rather, we view the sites as a long-term record of how early populations dealt with the challenges of colonizing a new landmass through many generations in the

Manuscript received 18 June 2015,
accepted 1 December 2015

DOI 10.1080/14619571.2016.1147315

Early Mesolithic period at the start of the Holocene. In the context of early Postglacial Scandinavia, the Early Mesolithic settler generations were literally opening new roads into a pristine natural landscape that had emerged and developed after the retreat of the Scandinavian ice sheet. In this article, we examine some aspects of the Postglacial colonization processes that took place in central Norway during the Early Holocene.

During the last glacial maximum (*c*. 20,000 cal BC) the Scandinavian Peninsula and much of the Nordic Seas were covered in ice (Andersen & Borns, 1997: 9). Although large areas of the Norwegian coast were free of ice already in the Allerød phase, in *c*. 13,000–12,000 cal BC (Mangerud et al., 2011), the landmass was not settled until after the Younger Dryas cold event (Bjerck, 1995; Bang-Andersen, 2003b). The whole Norwegian coast seems to have been colonized within a few centuries at the beginning of the Early Mesolithic period, dated to 9500–8000 cal BC (Bjerck, 1995) and, for 1500 years, highly mobile hunter–gatherer groups utilized the emerging land.

The distribution of Early Mesolithic sites shows a distinct pattern where some 96 per cent of sites are located in the coastal zone (Bjerck, 1983; Svendsen, 2007; Nyland, 2012; Breivik, 2014). Sites from the same period have also been recovered in mountain contexts (Tørhaug & Åstveit, 2000; Bang-Andersen, 2003a, 2012, 2013; Bjerck & Callanan, 2005; Callanan, 2008). The colonizers therefore approached and exploited two very different landscapes and resource situations. In this article we refer to these broad topographical zones as ecozones. The *coastal ecozone* ranges from the archipelago of the outer coast to more sheltered channels and fjord heads on the inner coast. Palaeo-oceanographic data suggest a highly productive marine environment, which gradually changed from arctic to sub-arctic during the Preboreal period (Breivik, 2014). The outer coast, with its myriad skerries and islands, seems to have been especially bountiful and would have housed a wide range of sea mammals, fish, and waterfowl throughout the period. The *mountain ecozone* ranges from alpine to subalpine environments. Climatic data and osteological evidence from the Late-Glacial period indicate that reindeer were present from an early stage and through the whole phase, and smaller species such as polar fox, arctic hare, and wolverine may have been present in the first phase of the Early Mesolithic (Hufthammer, 2001, 2006). As the glaciers retreated and temperatures increased, arctic species were partly replaced by a more temperate fauna (Hufthammer, 2006; Grøndahl et al., 2010).

On the basis of the distribution of sites across different ecozones, Early Mesolithic hunters are interpreted as specialized maritime hunters who adapted to coastal landscapes and resources, and at the same time as reindeer hunters who followed age-old traditions from the continental Palaeolithic cultures. In fact, finds from this period have recently been interpreted as evidence of two separate, synchronic specializations, with one group based in the mountains and the other on the coast (see Wygal & Heidenreich, 2014). Most authors recognize the existence of a dual economy based on the seasonal exploitation of mountain and coastal resources in the Early Mesolithic. However, studies still tend to focus on the primacy of one ecozone over the other. In this article we wish to examine how human activities in the mountain and coastal ecozones were combined and integrated during the 1500-year-long period of colonization of Norway. Similarities and differences between coastal and mountain sites have previously been emphasized on a number of occasions (e.g. Tørhaug & Åstveit, 2000; Bang-Andersen, 2003a, 2003b, 2012; Callanan, 2007; Svendsen, 2007; Bjerck et al., 2008; Fuglestvedt, 2009, 2012). In this article we focus systematically and in detail on these similarities and differences from an adaptive/strategic perspective: How did colonizing populations meet the challenges posed by different ecozones? Did they organize their settlements and technologies in similar ways, or did they modify sites and activities according to the different locations? Do we find ecozone-specific adaptations and specializations?

Central Norway is ideally suited to the study of these questions: Early Mesolithic sites have been preserved and investigated in both ecozones and the relatively short distances between mountain and coastal sites in the region mean that they are likely to have formed part of the same mobility system in the past (Figure 1). In order to better understand the similarities and differences between coastal and mountain sites during the Early Mesolithic, we compare four aspects of sites located in both ecozones: site organization, artefact composition, projectiles, and lithic raw material use. Their examination will allow us to discuss the questions outlined above.

Twelve Early Mesolithic Artefact Assemblages From Central Norway

Central Norway is located between 62° and 65° N and comprises three counties: Møre and Romsdal, Sør-Trøndelag, and Nord-Trøndelag. The topography ranges from skerries, islets, and islands, through sheltered sounds and narrow fjords, to

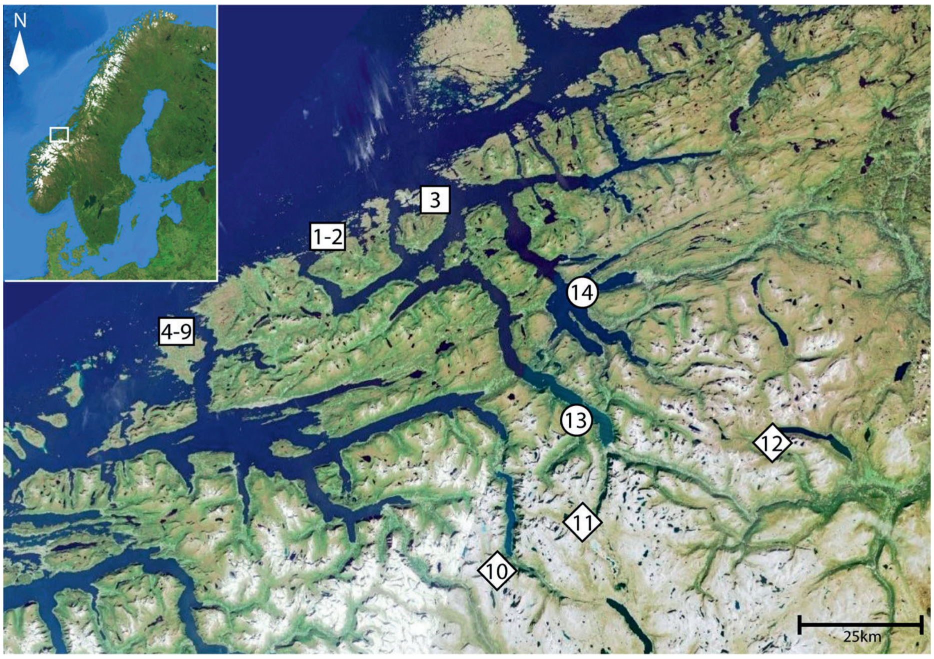


Figure 1. *Location of coastal (square) and mountain (lozenge) sites in central Norway included in the analysis. Nos. 1–2: Hestvikholmane Site 2–2012 & 3; no. 3: Kvernberget Site 20; nos. 4–9: Ormen Lange Site 48 Units A, G, I, J and Site 72 Units X & Y; no. 10: Sandgrovbotnen; no. 11: Reinsvatnet R1; no. 12: Brannhaugen. Other sites mentioned in the text: no. 13: Innvik and no. 14: Torvik.*

mountain plateaux and subalpine landscapes. A recent detailed synthesis of the region shows that *c.* 250 Early Mesolithic sites are distributed along the coast–inland axis (Breivik & Bjerck, in press).

Nine assemblages from five coastal sites and three assemblages from mountain contexts were chosen for the present study (Table 1). All the selected sites are well documented, with artefacts recorded within square metres or quarters, and with all excavated deposits sieved. In all cases, the excavated areas are assumed to cover a substantial part of the occupation site and are all interpreted as clean contexts, undisturbed by later activity. The assemblages recovered are thus considered to be representative of the Early Mesolithic period in the region. The selected sites date to different periods within the Early Mesolithic, but recent studies show a continuous use of the same toolkit and technology throughout the period and area (Breivik, 2014). The sites and assemblages selected for this study are considered, on this basis, as comparable and suitable for the study presented here. We shall start with giving some details of the sites selected.

The Coastal Sites

The Ormen Lange excavations on the island of Gossa in Aukra were conducted

Table 1. *Information on the Twelve Early Mesolithic Assemblages Analysed.*

Site	Ecozone	m asl	Radiocarbon dating BP/calibrated BC Calibrated dates generated using OxCal 3.10 (Bronk Ramsey, 2005)	Probable age cal BC	Reference
Ormen Lange Site 48, Unit A	Coastal	21		8800–9000	Bjerck et al. (2008)
Ormen Lange Site 48, Unit G	Coastal	20.6	9410 ± 55 BP (TUa-3576)/8760–8620 cal BC; 9515 ± 70 BP (TUa-3297)/9120–8740 cal BC	8800–9000	Bjerck et al. (2008)
Ormen Lange Site 48, Unit I	Coastal	20.1	9445 ± 130 BP (T-16928)/9150–8550 cal BC	8800–9000	Bjerck et al. (2008)
Ormen Lange Site 48, Unit J	Coastal	20	9480 ± 125 BP (T-17186)/9130–8630 cal BC	8800–9000	Bjerck et al. (2008)
Ormen Lange Site 72, Unit X	Coastal	18.5	9485 ± 110 BP (T-17001)/9120–8630 cal BC	8800–9000	Bjerck et al. (2008)
Ormen Lange Site 72, Unit Y	Coastal	18.5	9380 ± 70 BP (TUa-4589)/8750–8560 cal BC; 9480 ± 125 BP (T-17002)/9130–8630 cal BC	8800–9000	Bjerck et al. (2008)
Hestvikholmane Site 3	Coastal	31–33		8500–9000	Wammer (2006)
Hestvikholmane Site 2-2012	Coastal	39–40		*c.* 9500	Brede (2012)
Kvernberget Site 20	Coastal	40–45		*c.* 9300–9500	Strøm & Breivik (2008)
Reinsvatnet R1	Mountain	890	9495 ± 65 BP (TUa-6248)/9120–8650 cal BC	8600–9100	Callanan (2006, 2007)
Sandgrovbotnen	Mountain	1000		8000–9500	Sjøvold (1970)
Brannhaugen	Mountain	650		8000–9500	Bjerck & Callanan (2005)

during two field seasons in 2003 and 2004 (nos. 4–9 on Figure 1). The project included seven Early Mesolithic sites (Bjerck et al., 2008). On the largest site, Ormen Lange Site 48, over 70,000 lithic artefacts were recovered. The artefacts were distributed over eighteen units (Units A–R), each containing one or more lithic deposits—in most cases centred on a fireplace. On the basis of a series of radiocarbon dates as well as detailed analyses of the artefact distribution, the units were interpreted as traces of up to thirty occupations that took place within a timespan of some one hundred years, probably between 9000 and 8800 cal BC (Bjerck et al., 2008: 230, fig. 3.231). Four units (A, G, I, and J) are included in our analysis. Together they give a representative picture in terms of size and composition of the Ormen Lange Site 48 complex.

Ormen Lange Site 72 is located close to Site 48 but is much smaller in size. Here two separate units (X and Y) were identified (see Figure 2). Both are included in our study. In Unit X a rounded concentration of small, sorted stones was interpreted as a dwelling floor, perhaps in a tent. A fireplace and lithic deposits were recovered in association with this floor. Unit Y also included a stone dwelling floor and a fireplace. Artefacts were found scattered in and around the features. Both units were interpreted as single occupation events that occurred most probably within the same period as Site 48, i.e. between *c.* 9000 and 8800 cal BC (Bjerck et al., 2008: 436–44; Åstveit, 2009).

The agglomeration of separate units, as at Ormen Lange Sites 48 and 72, is not common in the Early Mesolithic record, where sites usually consist of a single occupation unit. For the purposes of the inter-site comparisons in the following analysis, we treat units from the Ormen Lange excavations as equal to individual sites.

Twelve Mesolithic sites were excavated in 2006 and 2012 on Hestvikholmane in Averøy (nos. 1–2 on Figure 1). Two Early Mesolithic sites from these excavations are included in this study. At Hestvikholmane Site 3, a tent ring with a central fireplace was recovered. A small quantity of lithics was associated with this structure, lying scattered inside the ring of stones. A large number of lithic artefacts was found together with a second fireplace in an area a few metres away from this dwelling structure. This was interpreted as the area where the main tool production took place. The site was believed to represent at least two different occupation events, and dated to *c.* 9700 BP (9200 cal BC) by shore-displacement curves (Wammer, 2006).

Hestvikholmane Site 2–2012 appeared as an extensive concentration of unsorted rocks during the initial stages of excavation. A dwelling floor consisting of a circular cleared area with an accumulation of artefacts was recovered amidst the rocky area. Two lithic deposits within the feature were interpreted as knapping areas and two concentrations of fire-cracked artefacts outside the dwelling were interpreted as the traces of fireplaces. The site was thought to be a camp used on two or more occasions, and dated to *c.* 10,000 BP (9500 cal BC) by shore-displacement curves (Brede, 2012).

At Kvernberget, Kristiansund, excavations were conducted in 2006 and 2007, and included three Early Mesolithic sites (no. 3 on Figure 1). Kvernberget Site 20 lay in an area with scattered lithics. A tent ring with an internal fireplace was recovered on the site. A large part of the artefacts were found in association with these structures. The site was interpreted as a single occupation of short duration (Strøm & Breivik, 2008) and the local shore-displacement curve places its use around 9800-1000 BP (9300–9500 cal BC).

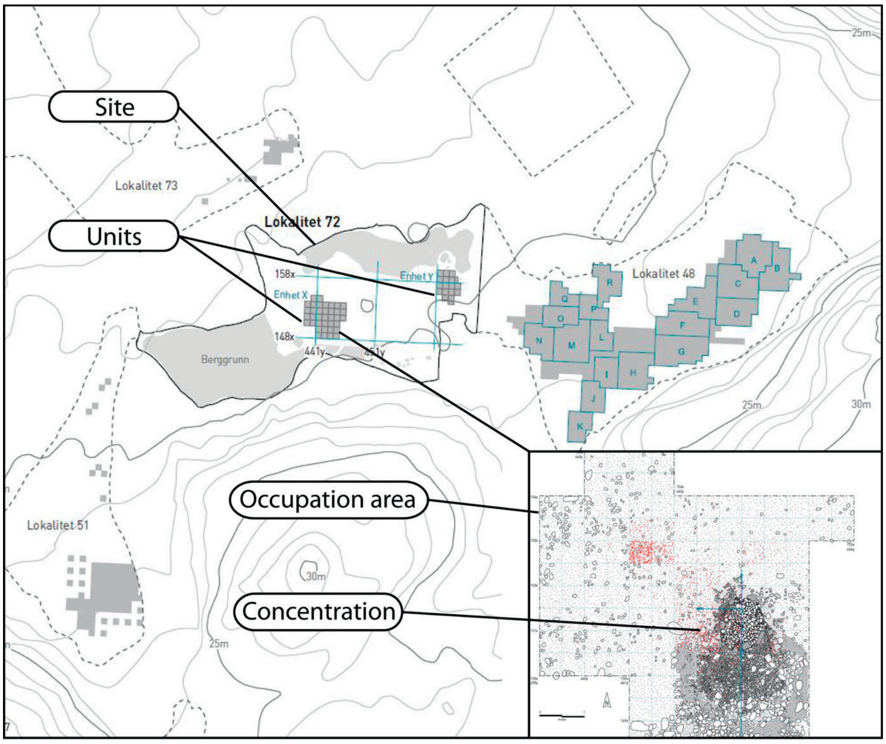


Figure 2. Terms used in the analysis to describe different site elements. The example is based on Site 72 from the Ormen Lange complex (Bjerck et al., 2008: figs. 3.573 & 3.576).

The Mountain Sites

The mountain site Reinsvatnet R1 (no. 11 on Figures 1 and 3) was excavated during two seasons in 2006 and 2009 and consisted of a fireplace surrounded by lithics. The lithics analysis indicated two activity areas in close association with each other. Production debris was concentrated around the fireplace, while a distinct work zone, characterized by a number of discarded tools, lay close by. The site was interpreted as the result of a single occupation. The fireplace was radiocarbon-dated to 9100–8600 cal BC (Callanan, 2006).

Sandgrovbotnen (no. 10 on Figure 1) was a small site discovered in the 1960s and excavated in 1970. This revealed an area of *c.* 6 m^2, cleared of stones and boulders, within which lithics were deposited (Sjøvold, 1970). Sandgrovbotnen has since been interpreted as a short-term occupation because of the size and character of the site. Typologically the lithics place the site in the Early Mesolithic or 9500–8000 cal BC (Callanan, 2007: 45–46).

Brannhaugen (no. 12 on Figure 1) was excavated in 2001. Parts of the site were disturbed during the construction of a mountain cabin, but the material recovered on the site suggests that this site was visited more than once. The distribution of the lithics indicates that a small temporary structure like a tent had probably been erected during occupation. The site was dated typologically to between 9500 and 8000 cal BC (Bjerck & Callanan, 2005).

Figure 3. *Landscape contrasts in central Norway. Views of excavations at two Early Mesolithic sites, the mountain site at Reinsvatnet R1 and coastal sites at Hestvikholmane.* Photograph by permission of NTNU University Museum/Martin Callanan (top) and Silje E. Fretheim (bottom).

These sites and units (hereafter simply referred to as 'sites') and assemblages will be compared in terms of the factors listed below.

Factors Studied

In order to investigate how Early Mesolithic sites were organized and used in different ecozones within the same geographical region, we charted the similarities and differences between the twelve artefact assemblages. Four different factors were taken into account: site organization, artefact composition, projectiles, and lithic raw material.

Site Organization

In a comprehensive study of Stone Age living spaces on the coast of western Norway, Nærøy (1988, 2000) analysed past behaviour as reflected in the relationship between artefact distribution and structural features on several sites (Nærøy, 2000: 90). His analysis encompassed elements including structural features, site size, artefact numbers, and distribution patterns. The aim was to identify activities undertaken on site and to single out individual activity areas. In the current study, we largely follow this approach by focusing on characteristics related to site organization: the quantity of artefacts deposited, the number of times the site was used and reused, the size of the site, and the type of structures associated with it. Similarities or differences across these categories should cast light on how the spatial organization of sites varied across the landscape.

Artefact Composition

Here we examine the relationship between the different artefact types and classes found in our assemblages. Analysing this relationship reveals what kinds of tools were produced or in use on the sites, and documents how lithic production and maintenance was organized across sites in different zones. Similar inter- and intra-site analyses carried out on coastal sites in central Norway have demonstrated structural similarities in Early Mesolithic lithic assemblages (Bjerck et al., 2008). Given the differences in the distribution of food resources and lithic raw material between the ecozones (see below), it is possible that differences in tool use and raw material reduction will become evident across the assemblages. We compare artefact composition according to tool class, in order to highlight differences and similarities between the sites. The analysis also presents an opportunity to search for higher order structural relationships within and across the inventories. Are there similarities in the types and proportions of artefacts, debitage, and tools recovered? Is there a common basic structure across inventories? In other words, is there a 'typical' Early Mesolithic assemblage?

Projectiles

Analysing assemblages at site level gives a good overview of technical relationships. In order to look more closely at possible ecozone-specific adaptations and specializations, we can also focus on individual classes of artefacts that might reflect these kinds of processes. Projectile points are an interesting category in this regard, as they are present on all sites in both zones and were used to hunt varying prey throughout the region. Earlier comparisons of projectile inventories from Early Mesolithic sites on the coast and mountains of south-western Norway suggest that it is possible to identify discrete chronological and perhaps functional differences between the projectile assemblages found on sites in these zones (Bang-Andersen, 2003b: 13). Perhaps hunting marine mammals and terrestrial mammals demanded different types of projectiles? Is this reflected in the projectiles found on the different sites? We shall compare the metrics of projectile points from the sites under study to see if there are differences in the projectile inventories used in the different ecozones.

Lithic Raw Material

The distribution of useable lithic raw materials varied across the landscape in the Early Mesolithic and throughout the Stone Age. Flint was the lithic raw material most commonly used for tool production in the Early Mesolithic in central Norway. Flint nodules are mostly found in natural secondary deposits on beaches, having been transported on ice floes from primary deposits elsewhere (Pettersen, 1999). Alternatives such as quartz, quartzite, and rock crystal were also available at different locations. Nonetheless, it has been shown that in southern Norway flint is dominant on Early Mesolithic mountain sites, implying that flint was being carried to inland sites rather than replaced by locally available types (Tørhaug & Åstveit, 2000; Bang-Andersen, 2003b: 16). Are the same tendencies discernible in Early Mesolithic central Norway? The aim of this analysis is to see how differential access to useable lithic raw materials affected Early Mesolithic sites across the ecozones of central Norway.

Our analysis is by no means exhaustive; there are numerous additional factors and details that could be compared between the sites. Our purpose is to reveal basic structural similarities and differences that should shed light on the adaptive strategies employed by the Postglacial colonizers of Norway. In the following section we present the results of these analyses.

Results

Site Organization

Lithics are the main marker of sites from this period and are often scattered over a wide area. However, dense concentrations of lithics are also often visible within this larger framework. In this analysis the term ‘site size’ refers to the size of the larger lithic scatters, whereas ‘lithic concentration’ refers to the size of dense lithic accumulations as interpreted by the excavators. While site size reflects the extent of activity on a given site, the size of lithic concentrations gives us a more finely grained impression of how the sites were organized and used in time and space.

Table 2 shows that site size in the coastal zone ranges between 8 and 40 m^2. In recent years, excavations on coastal sites have involved extensive use of mechanical excavators, which is reflected in the data here that includes several modern excavations. Mountain sites are usually excavated manually and delimited by way of test pits. This may be why site size tends to be smaller in the mountain zone. Despite these differences, the size range is very similar in both ecozones. None of the Early Mesolithic sites is smaller than 6 m^2.

Previous studies have shown that the most common Early Mesolithic reduction technique appears to have been soft hammer, direct percussion that produces relatively large amounts of debitage (Kutschera, 1999; Fuglestvedt, 2007). Table 2 illustrates that the number of artefacts recovered from our sites varies from a few hundred to several thousand. The most abundant assemblages are located on the coast as shown by the Ormen Lange assemblages. None of the mountain assemblages is of comparable size; the largest (Reinsvatnet R1) appears as medium-sized when compared to the largest coastal assemblages. On the other hand, smaller, less abundant assemblages are found both on the coast and in the mountains.

Nearly all the sites in the study consist of one dense concentration of lithic debitage and tools. The one exception is the mountain site of Reinsvatnet R1, where two distinct lithic concentrations were identified. The differences between the coastal and mountain zones in terms of size become less clear when looking at the lithic concentrations. While they range between *c.* 2 and 12 m^2 in extent, the majority measure between 6 and 10 m^2 both on the coast and in the mountains.

It can be challenging to estimate the exact number of occupations on a non-stratified site. Early Mesolithic sites are thought to be the product of either single or repeated occupations. Excavators often form a holistic impression of whether a particular site is the product of such single or multiple occupations. In most excavation reports, estimates of the number of episodes within an activity area are based either on the total number of artefacts or on the number of different raw material types recovered. The number of occupations listed in Table 2 is based on interpretations and analyses from the respective excavation reports (see references in Table 1). The results from sites in the coastal zone indicate that several were occupied on two or more occasions. Mountain sites appear more likely to represent single occupations. The site at Brannhaugen is an exception. Although small in size, the site was interpreted as a hunting station used on more than one occasion (Bjerck & Callanan, 2005).

The analysis further shows that fireplaces are a regular feature on Early

Table 2. *Analysis of Site Organization on Twelve Early Mesolithic Sites in Central Norway.*

Site	Site size	Number of lithic concentrations	Size of lithic concentration (s)	Number of artefacts	Number of occupations	Traces of fireplace	Traces of dwelling
Ormen Lange Site 48, Unit A	20 m^2	1	6–7 m^2	11,020	Multiple		
Ormen Lange Site 48, Unit G	27 m^2	1	6–7 m^2	9366	Multiple	x	x
Ormen Lange Site 48, Unit I	10 m^2	1	3 m^2	2631	One	x	
Ormen Lange Site 48, Unit J	8 m^2	1	1.5 m^2	853	One	x	
Ormen Lange Site 72, Unit X	20 m^2	1	8 m^2	1742	One	x	x
Ormen Lange Site 72, Unit Y	14 m^2	1	7 m^2	511	One	x	x
Hestvikholmane Site 3	40 m^2	1	8–10 m^2	3956	Two or more	x	x
Hestvikholmane Site 2–2012	45 m^2	1	9 m^2	3568	Two or more	x	x
Kvernberget Site 20	20 m^2	1	7 m^2	753	One	x	x
Reinsvatnet R1	40 m^2	2	9–12 m^2	4521	One	x	
Sandgrovbotnen	6 m^2	1	6 m^2	898	One		x
Brannhaugen	10 m^2	1	10 m^2	918	Two or more		

Mesolithic sites within the study area. These fireplaces are often small (<1 m^2), simple stone-set features containing charcoal, and in some cases heated flints. In most cases, the fireplace also served as a focal point for knapping activities. Four of the sites lack recognizable fireplaces. Interestingly, this includes Ormen Lange Site 48, Unit A, which is the largest site in the present analysis. Two of the mountain sites also lack fireplaces, although the records from the excavation at Sandgrovbotnen do mention at least one concentration of charcoal within the site area. In sum, there is no clear evidence for differential use of fireplaces on Early Mesolithic sites between the coast and mountains. However, the absence or presence of fireplaces may well be as much a function of differential preservation as of any variation in past behaviour.

The traces of dwellings found on sites in the study area include tent rings, constructed floor platforms, and cleared living spaces. Tent rings and floor platforms are found on five of the coastal sites (Table 2). Hestvikholmane Site 2–2012 and the mountain site at Sandgrovbotnen have an intentionally cleared living space. None of the mountain sites contained distinct traces of dwelling structures.

Artefact Composition

Figure 4 presents all the artefacts found on the sites studied, and shows the relationship between tools, blades and the different classes of debitage on each site. In this analysis differences across the ecozones are visible. On the coastal sites, flakes and production debris constitute

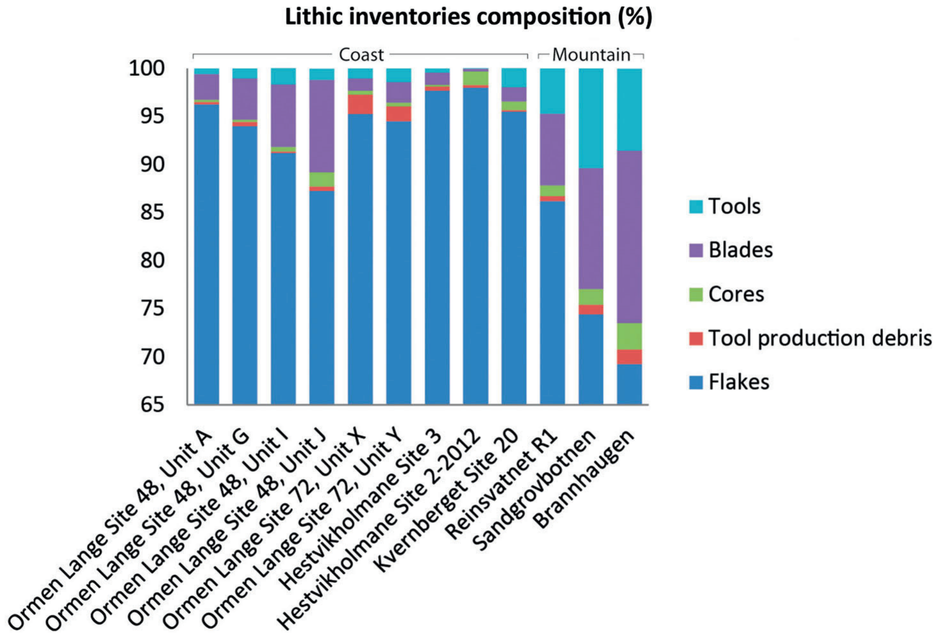


Figure 4. *Comparative overview of the composition of the Early Mesolithic inventories found on the sites included in this study. The inventories are divided into five main artefact categories. The values presented are percentages of the total inventory.*

well over 90 per cent of the total assemblage, with an average at around 94 per cent. Ormen Lange Site 48, Unit J deviates from this pattern with only 88 per cent debitage. The same site has a correspondingly higher percentage of blades. Tools constitute less than 2 per cent of the total assemblage on coastal sites. The mountain sites have a generally lower percentage of flakes and debris: Sandgrovbotnen and Brannhaugen have 70–75 per cent, while Reinsvatnet R1 has 87 per cent. Relatively large amounts of blades and cores are present on all three mountain sites, and a high percentage of tools (*c.* 5–10 per cent) is characteristic.

The 'tool' category in Figure 4 can be further divided into two sub-categories: 'formal' and 'informal'. The term 'formal tool' refers to secondarily modified flakes or blades with a recognizable, intentional form and/or function. Formal tools commonly found in Early Mesolithic assemblages include flake- and core-adzes, projectile points, scrapers, burins, and knives. The 'informal tool' category comprises blades and flakes with retouch and/or visible use-wear (see Callanan, 2007). The analysis in Figure 5 shows that in the coastal zone, formal tools generally make up around 40–50 per cent of the total tool inventory. Two sites deviate from this general pattern: both Ormen Lange Site 72, Unit Y and Hestvikholmane Site 2–2012 show a much higher dependence on formal tool categories. In the mountain ecozone, the formal component is lower and lies between *c.* 25 and 40 per cent.

The composition of formal tools on the different sites reveals several interesting trends (Figure 5). Although adzes are absent from three coastal sites, the analysis shows that flake- and core-adzes were common in the coastal zone in the Early

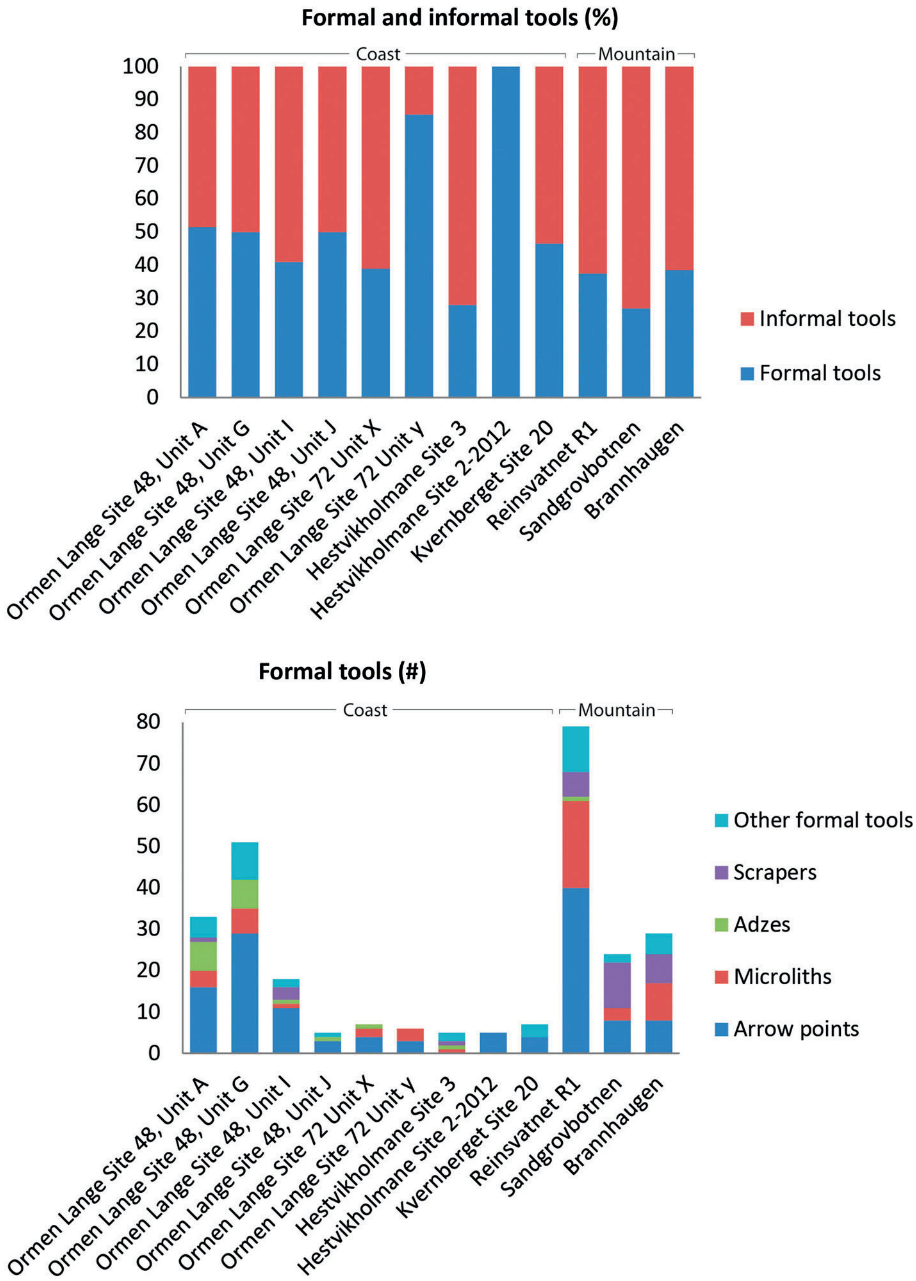


Figure 5. *Formal and informal tool analysis. Top: The relation between formal and informal tools by percentage on each site. Bottom: The number of formal tools, sorted by categories, present on each site.*

Mesolithic. Only one flake-adze was recovered in the mountain zone, at Reinsvatnet R1. This pattern confirms earlier observations regarding the geographical distribution of Early Mesolithic adzes in other regions (Bjerck, 1995: 135).

Projectile points are present in all assemblages. In fact, on two of the coastal sites

(Hestvikholmane Site 2–2012 and Ormen Lange Site 72, Unit Y) projectile points are the only formal categories recovered. The mountain site at Reinsvatnet R1 is the site with the highest number of points, and—generally speaking—projectile points play a more significant role in formal tool inventories in the mountains when compared with the coastal group.

Scrapers too play a more important part in mountain inventories compared to coastal assemblages. A similar tendency was also demonstrated in south-western Norway during the Early Mesolithic (e.g. Bang-Andersen, 2003b: 16).

Projectiles

Projectile points are found on all of the sites considered in this study. We have grouped the material into two main categories: tanged points (including single-edged, obliquely edged, and 'self-pointed' with retouch only in the tang area) and microliths (including lanceolate and rhombic forms) (see Ballin, 1996; Waraas, 2001: 38–48). The analysis is based on all complete and undamaged projectile points recovered (Figures 6 and 7); impact fractured, damaged, or incomplete points have been excluded. Thus the

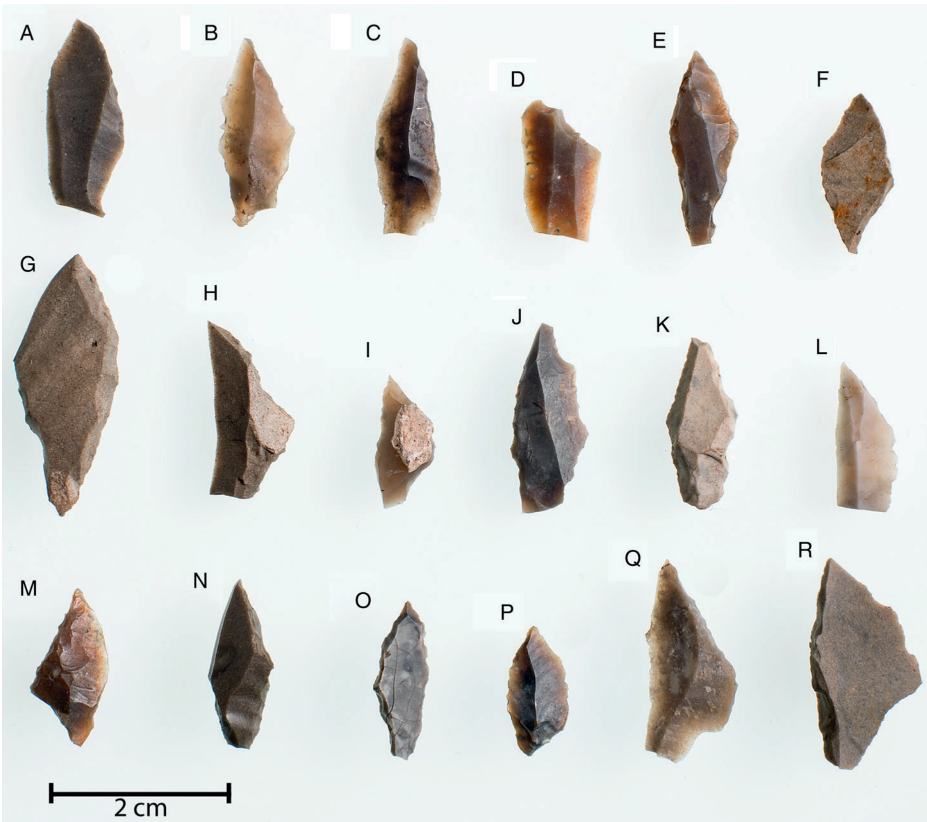


Figure 6. *Early Mesolithic flint projectiles found on coastal sites in central Norway. A–C: Ormen Lange Site 48 Unit G; D–F: Ormen Lange Site 48 Unit A; G–I: Ormen Lange Site 72 Unit X; J: Ormen Lange Site 48 Unit I; K: Ormen Lange Site 48 Unit J; L: Hestvikholmane 3; M & N: Hestvikholmane 2–2012; O & P: Kvernberget Site 20; Q & R: Ormen Lange Site 72 Unit Y.* Photograph by permission of NTNU University Museum/Åge Hojem.

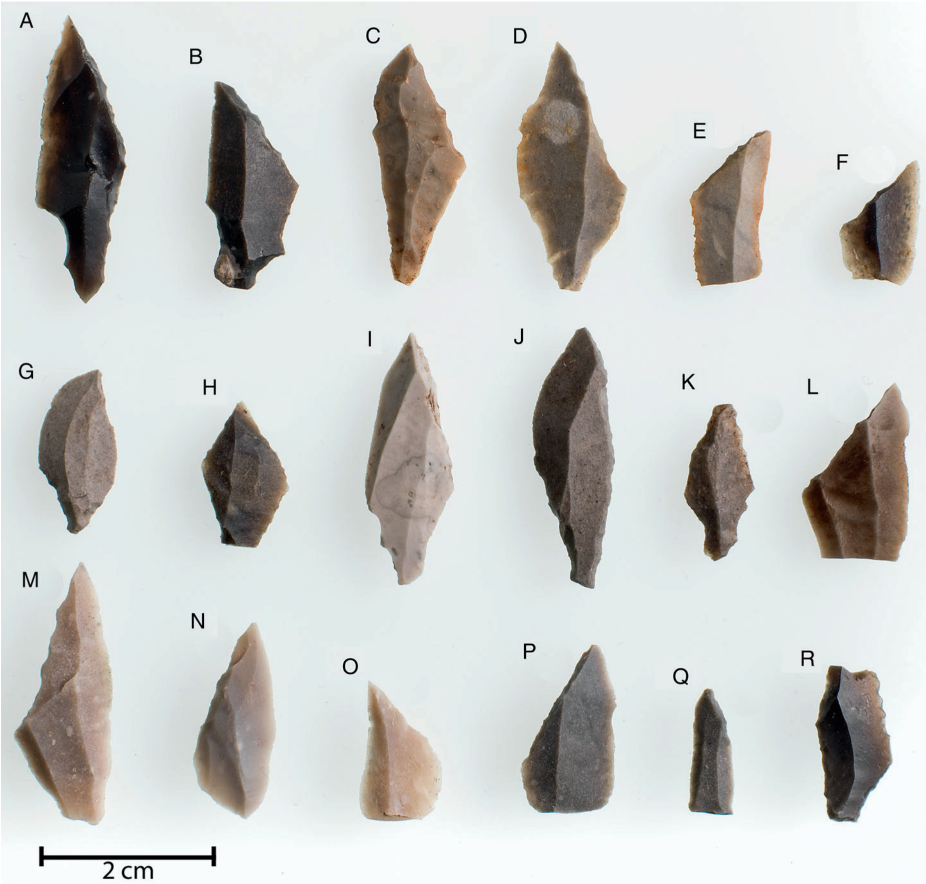
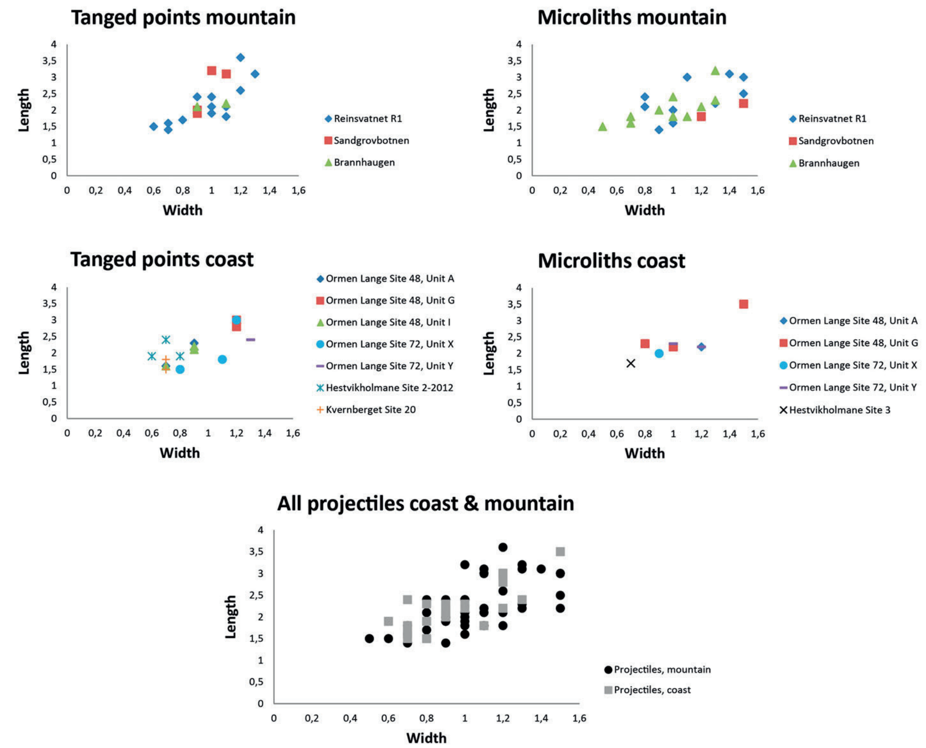


Figure 7. *Early Mesolithic flint projectiles found on mountain sites in central Norway. A–H: Reinsvatnet R1; I–L: Sandgrovbotnen; M–R: Brannhaugen.* Photograph by permission of NTNU University Museum/Åge Hojem.

analysis does not give comparative information about the frequency of projectile classes across the ecozones but focuses on possible metric variations. The maximum length and width of each point is measured.

In Figure 8, the metric values for each point are plotted according to site, typological class, and ecozone. Among tanged points on the coast, the length range is 1.5–3 cm, and the width varies between 0.5 and 1.5 cm. Microliths from the coastal ecozone measure between 1.5 and 3.5 cm in length. However, the majority are under 2.5 cm long and between 0.5 and 1.5 cm wide. In the mountains, tanged points measure between 1.5 and 3.5 cm in length and between 0.5 and 1.5 cm in width. The microliths are 1.5–3 cm long and 0.5–1.5 cm wide. When plotted together the projectiles appear as a homogeneous group with respect to metric dimensions. While there is a slight tendency towards longer and wider points in the mountains, a single lanceolate microlith from Ormen Lange Site 48, Unit G demonstrates that points of comparable size are present in the coastal zone too.

One aspect of the frequency of projectile classes across the ecozones deserves further



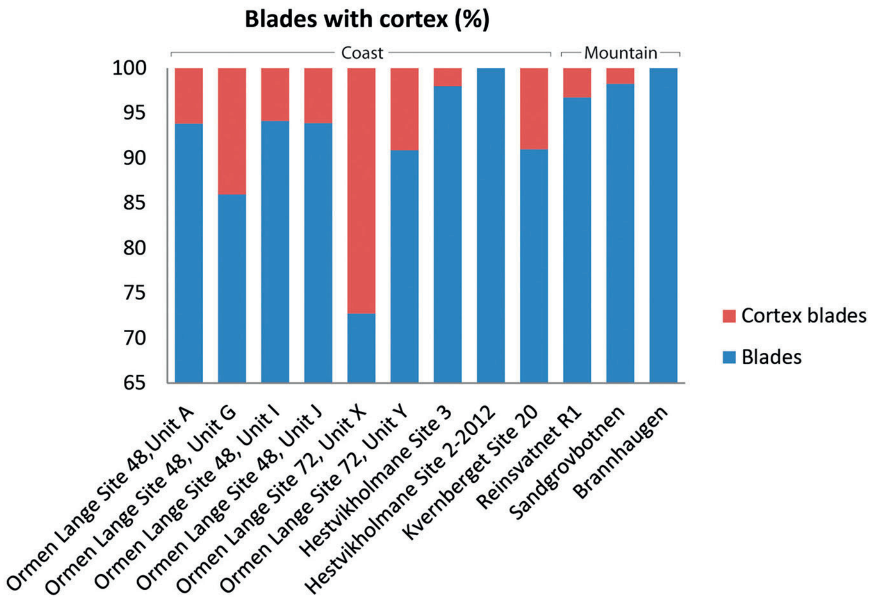
	Total number found on site			Total number in analysis		
Site	**Tanged points**	**Microliths**	**Total**	**Tanged points**	**Microliths**	**Total**
Ormen Lange Site 48, Unit A	16	4	**20**	3	1	**4**
Ormen Lange Site 48, Unit G	29	6	**35**	2	3	**5**
Ormen Lange Site 48, Unit I	11	1	**12**	3	0	**3**
Ormen Lange Site 48, Unit J	3	0	**3**	0	1	**4**
Ormen Lange Site 72, Unit X	4	2	**6**	3	0	**3**
Ormen Lange Site 72, Unit Y	3	3	**6**	1	2	**3**
Hestvikholmane Site 3	0	1	**1**	0	1	**1**
Hestvikholmane Site 2-2012	5	0	**5**	3	0	**3**
Kvernberget Site 20	4	0	**4**	2	0	**2**
Reinsvatnet R1	40	21	**61**	14	10	**24**
Sandgrovbotnen	8	3	**11**	4	2	**6**
Brannhaugen	8	9	**17**	3	9	**12**

Figure 8. *Projectile analysis. The metric data for a selection of projectiles are shown with the sites organized according to ecozone. The table gives both the total number of projectiles recovered and the numbers used in the analysis.*

comment. Figure 8 shows the total number of complete and damaged, fragmented or incomplete projectile points found on all sites before selection for the metric analysis. This appears to indicate that microliths are more common on mountain sites than on coastal sites. Despite this, there is little to substantiate the use of differentiated or specialized projectile points in either zone.

Lithic Raw Material

Figure 9 shows that flint is the dominant raw material on all sites. In six of the nine



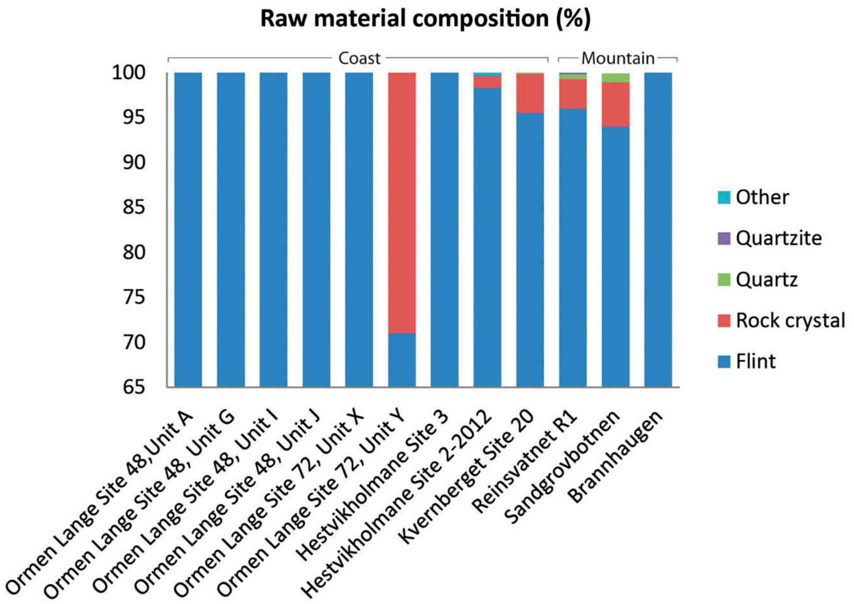


Figure 9. *Reduction strategy and lithic raw material analysis (percentage).*

coastal assemblages, flint is almost the only material present. Hestvikholmane Site 2–2012 has a small porphyry component, but the recovered pieces display no sign of reduction or use. A more striking exception is Ormen Lange Site 72, Unit Y, where rock crystal makes up nearly 30 per cent of the lithic raw material found at the site. Flint is also dominant on the mountain sites. Rock crystal, quartz, and quartzite make up just 4–6 per cent of the total raw material on two of the three mountain sites. At Brannhaugen only flint was used.

As previously noted, flint was not evenly distributed throughout the region in the Early Mesolithic. By comparing the number of cortex blades found on each site, we gain a more detailed view of how this variable access to lithic resources across the ecozones was managed. Cortex blades are blades where at least 50 per cent of the outer cortex usually found on natural flint nodules is still present. Tracking the number of cortical blades gives an indication of whether the initial reduction of natural flint nodules took place on a given site or not.

On the coastal sites, blade inventories usually consist of between 5 and 15 per cent cortex blades. Ormen Lange Site 72, Unit X is an outlier in this regard, with almost 30 per cent cortex blades. The two Hestvikholmane coastal sites have a very low cortex blade component. The number of cortex blades is also low on the three mountain sites in this analysis: none was found at Brannhaugen, and the cortex blade component on the two remaining mountain sites lies well below 5 per cent.

Discussion

The analysis above underlines a number of structural similarities in how sites were organized and used in both mountain and coastal landscapes during the Early Mesolithic in central Norway.

Across the ecozones, the sites appear as lithic scatters measuring between 6 and 45 m^2. Occupation areas usually contain a denser concentration of lithics that range between *c.* 2 and 12 m^2. The number of lithics contained within these areas ranges between *c.* 1000 and 11,000 artefacts. However, as many sites appear to have seen repeated deposition events, it is likely that the basic Early Mesolithic unit is more in the order of 1000–2000 lithics, as has been suggested by earlier studies (e.g. Nygaard, 1987; Nærøy, 2000; Bjerck, 2008; Bjerck et al., 2008: 564). Although the analysis contains examples of sites that are both larger and smaller than the general measurements, there appears to be a basic settlement size that is repeated across the ecozones during the Early Mesolithic. The dimensions and character of the basic settlement units among the analysed sites thus paint a picture similar to that suggested previously (Bjerck et al., 2008: 565–66): it envisages Early Mesolithic hunters as organized in small groups of a similar size, which remained on specific sites for short periods as they moved across and between the ecozones.

The overall Early Mesolithic site distribution pattern indicates that the coastal zone played a primary role in the settlement system. In our analysis, all the coastal sites were part of larger site complexes situated in topographical settings that were used and reused on several occasions throughout the Early Mesolithic, while the mountain sites were individual sites. It can be argued that intensive archaeological activity and the use of more efficient excavation methods on the coast has resulted in the discovery of larger site complexes there than in the mountain zone. Yet the occupation areas on the coastal sites in the study area tend to have larger lithic accumulations than their counterparts in the mountain zone, perhaps reflecting a more intensive use of the former locations. Our study of organizational patterns across ecozones confirms the impression that Early Mesolithic populations in central Norway relied heavily on the coastal zone, as proposed by other studies from the region (Bjerck, 1983; Svendsen, 2007; Bjerck et al., 2008; Breivik, 2014).

Remains of dwelling structures vary to such a degree that it is difficult to generalize beyond the fact that the living areas appear to have been of a similar size. There was probably a broad spectrum of dwelling structures in use across the landscape, ranging from open look-out positions to more substantial structures. In a recent study, Fretheim and colleagues (Fretheim et al., in press) emphasize not only the different forms of dwellings that were in use during the Early Mesolithic, but also the level of mobility and permanence that these must have represented. Here it is suggested that fully portable dwellings, such as tents, were the most common dwelling form in this period, and that more substantial structures may have included a combination of fixed construction elements and portable materials (see also Bang-Andersen, 2003a; Bjerck et al., 2008). Locales in the landscape that were targeted for specific reasons may have led to investing in more solid dwelling constructions (Fretheim et al., in press, with references). In our study, we find no evidence for a clear distinction between mountain and coast with respect to the permanence or portability of the dwelling structures in use. Apart from the durable dwelling remains at Ormen Lange Site 72, Unit X, structures in both ecozones seem to be portable and temporary dwellings. The differences that are evident in terms of construction type and portability were probably due to other circumstances.

When it comes to the artefact assemblages, the inventories across the ecozones seem to share a fundamental structure. Though the proportions vary, the inventories appear as accumulations of flakes, cores, blades, and tools that reflect all the steps of lithic tool production, from primary reduction of flint nodules, through production, maintenance, and use, to discard of artefacts. The underlying structure suggested for the group of coastal sites on Ormen Lange, with a fixed repertoire of tools that is likely to reflect similar arrays of activity (Bjerck et al., 2008: 558, 565), appears to be valid for other coastal sites in the region. At the same time, our analysis also highlights differences in tool composition between coastal sites: in two assemblages (Hestvikholmane Site 2–2012 and Ormen Lange Site 72, Unit Y) projectiles are the only formal tool component. These 'deviant' assemblages seem to represent a narrower range of activities than encountered on other sites. It has been argued that there is a correlation between assemblage diversity and assemblage size: small assemblages tend to be limited in diversity, while large assemblages tend to have a broader range. This builds on the argument that large assemblages are archaeological palimpsests made up of multiple occupation events, each of which could involve quite different activities (Bettinger, 1991: 79 with reference to Jones et al., 1983). Our largest assemblages do indeed tend to be quite diverse and similar in composition. However, the small Ormen Lange Site 72, Unit X and Hestvikholmane Site 3 demonstrate that there is no absolute relationship between size and artefact diversity. It is therefore likely that the 'deviant' assemblages are the result of different sets of activities taking place on these sites. When we consider that hundreds of sites have been discovered in the coastal ecozone, it seems only reasonable that there should be a range of different site types and functions governed by various non-functional factors such as the changing seasons, weather conditions, and resource availability. Looking beyond this variation, the general impression is that a wide range of more or less fixed activities were carried out on the coastal sites (see Bjerck et al., 2008). The three mountain assemblages are less varied and show a larger degree of inter-assemblage similarity with respect to tool categories than the coastal sites. Structural similarities across the mountain assemblages are further reflected in the relationship between formal and informal tools and between tools and production debris. These assemblages thus appear to reflect a narrower set of activities taking place on sites within the mountain ecozone. Yet the lithic package that we see in the mountains is made of elements that originate from the broader repertoire seen on the coast.

Several researchers see a connection between projectiles and terrestrial big game hunting (e.g. Bang-Andersen, 1996: 431; Fuglestvedt, 2005: 132). Fuglestvedt, in particular, argues that reindeer would have thrived on the coast during the Early Mesolithic and would consequently have been hunted in these environments. But projectiles also frequently appear on Early Mesolithic sites on small, remote islands that probably did not support populations of large terrestrial mammals. Projectile points were therefore probably used on a wide range of prey. Overall, the repertoire of arrow points found on all sites in our study are quite similar. It seems unlikely that the relatively small variations in size and form between the coastal and mountain assemblages reflect significant differences in functionality or the type of prey hunted. On the contrary, what we are seeing here appears to be a flexible tool technology, where blades of suitable sizes and properties were worked into projectiles that were then used for prey of different sizes and anatomies. The single notable difference between the projectile inventories is the higher number of microliths on mountain sites when compared with the coast. A pair of Early Mesolithic arrowshafts recovered in Sweden demonstrates that microliths were mounted laterally onto the shafts, presumably to increase the wounding power of the arrows on large prey (Larsen & Sjöström, 2011). Perhaps Early Mesolithic hunters in central Norway adapted their arrows to include lateral edges when hunting reindeer in the mountains. This would go some way to explaining the larger number of microliths on mountain sites. But even if this interpretation proves to be correct, this is still only a slight technical variation within in a projectile repertoire that was fundamentally identical in both ecozones.

The data sets that we have analysed suggest that the Early Mesolithic colonizers were organized in a way that produced similar archaeological imprints across the landscape. Referring to Lewis Binford's forager–collector continuum (Binford, 1980), the sites may be expressions of a 'residential mobility type', where the entire social unit moved to the resources to be gathered. The residential mobility type, which is practised by groups that Binford terms 'foragers', will produce two types of sites: 'residential bases' and 'locations'. The 'residential bases' are the loci from which foraging parties originate and where most processing, manufacturing, and maintenance activities take place (Binford, 1980: 9). They are characterized by a low diversity in tools and features, as well as a high degree of similarity between the site assemblages (Chatters, 1987: 342). A 'location' is a place where extractive tasks are carried out. The overall low visibility of the latter sites makes them hard to detect (Binford, 1980: 9). Forager strategy is further associated with high mobility, low-bulk inputs, and regular daily food procurement strategies organized on an encounter basis, as opposed to collector strategy which is associated with larger social units which split into specially organized task groups that seek out specific resources. Collectors thus tend to produce diverse sites, ranging from large residential bases (often with specialized activity areas and permanent or semi-permanent dwellings), field camps (temporary bases for a task group), stations, locations, and caches (where food is temporarily stored) (Binford, 1980: 9–12).

Our sites clearly represent similarly sized groups that approached the various resource situations with the same tool technology and site organization. Nevertheless the artefact inventories represent slightly varied patterns of activity and production across the zones. On coastal sites the amount of lithic waste and debris is much greater than on mountain sites. It seems that a higher degree of continuous production and maintenance of tools was taking place here, as if to be ready for a wide range of tasks, including the preparation of cores and blanks to bring along on inland hunting expeditions during certain seasons. The high percentage of tools on mountain sites supports the idea that they were camps where gearing-up and tool maintenance sessions connected to hunting events were undertaken (Callanan, 2007 with reference to Bleed, 1986). The hunting parties probably had a different composition than that of the basic social unit. It may be argued that the colonizers of Early Mesolithic Norway were foragers with occasional collector behaviour (Breivik et al., in press).

Olsen (1992: 255), Bergsvik (1995), and Bang-Andersen (1996: 436–39) propose similar settlement models for the Early Mesolithic in western Norway. In these models, coastal bases are linked to special task sites in the mountains by intermediary sites located at strategic points along inner fjord basins. In central Norway, a few sites with clear Early Mesolithic components, such as Innvik and Torvik (see location on Figure 1, nos. 13 and 14), are known from inner fjords (Svendsen, 2007: 85–87), and this would suit such models. Our analysis adds detail to this general picture by demonstrating that forays into the fjord arms and mountain sites were based on sites of a similar size and structure to those used on the coast. Even allowing for a degree of site variation in terms of size and function, the overriding impression is that small group size and high mobility was fundamental to Early Mesolithic settlement across ecozones—it allowed its inhabitants to move easily and quickly through and across the landscapes whenever necessary.

Conclusion

The overall aim of this analysis has been to cast further light on the colonization process that unfolded through time along the western flank of Scandinavia during the Early Holocene. At that time, Early Mesolithic groups moved into a complex and demanding environment and succeeded in populating the region over a short period. During this process, not only did they exploit the coastline and move along it; nearby mountain landscapes were also taken into use. Examining how these populations approached and solved the ecozone puzzle that faced them appears to reveal something essential about Early Mesolithic mobile hunters as expert and successful colonizers.

As people approached the waters along the Norwegian coast shortly after *c.* 10,000 cal BC, they faced a seascape that was familiar, yet different from the territories and landscapes they had left behind in southern Scandinavia. Following the coastline from western Sweden northwards, they mostly passed through passages that were sheltered by islands and skerries. But at times, they also had to cross stretches of open sea that were dangerous and difficult to navigate. Upon reaching south-western Norway they faced a landscape configuration that was radically different to the open, flat landscapes of the north-western coast of Europe and around the North Sea basin. Behind the rich shorelines, skerries, and islands of south-western Norway lay high alpine peaks and mountain plateaux that were clearly visible from the coast. Not only were the distances between these landscapes relatively short, in many cases they were also connected by long fjord arms that were easily navigable. This gave access to seasonal mountain resources, some of which were well known to earlier Palaeolithic continental hunters. They met the same compressed landscape combination in different places along the coast, as was the case in central Norway. Overviews of the distribution of known Early Mesolithic sites show distinct concentrations in these landscape situations (Breivik, 2014). This distribution is probably no coincidence. Combining and timing their hunting activities both *high* in the mountains and *low* along the coasts gave Early Mesolithic groups access to resources that complemented each other in a 'colonizer package' that was apparently quite successful.

The distribution of Early Mesolithic sites shows that colonizers relied heavily on coastal environments and marine resources. Not only are the overwhelming majority of Early Mesolithic sites located along the coast, several large site complexes and dense artefact accumulations also show how particular maritime habitats, areas, and camp spots were visited repeatedly. Moreover, the colonizers seem to have been seeking the most productive marine habitats, suggesting that their movements into the Norwegian landscape were grounded in well-developed knowledge about marine resources and environments, which included navigation and probably hunting by boat. The question is how did these Early Mesolithic groups combine this reliance on the coastal zone with the opportunities offered by the nearby mountainscapes?

Our analysis suggests that the use of a standard, generalized lithic technology, combined with high residential mobility and small group size, enabled the colonizing groups to overcome the risks and difficulties associated with settling and seeking out resources in new and unknown landscapes. The foragers were organized in social units who mainly moved within the coastal zone, but occasionally reorganized into teams of similar size but probably different composition, maintaining the basic site structure while hunting large game in the mountain zone. By staying mobile and using an all-round technology, they were able to respond quickly and effectively to the landscape and environment as it developed around them. These traits enabled them to explore the new landscape and take whatever prey they came across, whether it was from boats or on the land. Recognizing Early Mesolithic colonizers as highly mobile strategic generalists that were drawn to productive coastal/alpine ecotones is an attractive interpretation. It could explain the differential distribution of sites at a national level and the rapidity with which the roughly 2000-km-long coast was settled.

This generalist adaptation sprang from deeper continental cultural roots. The pioneer groups came to the new landscapes with adaptive strategies that were already well-tested in harsh Late-Glacial environments on the continent. In the Pleistocene/Holocene transition, the groups expanded their mobile approach to archipelagic seascapes. As they continued northwards from the North European plains onto the western Scandinavian coast, they faced a new situation where their regular package of tools, technology, site structure, and social organization may or may not have been suitable. Our study suggests that their lifestyle was adaptive and successfully applied to new alpine environments, with only small adjustments necessary in response to raw material and resource variation. It appears that part of the solution to populating and settling new and dynamic Postglacial landscapes lay in keeping constantly on the move in small groups, and not specializing technically in favour of one ecozone over another.

Acknowledgements

We would like to thank Prof. Hein B. Bjerck and Prof. Hans Peter Blankholm for constructive feedback on earlier versions of this manuscript. We are also grateful to three anonymous reviewers whose comments have contributed to improving this article.

ORCID

Heidi M Breivik http://orcid.org/0000-0002-9849-5173
Martin Callanan http://orcid.org/0000-0003-2350-0596

References

Andersen, B.G. & Borns, H.W. 1997. *The Ice Age World*. Oslo: Universitetsforlaget.

Ballin, T.B. 1996. *Klassifikasjonssystem for stenartefakter*. Universitetets Oldsaksamling, Varia 36. Oslo: Universitetet i Oslo.

Bang-Andersen, S. 1996. Coast/Inland Relations in the Mesolithic of Southern Norway. *World Archaeology*, 27(3):427–43.

Bang-Andersen, S. 2003a. Encircling the Living Space of Early Postglacial Reindeer Hunters in the Interior of Southern Norway. In: L. Larsson, H. Kindgren, K. Knutsson, D. Loeffler and A. Åkerlund, eds. *Mesolithic on the Move. Papers Presented at the Sixth International Conference on the Mesolithic in Europe*. Oxford: Oxbow, pp. 193–204.

Bang-Andersen, S. 2003b. Southwest Norway at the Pleistocene/Holocene Transition: Landscape Development, Colonization, Site Types, Settlement Patterns. *Norwegian Archaeological Review*, 36(1):5–25.

Bang-Andersen, S. 2012. Colonizing Contrasting Landscapes. The Pioneer Coast Settlement and Inland Utilization in Southern Norway 10,000–9,500 Years Before Present. *Oxford Journal of Archaeology*, 31(2):103–20.

Bang-Andersen, S. 2013. Prehistoric Reindeer Hunting in South-West Norway with Emphasis on the Period 1000 BC to AD 1000: Overview, Retrospect and Perspectives. In: O. Grimm and U. Schmölcke, eds. *Hunting in Northern Europe until 1500 AD: Old Traditions and Regional Developments, Continental Sources and Continental Influences*. Neumünster: Wachholtz, pp. 41–55.

Bergsvik, K.A. 1995. Bosetningsmønstre på kysten av Nordhordland i steinalder. En geografisk analyse. *Arkeologiske skrifter, Arkeologisk institutt, Bergen Museum*, 8: 111–30.

Bettinger, R.L. 1991. *Hunter–Gatherers. Archaeological and Evolutionary Theory*. New York: Plenum.

Binford, L.R. 1980. Willow Smoke and Dogs' Tails: Hunter–Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity*, 45(1): 4–20.

Bjerck, H.B. 1983. Kronologisk og geografisk fordeling av mesolitiske element i Vest- og Midt-Norge. Unpublished Mag. art. dissertation, University of Bergen.

Bjerck, H.B. 1995. The North Sea Continent and the Pioneer Settlement of Norway. In: A. Fischer, ed. *Man and Sea in the Mesolithic*. Oxford: Oxbow, pp. 131–43.

Bjerck, H.B. 2008. Norwegian Mesolithic Trends: A Review. In: G. Bailey and P. Spikins, eds. *Mesolithic Europe*. Cambridge: Cambridge University Press, pp. 60–106.

Bjerck, H.B., Åstveit, L.I., Gundersen, J., Meling, T., Jørgensen, G. & Normann, S. eds. 2008. *NTNU Vitenskapsmuseets arkeologiske undersøkelser Ormen Lange Nyhamna*. Trondheim: Tapir Academic Press.

Bjerck, H.B. & Callanan, M. 2005. Brannhaugen. Unpublished report. NTNU University Museum, Trondheim.

Bleed, P. 1986. The Optimal Design of Hunting Weapons: Maintainability or Reliability. *American Antiquity*, 51(4): 737–47.

Brede, A. 2012. Arkeologisk undersøkelse i forbindelse med utbyggingsplaner for Hestvikholmane industriområde, Averøy kommune, Møre og Romsdal, 2012.

Lokalitet 1 og 2. Unpublished report, NTNU University Museum, Trondheim.

Breivik, H.M. 2014. Palaeo-Oceanographic Development and Human Adaptive Strategies in the Pleistocene–Holocene Transition: A Study from the Norwegian Coast. *The Holocene*, 24(11):1478–90.

Breivik, H.M. & Bjerck, H.B. in press. Early Mesolithic Central Norway: A Review of Research History, Settlements and Tool Tradition. In: H.P. Blankholm, ed. *The Early Settlement of Northern Europe – Economy, Settlement and Society*. Sheffield: Equinox.

Breivik, H.M., Bjerck, H.B., Zangrando, A.F. J. & Piana, E.L. in press. On the Applicability of Environmental and Ethnographic Reference Frames: An Example from the High-Latitude Seascapes of Norway and Tierra del Fuego. In: H.B. Bjerck, H.M. Breivik, S. Fretheim, E. Piana, B. Skar, A. Tivoli and A.F.J. Zangrando, eds. *Marine Ventures: Archaeological Perspectives on Human-Sea Relations*. Sheffield: Equinox.

Bronk Ramsey, C. 2009. Bayesian Analysis of Radiocarbon Dates. *Radiocarbon*, 51(1): 337–60.

Callanan, M. 2006. Reinsvatnet. Unpublished excavation report, NTNU University Museum. Trondheim.

Callanan, M. 2007. On the Edge: A Survey of Early Mesolithic Tools from Central Norway. Unpublished MA dissertation, University of Trondheim.

Callanan, M. 2008. Steinalderpionerene i Storlidalen. *Bøgda vår. Årbok for Oppdal historielag*: 5–15.

Chatters, J.C. 1987. Hunter–Gatherer Adaptations and Assemblage Structure. *Journal of Anthropological Archaeology*, 6: 336–75.

Fretheim, S.E., Bjerck, H.B., Breivik, H.M. & Zangrando, A.F.J. in press. Tent, Hut or House? A Discussion on Early Mesolithic Dwellings Emanating from the Site Mohalsen 2012–II, Vega, Northern Norway. In: H.P. Blankholm, ed. *The Early Settlement of Northern Europe – Economy, Settlement and Society*. Sheffield: Equinox.

Fuglestvedt, I. 2005. *Pionerbosetningens fenomenologi. Sørvest-Norge og Nord-Europa 10 200/10 000–9500 BP*. Stavanger: Arkeologisk museum i Stavanger.

Fuglestvedt, I. 2007. The Ahrensburgian Galta 3 Site in SW Norway. Dating, Technology and Cultural Affinity. *Acta Archaeologica*, 78(2):87–110.

Fuglestvedt, I. 2009. *Phenomenology and the Pioneer Settlement on the Western Scandinavian Peninsula*. Göteborg: Bricoleur Press.

Fuglestvedt, I. 2012. The Palaeolithic Condition on the Scandinavian Peninsula: The Last Frontier of a 'Palaeolithic way' in Europe. *Norwegian Archaeological Review*, 45(1):1–29.

Grøndahl, F.A., Hufthammer, A.K., Dahl, S. O. & Rosvold, J. 2010. A Preboreal Elk (*Alces alces* L., 1758) Antler from South-Eastern Norway. *Fauna norvegica*, 30:9–12.

Hufthammer, A.K. 2001. The Weichselian (c. 115,000–10,000 B.P.) Vertebrate Fauna of Norway. *Bollettino della Società Paleontologica Italiana*, 40(2):201–08.

Hufthammer, A.K. 2006. The Vertebrate Fauna of Eastern Norway – From the Ice Age to the Middle Ages. *Kulturhistorisk Museum Skrifter*, 4:191–202.

Jones, G.T., Gayson, D.K. & Beck, C. 1983. Artifact Class Richness and Sample Size in Archaeological Surface Assemblages. In: R. C. Dunnell and D.K. Grayson, eds. *Lulu Linear Punctated: Essays in Honor of George Irving Quimby*. Ann Arbor (MI): Museum of Anthropology, University of Michigan Anthropological Papers, pp. 55–73.

Kutschera, M. 1999. Vestnorsk tidligmesolitikum i et nordvesteuropeisk perspektiv. In: I. Fuglestvedt, T. Gansum and A. Opedal, eds. *Et hus med mange rom. Vennebok til Bjørn Myhre på 60-årsdagen*. AmS-Rapport, Bind A. Stavanger: Arkeologisk museum, Universitetet i Stavanger, pp. 43–52.

Larsson, L. & Sjöström, A. 2011. Early Mesolithic Flint-Tipped Arrows from Sweden. Antiquity 85(330) (December 2011) [accessed 10 November 2015], Project Gallery. Available at: <http://antiquity.ac.uk/projgall/larsson330/>.

Mangerud, J., Gyllencreutz, R., Lohne, Ø. & Svendsen, J.I. 2011. Glacial History of Norway. In: J. Ehlers, P.L. Gibbard and P. D. Hughes, eds. *Quaternary Glaciations – Extent and Chronology: A Closer Look (Developments in Quaternary Science, 15)*, Elsevier, Amsterdam, pp. 279–98.

Nærøy, A.J. 1998. Stone Age Living Spaces in Western Norway. Unpublished Dr. Art. dissertation, University of Bergen.
Nærøy, A.J. 2000. *Stone Age Living Spaces in Western Norway*. British Archaeological Reports International Series 857. Oxford: John & Erica Hedges.
Nygaard, S.E. 1987. Socio- Economic Developments along the Southwestern Coast of Norway between 10,000 and 4,000 BC. In: P. Rowley-Conwy, M. Zvelebil and H.P. Blankholm, eds. *Mesolithic Northwest Europe: Recent Trends*. University of Sheffield, Sheffield, pp. 147–54.
Nyland, A.J. 2012. Lokaliseringsanalyse av tidligmesolittiske pionerboplasser. In: H. Glørstad and F. Kvalø, eds. *HAVVIND – Paleogeografi og arkeologi*. Oslo: Norsk Maritimt Museum & Kulturhistorisk Museum.
Olsen, A.B. 1992. Kotedalen – en boplass gjennom 5000 år. *Bind I. Fangstbosetning og tidlig jordbruk i Vestnorsk steinalder: Nye funn og nye perspektiver*. Bergen: Universitetet i Bergen.
Pettersen, K. 1999. The Mesolithic in Southern Trøndelag. In: J. Boaz, ed. *The Mesolithic of Central Scandinavia*. Oslo: Universitets Oldsaksamlings Skrifter Ny Rekke 22, pp. 153–66.
Sjøvold, T. 1970. Arkeologisk registrering ved Grytten kraftanlegg. Rauma kommune. Unpublished report. NTNU University Museum, Trondheim.
Strøm, I.O. & Breivik, H.M. 2008. Arkeologiske undersøkelser. Reguleringsplan Kvernberget lufthavn. Lokalitet 20. Aktivitetsområde fra eldre steinalder. Unpublished report. NTNU University Museum, Trondheim.
Svendsen, F. 2007. Lokaliteter og landskap i tidlig mesolittisk tid. En geografisk analyse fra Nordvest-Norge. Unpublished MA dissertation, University of Trondheim.
Tørhaug, V. & Åstveit, L.I. 2000. Steinalderboplassene ved Store Fløyrlivatn. *Frá haug ok heiðni*, 2000(1):35–39.
Wammer, E.U. 2006. Arkeologiske undersøkelser av lokalitet 3 i forbindelse med utvidelse av Hestvikholmane industriområde på Averøya, sommeren 2006. Unpublished report. NTNU University Museum, Trondheim.
Waraas, T.A. 2001. Vestlandet i tidleg Preboreal tid. Fosna, Ahrensburg eller vestnorsk tidligmesolitikum? Unpublished cand. phil. dissertation, University of Bergen.
Wygal, B.T. & Heidenreich, S. 2014. Deglaciation and Human Colonization of Northern Europe. *Journal of World Prehistory*, 27:111–44.
Åstveit, L.I. 2009. Different Ways of Building, Different Ways of Living: Mesolithic House Structures in Western Norway. In: P. Woodman and S. McCartain, eds. *Mesolithic Horizons 1*. Oxford: Oxbow, pp. 414–21.

Biographical Notes

Heidi M. Breivik is a PhD scholar in archaeology at the Norwegian University of Science and Technology (NTNU) in Trondheim. Her research focuses on early marine hunter–gatherer groups and human–environment relations in the Pleistocene/Holocene transition.

Address: NTNU University Museum, N-7491 Trondheim, Norway. [email: heidi.breivik@ntnu.no]

Martin Callanan holds a PhD in archaeology from the Norwegian University of Science and Technology (NTNU) in Trondheim. He is a Post-Doctoral researcher at the NTNU University Museum, Trondheim, Norway. His research focuses on various aspects of mountain archaeology, in particular on archaeological alpine snow patches and frozen cultural heritage in general. At present he is coordinator for the international Frozen Pasts Network and Managing Editor of the *Journal of Glacial Archaeology*.

Address: NTNU University Museum, N-7491 Trondheim, Norway. [email: martin.callanan@ntnu.no]

Par monts et par vaux: chasseurs et stratégies de colonisation en Norvège centrale à l'époque postglaciaire entre 9500 et 8000 cal BC

Cet article considère certains aspects du processus de colonisation postglaciaire qui eut lieu en Norvège centrale au début du Mésolithique, entre environ 9500 et 8000 cal BC. La distribution géographique des sites indique que les nouveaux arrivants ont colonisé et exploité une contrée avec des ressources et des paysages et très différents, allant d'un archipel côtier à un environnement alpin. L'analyse de douze ensembles d'objets lithiques provenant du centre de la Norvège nous permet d'examiner comment ces groupes colonisateurs ont fait face à des éco-zones fort variées. Ont-ils aménagé leurs habitats et utilisés leurs connaissances techniques de la même façon ou ont-ils adaptés leurs activités suivant le terrain qu'ils occupaientL'étude de l'organisation des sites, de la composition des ensembles, des techniques de production de projectiles et des matières premières lithiques nous permet d'apporter quelques réponses à ces questions. Les sites étaient apparemment de la même taille et contenaient des structures semblables quoique soient les éco-zones. À part quelques exceptions dans la composition de l'outillage, le matériel lithique ne semble pas différer suivant les zones écologiques. Nous en concluons que l'utilisation d'un outillage lithique générique et standard appartenant à de petits groupes hautement mobiles a permis à ces populations de surmonter les difficultés et les risques associés au nouveau milieu qu'ils ont occupé et exploité. Translation by Madeleine Hummler

Mots-clés: Norvège, débuts du Mésolithique, milieu côtier et montagnard, adaptation généralisée

Über Berg und Tal: nacheiszeitliche Besiedlungsstrategien in Zentralnorwegen zwischen 9500 und 8000 cal BC

In diesem Artikel werden verschiedene Aspekte der nacheiszeitlichen Besiedlungsprozesse, die im frühen Mesolithikum (ca. 9500–8000 cal BC) in Zentralnorwegen stattfanden, untersucht. Die Verbreitung der Fundstellen zeigt, dass die Besiedler auf eine Landschaft mit zwei sehr verschiedenen Geländen—von Inselgruppen bis Hochgebirge—und Rohstoffquellen stießen. Die Auswertung der Befunde von zwölf Fundstellen in Zentralnorwegen ist Anlass zu einer Untersuchung der Art und Weise, wie diese Einwanderer mit den verschiedenen ökologischen Zonen zurechtkamen. Waren ihre Siedlungen und technische Fähigkeiten immer die gleichen oder gab es Anpassungen je nach Bereich? Die Untersuchung der Siedlungsstruktur, der Zusammensetzung der Befunde, der technischen Eigenschaften der Projektile und der Rohstoffe zeigt, dass die Fundstellen hinsichtlich ihrer Flächen und Strukturen in den verschiedenen ökologischen Bereichen ähnlich sind. Abgesehen von einigen Schwankungen in der Zusammensetzung der Geräte, wurden keine Unterschiede oder technische Anpassungen im lithischen Befund in den verschiedenen Ökozonen beobachtet. Wir sind der Ansicht, dass eine standardisierte und allgemein brauchbare Steintechnologie, zusammen mit einer hohen Mobilität und kleiner Gruppengröße, es ermöglichte, die Risiken und Schwierigkeiten einer Besiedlung in einer unbekannten Landschaft zu überwinden. Translation by Madeleine Hummler

Stichworte: Norwegen, frühes Mesolithikum, Küsten- und Berglandschaft, verallgemeinerte Anpassung

Paper 5

Bjerck, H.B. and Breivik, H.M. (2012)

Off shore pioneers: Scandinavian and Patagonian lifestyles compared in the Marine Ventures project.

Is not included due to copyright

Paper 6

Breivik, H.M., Bjerck, H.B., Zangrando, A.F.J. and Piana, E.L. (in press)

On the applicability of environmental and ethnographic reference frames: An example from the high-latitude seascapes of Norway and Tierra del Fuego.

Is not included due to copyright

Appendices

Appendix A: List of 86 sites from central Norway dated by the use of shore-displacement curves. The list is the basis for the temporal analyses and Fig.2 in Paper 2 (Breivik and Bjerck in press) and Fig.4, 5 and 6 in Paper 3 (Breivik 2014)

Appendix B: List of the 244 sites in central Norway presented and analyzed in Paper 2 (Breivik and Bjerck in press)

Appendix C: Lists and site distribution maps of Early Mesolithic sites in Norway. The list is the basis for Fig.3 and Table 2 in Paper 3 (Breivik 2014)

Appendix D: Complete overview of artefacts recovered on the sites presented and analyzed in Paper 4 (Breivik and Callanan in press)

Appendix E: Complete list of projectiles recovered from the presented and analyzed sites in Paper 4 (Breivik and Callanan in press)

Appendix F: List of Early Mesolithic search terms (Norwegian)

Appendix G: Database sheet for the recording of Early Mesolithic sites in central Norway

Appendix H: Isobases and shore-displacement curves in central Norway

Appendix A

List of 86 sites from central Norway dated by the use of shore-displacement curves

APPENDIX A

List of 86 sites from central Norway dated by the use of shore-displacement curves.

The list is the basis for the temporal analyses and Fig.2 in Paper 2 (Breivik and Bjerck in press) and Fig.4, 5 and 6 in Paper 3 (Breivik 2014). Sorted chronologically by oldest possible date.

SITE INFORMATION				DATING			LOCATION	ARTEFACTS				
Site no	**Site name**	**County**	**Municipality**	**M asl**	**Oldest possible date**	**Time period**	**Location**	**Tanged point(s)**	**Microlith(s)**	**Flake-adze(s)**	**Core-adze(s)**	**Unifacial core(s)**
55	Svensvik, Site II	M&R	Aure	c. 47	10000	Early Preboreal	Exposed	x				
58	Tjeldbergodden, Seterbekken 3	M&R	Aure	60	10000	Early Preboreal	Exposed	x	x	x		
87	NØ for oppkomme SV for Bremsneshatten	M&R	Averøy	c. 37	10000	Early Preboreal	Exposed	x	x	x		x
235	Sandnes ytre	M&R	Rauma	66	10000	Early Preboreal	Retracted	x				
245	Ørnetua ved Reira	M&R	Smøla	c. 30	10000	Early Preboreal	Exposed	x				
280	Nord for Storfjorden	S-T	Frøya	33	10000	Early Preboreal	Exposed					x
282	Skarsvåg I	S-T	Frøya	40,6	10000	Early Preboreal	Exposed	x	x	x		x
25	Kleiven (2)	M&R	Aukra	c. 25	9900	Early Preboreal	Exposed			x		x
32	Ormen Lange, Site 51	M&R	Aukra	22	9900	Early Preboreal	Exposed	x		x	x	
38	Røaelven	M&R	Aukra	18	9900	Early Preboreal	Exposed			x	x	x
39	Røds/Ljøviks utmark (2 sites)	M&R	Aukra	18	9900	Early Preboreal	Exposed	x		x		
72	Grønnbakken	M&R	Averøy	c. 30	9900	Early Preboreal	Exposed				x	x
85	Mellemset (3)	M&R	Averøy	30	9900	Early Preboreal	Exposed			x		
86	Nedenfor Valseshulen	M&R	Averøy	c. 35	9900	Early Preboreal	Exposed			x		x
107	Vevang	M&R	Eide	26,5-27	9900	Early Preboreal	Exposed	x	x		x	x
195	Mellom Røseren og Voldvatnet	M&R	Kristiansund	c. 40	9900	Early Preboreal	Exposed			x		
214	Byttingsbøen	M&R	Midsund	c. 20	9900	Early Preboreal	Retracted	x		x		x
220	Klauset søndre	M&R	Midsund	c. 25	9900	Early Preboreal	Retracted			x		
239	Dyrnesvatnet (Site 8/R16)	M&R	Smøla	18-19	9900	Early Preboreal	Exposed					x
9	Grunnvikbakken	M&R	Aukra	c. 22	9800	Early Preboreal	Exposed				x	
57	Tjeldbergodden, Kalvheiane 5	M&R	Aure	52	9800	Early Preboreal	Exposed			x		
66	Ekkilsøy, Site 6	M&R	Averøy	c. 30	9800	Early Preboreal	Exposed	x	x	x	x	x
79	Hestvikholmane, Site 4/5	M&R	Averøy	32-33	9800	Early Preboreal	Exposed		x			x
115	Havnnes (1)	M&R	Fræna	20	9800	Early Preboreal	Exposed	x	x	x		x
193	Kvernberget, Site 24	M&R	Kristiansund	42	9800	Early Preboreal	Exposed	x	x	x		
224	Midtbø	M&R	Midsund	16,4	9800	Early Preboreal	Retracted	x		x		
257	Gjermundnes, Leikarnes (Legernes)	M&R	Vestnes	45	9800	Early Preboreal	Retracted	x	x			x
294	Asmundvåg og Hestnes	S-T	Hitra	36,2	9800	Early Preboreal	Exposed	x				
305	Mørkdalen	S-T	Hitra	36,4	9800	Early Preboreal	Exposed			x		
309	Straum	S-T	Hitra	44,3	9800	Early Preboreal	Exposed			x	x	
325	Bonenget	S-T	Åfjord	98-100	9800	Early Preboreal	Retracted	x		x		x
8	Futviken	M&R	Aukra	21,3	9700	Early Preboreal	Exposed	x	x	x	x	x
53	Sandviken 2	M&R	Aure	c. 40	9700	Early Preboreal	Exposed			x	x	
76	Hestvikholmane, Site 2	M&R	Averøy	c. 30	9700	Early Preboreal	Exposed	x	x			x
78	Hestvikholmane, Site 3	M&R	Averøy	31-33	9700	Early Preboreal	Exposed	x		x		x
84	Mellemset (2)	M&R	Averøy	c. 25	9700	Early Preboreal	Exposed				x	
90	Sanden R14	M&R	Averøy	30	9700	Early Preboreal	Exposed		x			
178	Clausenenget 1	M&R	Kristiansund	c. 30	9700	Early Preboreal	Exposed	x		x		
179	Clausenenget 3	M&R	Kristiansund	c. 30	9700	Early Preboreal	Exposed			x	x	
181	Gartneriet "Roligheden"	M&R	Kristiansund	c. 30	9700	Early Preboreal	Exposed	x		x		x
194	Leithegården 2	M&R	Kristiansund	31,5	9700	Early Preboreal	Exposed		x			
278	Mellom Flatval og Skarsvåg	S-T	Frøya	30	9700	Early Preboreal	Exposed	x				
283	Skarsvåg III	S-T	Frøya	34,6	9700	Early Preboreal	Exposed			x		
18	Hardbraken	M&R	Aukra	c. 20	9600	Early Preboreal	Exposed			x		x
33	Ormen Lange, Site 62	M&R	Aukra	17	9600	Early Preboreal	Exposed	x	x			
48	Hushaugen	M&R	Aure	43-44	9600	Early Preboreal	Exposed		x	x		x
60	Trollhaugekra/Hallarstøa	M&R	Aure	c. 50	9600	Early Preboreal	Exposed			x		x
80	Hestvikholmane, Site 6	M&R	Averøy	28	9600	Early Preboreal	Exposed	x				x
92	Stavneset, Site 1	M&R	Averøy	27	9600	Early Preboreal	Exposed		x			x
123	Lærargården	M&R	Fræna	10,6-10,9	9600	Early Preboreal	Exposed	x		x		
183	Kolvik I	M&R	Kristiansund	c. 30	9600	Early Preboreal	Exposed	x	x			x
184	Kolvik II (Neset)	M&R	Kristiansund	c. 30	9600	Early Preboreal	Exposed	x		x	x	x
189	Kolvik VIII	M&R	Kristiansund	c. 30	9600	Early Preboreal	Exposed	x	x	x		
197	Ner-Bolga	M&R	Kristiansund	c. 30	9600	Early Preboreal	Exposed		x			x
204	Ødegården I	M&R	Kristiansund	c. 30	9600	Early Preboreal	Exposed	x		x		x
205	Ødegården II	M&R	Kristiansund	c. 30	9600	Early Preboreal	Exposed			x		x
206	Ødegården III	M&R	Kristiansund	c. 30	9600	Early Preboreal	Exposed		x	x		x
241	Nelvika, Nelvikberget	M&R	Smøla	c. 30	9600	Early Preboreal	Exposed					x
275	Hammarvatnet SV	S-T	Frøya	c. 30	9600	Early Preboreal	Exposed			x		
29	Ormen Lange 31	M&R	Aukra	14	9500	Late Preboreal	Exposed	x	x			
41	Sundstad	M&R	Aukra	13,9-15	9500	Late Preboreal	Exposed	x	x	x		x
44	Golma	M&R	Aure	c. 30	9500	Late Preboreal	Exposed	x		x	x	x
104	Sør for Bremsneshatten	M&R	Averøy	c. 25	9500	Late Preboreal	Exposed					x
172	Blommen av Rensvik	M&R	Kristiansund	c. 30	9500	Late Preboreal	Exposed	x	x		x	x
174	Bolgvåg	M&R	Kristiansund	c. 30	9500	Late Preboreal	Exposed	x		x		x
196	Minde, Strand	M&R	Kristiansund	c. 25	9500	Late Preboreal	Exposed	x	x	x		x
200	Omsund IV	M&R	Kristiansund	c. 30	9500	Late Preboreal	Exposed			x		x
270	Vikamoen (2)	S-T	Agdenes	70	9500	Late Preboreal	Exposed			x		
272	Flatval III	S-T	Frøya	c. 30	9500	Late Preboreal	Exposed					x
287	Haugen av Vitsø (2)	S-T	Hemne	70	9500	Late Preboreal	Retracted			x		
323	Vorpbukta 1	S-T	Snillfjord	c. 60	9500	Late Preboreal	Exposed			x	x	x
128	Skarhaug (1)	M&R	Fræna	c. 15	9400	Late Preboreal	Exposed	x	x	x	x	x
296	Dolm prestegård	S-T	Hitra	27,5	9400	Late Preboreal	Exposed				x	x
310	Svankilen	S-T	Hitra	25,2	9400	Late Preboreal	Exposed			x		
129	Skarhaug (3)	M&R	Fræna	13,5	9300	Late Preboreal	Exposed			x		
171	Allanenget III, IV	M&R	Kristiansund	20-21	9300	Late Preboreal	Exposed	x	x	x		
176	Brunsvika, Sommerfjøsdalen	M&R	Kristiansund	c. 20	9300	Late Preboreal	Exposed			x	x	x
243	Tyrhaug	M&R	Smøla	24	9300	Late Preboreal	Exposed				x	
258	Gjermundnes, Saltkjelviken (2)	M&R	Vestnes	30	9300	Late Preboreal	Retracted		x	x	x	x
289	Kirksæter (1)	S-T	Hemne	c. 60	9300	Late Preboreal	Retracted	x	x	x	x	x
291	Stølan	S-T	Hemne	c. 60	9300	Late Preboreal	Retracted			x		
230	Haukebø	M&R	Molde	c. 15	9200	Late Preboreal	Retracted			x		
237	Skålhamn	M&R	Rauma	c. 30	9200	Late Preboreal	Retracted	x	x	x		
313	Vikansvingen, Site 1	S-T	Hitra	c. 25	9100	Late Preboreal	Exposed			x		
252	Svartvorpa	M&R	Tingvoll	c. 25	9000	Late Preboreal	Retracted			x		x
300	Hjertåsen, vestre skråning	S-T	Hitra	35,6	9000	Late Preboreal	Exposed				x	

Abbrevations: S-T = Sør-Trøndelag County; N-T = Nord-Trøndelag County; M&R = Møre og Romsdal County.

Appendix B

List of the 244 sites in central Norway presented and analyzed in Paper 2 (Breivik and Bjerck in press)

APPENDIX B

List of the 244 sites in central Norway presented and analyzed in Paper 2 (Breivik and Bjerck in press).
Sorted alphabetically after county, municipality and site name.

SITE INFORMATON					ARTIFACTS								DATING			INVESTIGATION		LOCATION
Site no	**County**	**Municipality**	**Site name**	**Identification numbers**	**Flake-adzes**	**Core-adzes**	**Tanged points**	**Microliths**	**Micro burins**	**Unifacial cores**	**Burins**	**Irregular blades**	**M asl**	**Age**	**Artifacts from later periods**	**Year recovered / investigated**	**Level of investigation**	**Zone**
2	M&R	Aukra	Bjørnerem (2)	T13663	1								2-6	9100-9300 BP (iso. 27)	LM/N +	1925-27	SF	A
4	M&R	Aukra	Bytningsvik	T12198, 12403, 14444, 15363	2		14					X	15-17; 24	9900 BP; 10500 BP (iso. 22)		1920, 1921, 1931, 1937	E	A
5	M&R	Aukra	Eikrem II / Storakerhaugen	T11752, 11774, 11819, 11902, 11957, 12084, 12096, 12254, 12383, 12538, 12873, 13083, 13272, 13808, 14225, 15953		1-2	4	3-4		1	1	X	15-20	9600-9700 BP (iso. 33)	MM/LM, IA	1917, 1918, 1919, 1920, 1921, 1922, 1924, 1925, 1926, 1928, 1930, 1940	SF	A
6	M&R	Aukra	Eikrem III	T12536	1										MM/LM, MN	1922	C	A
7	M&R	Aukra	Eikrem, Grunnvikneset og Futvikhammeren	T18799		1							c. -85			1967	SF	A
8	M&R	Aukra	Futviken	T12539, 12944	1	2	4-7	2-4		3			21,3	9700 BP (iso. 33)		1922, 1924	C	A
9	M&R	Aukra	Grunnvikbakken	T13459		1							c. 22	9800 BP (iso. 33)		1926	SF	A
12	M&R	Aukra	Gossen/Nyhamna, Grynnvika Site 18	T22722									11,5	9500 BP (iso. 30)		2005	Su	A
17	M&R	Aukra	Hagetun	T19773		1							22-23	9900-10000 BP (iso. 30)		1977	SF	A
18	M&R	Aukra	Hardbraken	T10973	1					3		X	c. 20	9600 BP (iso. 38)		1914	SF	A
19	M&R	Aukra	Hellegata	T12400, 14778, 15674	2	1	0-1			1			22,5	10200 BP (iso. 25)	MM/LM?	1921, 1933, 1938	C	A
20	M&R	Aukra	Hjellviken	T12004, 13706		1	0-1			2		X	25-30	9800-10000 BP (iso. 38)	MM/LM, LM/N	1919, 1928	C	A
21	M&R	Aukra	Hogsnes	T13265, 14607, 14449	0-1	1						X	10 / 30	9300 BP / 10200 BP (iso. 33)	LN/EBA?	1926, 1931, 1932	C	A
24	M&R	Aukra	Kleiven (1)	T10360	1							X			LN/EBA	1912	C	A
25	M&R	Aukra	Kleiven (2)	T14608	1					1		X	c. 25	9900 BP (iso. 33)		1932	SF	A
28	M&R	Aukra	Norli/Nordli	T12447, 12537, 13811	1			0-1			1	X	6-14	9000-9500 BP (iso. 33)	LM, N	1922, 1928	C	A
29	M&R	Aukra	Ormen Lange, Site 31	T22735			0-2	4					14	9500 BP (iso. 30)			E	A
31	M&R	Aukra	Ormen Lange, Site 49	T22753			1						10-11	9400-9500 BP (iso. 30)			E	A
33	M&R	Aukra	Ormen Lange, Site 62	T22766			12-14	5					17	9600 BP (iso. 30)			E	A
30	M&R	Aukra	Ormen Lange, Site 48	T22752	54		228	61	104	78	32	X	19-21	9075±50 BP-9695±95 BP	LN/EBA	2003-2004	E	A
32	M&R	Aukra	Ormen Lange, Site 51	T22755	4	1	1					X	22	9900 BP (iso. 30)	LN	2003	E	A
34	M&R	Aukra	Ormen Lange, Site 72	T22772	1		7	5	8	1		X	18,5	9380±70 BP-9480±125 BP	LM	2003	E	A
35	M&R	Aukra	Ormen Lange, Site 73	T22773	3		1	3		1	2		15-18	9500-9600 BP (iso. 30)		2003	E	A
36	M&R	Aukra	Ormen Lange, Site 76/76b	T22731	3			2		1	1		14-16	9155±65 BP-9440±70 BP		2003	E	A
37	M&R	Aukra	Riksfjord	T10845	1											1913	SF	A
38	M&R	Aukra	Røaelven	T13086	0-1	1-2				1		X	18	9900 BP (iso. 25)		1925	SF	A
39	M&R	Aukra	Røds/Ljøviks utmark (2 sites)	T14777	2		1					X	18	9900 BP (iso. 25)		1933	C	A
40	M&R	Aukra	Storhaugen	T13815			1-2					X	22,5	10200 BP (iso. 25)	MM/LM?	1928	C	A
41	M&R	Aukra	Sundstad	T14610, 14776, 15001, 15354	3		1-2	2		1		X	13,9-15	9500 BP (iso. 33)	MM/LM/N	1932, 1933, 1934, 1937	C	A
42	M&R	Aure	Breivik (Golma)	T11716				1								1917	C	A
44	M&R	Aure	Golma	T9461-68, 11071-75	2	2	5			3			c. 30	9500 BP (iso. 55)		1910, 1914	E	A
46	M&R	Aure	Grisvågøy, Valhall	T21123				1					50-53	9600-9700 BP (iso. 67)		1987	Su	A
47	M&R	Aure	Gullsteindalen, Site 5	n/a	1											2006	Su	A
48	M&R	Aure	Hushaugen	T12271	1			1		1		X	43-44	9600 BP (iso. 67)		1921	SF	A
49	M&R	Aure	Ingeborgvikvatn	T18619				1				X				1965	SF	A
51	M&R	Aure	Lesund gård	T9514-17, UN157	0-1		1	1		1						1910	C	A
53	M&R	Aure	Sandviken 2	T10339	1	1							c. 40	9700 BP (iso. 58)		1912	SF	A
54	M&R	Aure	Smedneset (R5)	T19488, 19585			1		1		2	X	c. 25	9100 BP (iso. 62)	MM/LM	1974, 1975	E	A
55	M&R	Aure	Svensvik, Site II	T20858			1						c. 47	10000 BP (iso. 55)		1991	Su	A
56	M&R	Aure	Tjeldbergodden, Kalvheiane 2 (2a and 2b)	T21626	2								44-50	9500-9700 BP (iso. 70)		1992-1993	E	A
57	M&R	Aure	Tjeldbergodden, Kalvheiane 5	T21666	1								52	9800 BP (iso. 70)		1992	E	A
58	M&R	Aure	Tjeldbergodden, Seterbekken 3	T22056	1		7	1					60	10000 BP (iso. 70)	MM/LM?	1995	E	A
60	M&R	Aure	Trollhaugekra/ Hallarstøa	T19165, 21115	4-5					2		X	c. 50	9600 BP (iso. 75)	MM/LM	1972	SF	A
62	M&R	Aure	Ved øvre Lesundvann	T9505-09	0-1					1		X	32-34	9200-9300 BP (iso. 67)		1910	C	A
64	M&R	Averøy	Ekkilsøy, Site 1 (Langmyra)	T20914, 20696, 21071		1	1	1		1		X	35-40	10000-10200 BP (iso. 43)		1984, 1986	Su	A
65	M&R	Averøy	Ekkilsøy, Site 5	T21070, 21482, 21482	1		1-2	0-2					35-40	10000-10200 BP (iso. 43)		1986-1989	C	A

Abbreviations:
"Artifacts from later periods": MM = Middle Mesolithic; LM = Late Mesolithic; N = Neolithic; EN = Early Nesolithic; MN = Middle Neolithic; LN = Late Neolithic; EBA = Early Bronze Age; IA = Iron Age; X = Undecided period; ? = Uncertain.

"Year recovered / investigated": SF = Stray find, found by chance; C = Collected, systematically/from potential sites; Su = Surveyed, subsurface; E = Excavated.

"Zone": A = The outer archipelago; B = Around fjord heads or retracted channels; C = Inner fjord areas; D = Mountain

APPENDIX B

SITE INFORMATON					ARTIFACTS								DATING			INVESTIGATION		LOCATION
Site no	**County**	**Municipality**	**Site name**	**Identification numbers**	**Flake-adzes**	**Core-adzes**	**Tanged points**	**Microliths**	**Micro burins**	**Unifacial cores**	**Burins**	**Irregular blades**	**M asl**	**Age**	**Artifacts from later periods**	**Year recovered / investigated**	**Level of investigation**	**Zone**
66	M&R	Averøy	Ekkilsøy, Site 6	T21069-69, 20989, 21272, 21481	3	1	2	2		1			c. 30	9800 BP (iso. 44)		1985-1989	C	A
67	M&R	Averøy	Ekkilsøy, vestsiden av øya	T9763-66						1						1911	C	A
68	M&R	Averøy	Futsæter 1	T9539	1					1			30-40	9800-10200 BP (iso. 43)		1910	C	A
69	M&R	Averøy	Futsæter 2	T9802-07	1								50-60	11500-12300 BP (iso. 43)		1911	C	A
70	M&R	Averøy	Gjengstøa, Site 2	T23133			1						30-35	9700-9900 BP (iso. 45)		2001	Su	A
71	M&R	Averøy	Grønbukt/Løken (R12-84)	T20692, 20996			2						30-35	9700-9900 BP (iso. 45)		1984, 1986	E	A
72	M&R	Averøy	Grønnbakken	T17874		2				1			c. 30	9900 BP (iso. 40)		1957	SF	A
74	M&R	Averøy	Henda	T21480	4	1		6		7			25-30	9700-9900 BP (iso. 40)		1991	SF	A
77	M&R	Averøy	Hestvikholmane Site 2-2012	T25777			5						39-40	9900-10000 BP (iso. 47)			E	A
75	M&R	Averøy	Hestvikholmane, Site 1	T23435		1	5-7	5	11	2			30-33	9700-9800 BP (iso. 47)		2006	E	A
76	M&R	Averøy	Hestvikholmane, Site 2	T23436, 23111			1	2	1	2			c. 30	9700 BP (iso. 47)		2006	E	A
78	M&R	Averøy	Hestvikholmane, Site 3	T23112	1			1	1	1			31-33	9700 BP (iso. 47)		2006	E	A
79	M&R	Averøy	Hestvikholmane, Site 4/5	T23408, 23113				5	5	1	2		32-33	9800 BP (iso. 47)		2006	E	A
80	M&R	Averøy	Hestvikholmane, Site 6	T23409			1			1			28	9600 BP (iso. 47)		2006	E	A
81	M&R	Averøy	Løkmyren 1	T9923-28						1			25-30	9500-9700 BP (iso. 45)		1911	C	A
82	M&R	Averøy	Løkmyren 2	T10334	1								25-30	9500-9700 BP (iso. 45)		1912	C	A
83	M&R	Averøy	Løkmyren 3	T10335-38			1	1		2			25-30	9500-9700 BP (iso. 45)		1912	C	A
84	M&R	Averøy	Mellemset (2)	T17922		1							c. 25	9700 BP (iso. 40)		1957	SF	A
85	M&R	Averøy	Mellemset (3)	T18031	2								30	9900 BP (iso. 40)		1959	C	A
86	M&R	Averøy	Nedenfor Valseshulen	T9541, 9900-03	1					1			c. 35	9900 BP (iso. 45)		1910, 1911	C	A
87	M&R	Averøy	NØ for oppkomme SV for Bremsneshatten	T9904-13, 10426-30, 11077, 19005	3		9	3		11			c. 37	10000 BP (iso. 45)		1911, 1913, 1914, 1970	C	A
89	M&R	Averøy	Sandbukt nedre og øvre	T20690			1	1					c. 35-40	9900-10100 BP (iso. 45)		1984	Su	A
90	M&R	Averøy	Sanden R14	T20694				1					30	9700 BP (iso. 45)		1984	Su	A
92	M&R	Averøy	Stavneset, Site 1	T22682				1	1	2			27	9600 BP (iso. 43)		2005	Su	A
102	M&R	Averøy	Stavneset, Site 19		1		1						35	9240+65 BP; 9220+70 BP		2001	Su	A
91	M&R	Averøy	Stavneset, Område 1, Storseterhaugen	n/a	1		1						35-40	10000-10200 BP (iso. 43)	X?	2005	Su	A
104	M&R	Averøy	Sør for Bremsneshatten	T9542-47						1			c. 25	9500 BP (iso. 45)		1910	C	A
105	M&R	Averøy	Tøvikmyra	T21479	1								25-28	9700-9800 BP (iso. 39)		1991	E	A
106	M&R	Averøy	Volden	T20401	1								30-35	9700-9900 BP (iso. 45)		1982	SF	A
107	M&R	Eide	Vevang	T15381		1	3	2		3			26,5-27	9900 BP (iso. 35)		1937	SF	A
108	M&R	Fræna	Bud	T15396			1					X				1937	C	A
109	M&R	Fræna	Digerhals	T11613	1				1			X				1916	C	A
110	M&R	Fræna	Engelsæte	T10568, 10782, 11046	1					3		X				1913	C	A
111	M&R	Fræna	Engelsæte / Stavik Ytre	T12413	1											1921	C	A
112	M&R	Fræna	Fjellheim	T16367			1					X			LM/EN/MN	1945	SF	A
113	M&R	Fræna	Gjerdet	T13323, 13840, 14459, 14467, 14513, 14737, 14758, 14915, 14934, 15062, 15111, 15163, 15290, 15395, 16294, 17002, 17597	4		6	2-3	2	3		X			MM/LM, LN/EBA	1926, 1928, 1932-37, 1944, 1950, 1955	C	A
114	M&R	Fræna	Harøy indre	T12699, 13667, 13846		0-1	1-2								MM/LM/N	1923, 1927, 1928	C	A
115	M&R	Fræna	Havnnes (1)	T10351, 10437, 10439, 10449, 11486, 11936, 11987, 12140, 12291, 12458, 12579, 13609, 13612, 13998, 14079, 14218	3		4	0-3	2	5		X	20	9800 BP (iso. 33)	MM/LM, N/EBA, IA?	1912-13, 1918-22, 1927, 1929-30	C	A
116	M&R	Fræna	Havnnes (3)	T12221	1		0-2			1	1	X				1920	C	A
117	M&R	Fræna	Høgtun	T20507	1					2		X				1982	SF	A
119	M&R	Fræna	Kjørsvik (1)	T10399, 11561, 11757-58, 12847	3-4	1-2		1-2		5		X	14,5-22	9600-9900 BP (iso. 30)	LM/N	1912, 1916, 1917, 1924	E	A
120	M&R	Fræna	Kjørsvik (2)	T18406		1										1963	C	A

Abbreviations:

"Artifacts from later periods": MM = Middle Mesolithic; LM = Late Mesolithic; N = Neolithic; EN = Early Nesolithic; MN = Middle Neolithic; LN = Late Neolithic; EBA = Early Bronze Age; IA = Iron Age; X = Undecided period; ? = Uncertain.

"Year recovered / investigated": SF = Stray find, found by chance; C = Collected, systematically/from potential sites; Su = Surveyed, subsurface; E = Excavated.

"Zone": A = The outer archipelago; B = Around fjord heads or retracted channels; C = Inner fjord areas; D = Mountain

APPENDIX B

SITE INFORMATON					ARTIFACTS								DATING			INVESTIGATION		LOCATION
Site no	**County**	**Municipality**	**Site name**	**Identification numbers**	**Flake-adzes**	**Core-adzes**	**Tanged points**	**Microliths**	**Micro burins**	**Unifacial cores**	**Burins**	**Irregular blades**	**M asl**	**Age**	**Artifacts from later periods**	**Year recovered / investigated**	**Level of investigation**	**Zone**
121	M&R	Fræna	Knotten	T21218			1						25-30	9900-10100 BP (iso. 35)		1987	Su	A
122	M&R	Fræna	Lille Korsberget	T11627	1			1								1916	C	A
123	M&R	Fræna	Lærargården	T16295	1		1-2					X	10,6-10,9	9600 BP (iso. 25)		1944	C	A
125	M&R	Fræna	Myren	T14821				1	1							1934	C	A
127	M&R	Fræna	Sandblåst	T15376	1					1		X	12-17	9400-9600 BP (iso. 33)		1937	C	A
128	M&R	Fræna	Skarhaug (1)	T11418, 11616, 11634, 11647, 12246, 13399, 13510-11, 13709	2-3	1-2	2-3	2	1	1		X	c. 15	9400 BP (iso. 35)	LM/N, IA	1915-16, 1920, 1926-28	C	A
129	M&R	Fræna	Skarhaug (3)	T12899, 13657	1							X	13,5	9300 BP (iso. 35)	LM/N, IA?	1924, 1927	C	A
130	M&R	Fræna	Solbakken	T12709			1									1923	C	A
131	M&R	Fræna	Stavik	T13982	1										LN/EBA	1929	C	A
132	M&R	Fræna	Stavik indre (1)	T12079			1					X				1919	C	A
135	M&R	Fræna	Tornes	T10505, 11967, 12005	0-1		0-1	1				X	n/a			1913, 1919	C	A
136	M&R	Fræna	Tornes (i utmarken)	T14007	1								c. 30	10100 BP (iso. 35)		1929	C	A
137	M&R	Fræna	Tornes (spredte funn)	T10067-68	1		0-1									1912	C	A
138	M&R	Fræna	Tornes nedre (flere steder)	T10346-50, 10407-08	1	1						X			MM/LM, LM/N	1912	C	A
139	M&R	Fræna	Tornes nedre I	T9993, 10026, 10123			1			1		X	>25	9800 BP (iso. 35)	MM/LM	1912	C	A
140	M&R	Fræna	Tornes nedre II	T9997					1	1		X	Over 25	9800 BP (iso. 35)	MM/LM	1912	C	A
141	M&R	Fræna	Tornes nedre III	T9999		1		1			1	X	c. 25 (?)	9800 BP (iso. 35)		1912	C	A
142	M&R	Fræna	Tornes nedre IV	T10011-16	0-2		3-5	1-2			1	X	c. 25 (?)	9800 BP (iso. 35)		1912	C	A
143	M&R	Fræna	Tornes nedre VII	T10041-46	3	2				4		X	c. 25?	9800 BP (iso. 35)		1912	C	A
144	M&R	Fræna	Tornes øvre	T11890	1			1								1918	C	A
145	M&R	Fræna	Tornes/Ausa	T9998			1					X	25-40	9800-11300 BP (iso. 35)	MM/LM?	1912	C	A
146	M&R	Fræna	Vaagøy	T12133	1							X				1920	SF	A
147	M&R	Fræna	Vangen av Kalsnes	T17236			1					X				1952	SF	A
149	M&R	Halsa	Almli	T15909, 16174, 16262	2	1		1		1		X	80-90	9900-10200 BP (iso. 95)		1940, 1943, 1944	SF	B
170	M&R	Kristiansund	Allanenget I, II, VI	T10558, 11047-53, 11068, 11714, 12289	3	1		1		4			27-30	9600-9700 BP (iso. 45)		1913-14, 1917, 1921	E	A
171	M&R	Kristiansund	Allanenget III, IV	T11054-67, 11266, 11433-34, 11713	0-2		2-3	1-2					20-21	9300 BP (iso. 45)	MM/LM/N	1914, 1915, 1917	E	A
172	M&R	Kristiansund	Blommen av Rensvik	T10314, 17493, 17824, 18263		3	6	2		4			c. 30	9500 BP (iso. 52)		1912, 1954, 1957, 1962	C	A
173	M&R	Kristiansund	Bolga	T19227	1		3								LN/EBA?	1973	C	A
174	M&R	Kristiansund	Bolgvåg	T12269	1		1			1			c. 30	9500 BP (iso. 52)		1921	C	A
175	M&R	Kristiansund	Breivik på Nordlandet	T11070			1									1914	C	A
176	M&R	Kristiansund	Brunsvika, Sommerfjøsdalen	T9125, 9184-89, 9335-43	0-1	0-1				2			c. 20	9300 BP (iso. 45)		1910	E	A
177	M&R	Kristiansund	Christies Minde	T9158-68, 9611-9615, 9759, 9959, 10327-32, 10425	14		8-9	2		5			44	10300 BP (iso. 45)		1909-13	E	A
178	M&R	Kristiansund	Clausenenget 1	T11097	2		1						c. 30	9700 BP (iso. 45)		1914	C	A
179	M&R	Kristiansund	Clausenenget 3	T11712, 12267	1	1							c. 30	9700 BP (iso. 45)		1917, 1921	C	A
180	M&R	Kristiansund	Dunkersundet	T11965		1-2							c. 18-20	9300-9400 BP (iso. 45)	LM/N?	1918, 1919	E	A
181	M&R	Kristiansund	Gartneriet "Roligheden"	T11709, 12916, 16576	2		1			2			c. 30	9700 BP (iso. 45)		1917, 1924, 1948	C	A
182	M&R	Kristiansund	Gløsvåg I	T9443, 9151	1											1910	C	A
183	M&R	Kristiansund	Kolvik I	T9446-50			4	4		1		X	c. 30	9600 BP (iso. 50)		1910	C	A
184	M&R	Kristiansund	Kolvik II (Neset)	T9618, 9960, 10341, 19737	2-3	0-1	2			3	1	X	c. 30	9600 BP (iso. 50)		1911, 1912, 1976	Su	A
185	M&R	Kristiansund	Kolvik III (Nordre Kolvik)	T11704		1	2			1						1911, 1917	C	A
186	M&R	Kristiansund	Kolvik IV	T11432	1								30-40	9600-9900 BP (iso. 50)		1915	C	A
187	M&R	Kristiansund	Kolvik V	T11699			1			1						1917	C	A
188	M&R	Kristiansund	Kolvik VI	T11700			2									1917	C	A
189	M&R	Kristiansund	Kolvik VIII	T11702	1		1	2					c. 30	9600 BP (iso. 50)		1917	C	A
190	M&R	Kristiansund	Kvennbergmyra	T23533				1		1			30	9320±55 BP; 9395±50 BP		2007	E	A
191	M&R	Kristiansund	Kvernberget, Site 1	T23522	7	1	39	8	9	17	1	X	35,5–41	9220±55 BP		2007	E	A
192	M&R	Kristiansund	Kvernberget, Site 20	T23523			4			1	1		40-45	9800-10000 BP (iso. 52)		2007	E	A
193	M&R	Kristiansund	Kvernberget, Site 24	T23525	1		6	2	8				42	9800 BP (iso. 52)		2007	E	A
194	M&R	Kristiansund	Leithegården 2	T22573				1-2					31,5	9700 BP (iso. 50)		2001	E	A
195	M&R	Kristiansund	Mellom Røseren og Voldvatnet	T9929	1								c. 40	9900 BP (iso. 50)		1911	C	A
196	M&R	Kristiansund	Minde, Strand	T10424, 11264, 11715	1-2		3	0-1		3		X	c. 25	9500 BP (iso. 45)	MM/LM	1913-14, 1917	C	A
197	M&R	Kristiansund	Ner-Bolga	T18171, 18323				1-2		1			c. 30	9600 BP (iso. 50)		1960, 1962	SF	A
198	M&R	Kristiansund	Omsund I	T9888-90			1									1911	C	A
199	M&R	Kristiansund	Omsund II	T9891-98, 10317-19			5									1911-12	C	A
200	M&R	Kristiansund	Omsund IV	T11797	4					1			c. 30	9500 BP (iso. 52)		1918	C	A

Abbreviations:

"Artifacts from later periods": MM = Middle Mesolithic; LM = Late Mesolithic; N = Neolithic; EN = Early Nesolithic; MN = Middle Neolithic; LN = Late Neolithic; EBA = Early Bronze Age; IA = Iron Age; X = Undecided period; ? = Uncertain.

"Year recovered / investigated": SF = Stray find, found by chance; C = Collected, systematically/from potential sites; Su = Surveyed, subsurface; E = Excavated.

"Zone": A = The outer archipelago; B = Around fjord heads or retracted channels; C = Inner fjord areas; D = Mountain

APPENDIX B

SITE INFORMATON					ARTIFACTS								DATING			INVESTIGATION		LOCATION
Site no	County	Municipality	Site name	Identification numbers	Flake-adzes	Core-adzes	Tanged points	Microliths	Micro burins	Unifacial cores	Burins	Irregular blades	M asl	Age	Artifacts from later periods	Year recovered / investigated	Level of investigation	Zone
201	M&R	Kristiansund	Omsund, Site 1	T19850		1										1978	C	A
202	M&R	Kristiansund	Voldvatnet II	T9126, 9326, 9548, 9499-9503, 10323, 19674	3	0-1	9	10-11	3	1			37-43	9800-10000 BP (iso. 50)		1909, 1910, 1912	E	A
203	M&R	Kristiansund	Voldvatnet V	T11431	1		3	1		1			40-42	9900-10000 BP (iso. 50)		1915	C	A
204	M&R	Kristiansund	Ødegården I	T9124, 9155, 9218 og 9418-23, 9608, 9919-22, 10261, 16246	0-2		2		3	3		X	c. 30	9600 BP (iso. 50)		1910-12	C	A
205	M&R	Kristiansund	Ødegården II	T10253	1					2			c. 30	9600 BP (iso. 50)		1912	C	A
206	M&R	Kristiansund	Ødegården III	T10254-60	2-3			1-2		3			c. 30	9600 BP (iso. 50)		1912	C	A
207	M&R	Kristiansund	Øvrevågens reperbane I	T9190/9327/9486, 9488-93, 9609, 10322, 11705	2		0-1						25-30	9500-9700 BP (iso. 45)		1910-12, 1917	E	A
208	M&R	Kristiansund	Øvrevågens reperbane II (søndenfor reperbanen)	T9325, 9486, 11706	3			1		1		X	25-30	9500-9700 BP (iso. 45)		1910, 1917	E	A
209	M&R	Kristiansund	Øvrevågens reperbane III	T11707	2-3		1			2			25-30	9500-9700 BP (iso. 45)		1917	C	A
210	M&R	Kristiansund	Øvrevågens reperbane IV	T11708	1								25-30	9500-9700 BP (iso. 45)		1917	C	A
211	M&R	Midsund	Bjørnerem (1)	T9844			1									1911	C	A
212	M&R	Midsund	Bjørnerem (3)	T14342			1					X	c. 25	10200 BP (iso. 27)	LM/N +	1926, 1927, 1931	C	A
213	M&R	Midsund	Blø	T16557				1		1						1947	C	A
214	M&R	Midsund	Byttingsbøen	T13925	2		1-2			1			c. 20	9900 BP (iso. 28)		1925, 1929	SF	A
217	M&R	Midsund	Geitvika III	T21579	2		2	2-3		7		X	17-21	9900-10100 BP (iso. 25)		1956	E	A
218	M&R	Midsund	Granli	T17659				1								1955	SF	A
219	M&R	Midsund	Gråmyra	T21571	0-1	1	1-2	1	1	3	2		14-20	9600-9800 BP (iso. 30)	LM?	1963	E	A
220	M&R	Midsund	Klauset søndre	T15723	1								c. 25	9900 BP (iso. 33)		1939	SF	A
221	M&R	Midsund	Korsvika II	T15713, 21582	5		3	2	3	8	1	X	23,5-27,5	10000-10200 BP (iso. 30)	LM, IA	1929, 1939, 1955	E	A
222	M&R	Midsund	Lyngbø	T17092, 17322, 17756	3-4	1	1				1	X	15-18	9700-9800 BP (iso. 28)	MM/LM	1951-52, 1956	C	A
224	M&R	Midsund	Midtbø	T18313, 18546	1		0-1						16,4	9800 BP (iso. 28)		1962, 1964	C	A
225	M&R	Midsund	Rakvaag	T10465, 10648	1								10 (?)	9400 BP (iso. 30)		1913	E	A
226	M&R	Midsund	Ramhella I	T9876-80	1											1911	C	A
227	M&R	Midsund	Ramhella II	T9881-85	1											1911	C	A
228	M&R	Midsund	Ramhella III	T9886				1								1911	C	A
229	M&R	Molde	Draget	T7212 og 7302, T7539, 8394, 8561, 8864, 9728-33, 11178, 15699	1	1		2		4		X	28-30	10400-11000 BP (iso. 59)	MM, LM/N, LN/EBA	1902, 1904-05, 1907-09, 1911, 1914, 1936	SF	B
230	M&R	Molde	Haukebø	T13387, 16979, 17137	1						1	X	c. 15	9200 BP (iso. 42)		1926, 1950, 1951	SF	B
231	M&R	Molde	Åsvang	T6820	1							X				1902	SF	B
232	M&R	Nesset	Sandgrovbotnen	T18787, 19054			8	3					1070			1967, 1970	E	D
234	M&R	Rauma	Holm	T13559, 16602	1							X	c. 35/65-70	9000 BP / 10000-10200 BP (iso. 75)		1927, 1948	SF	C
235	M&R	Rauma	Sandnes ytre	T13336, 13476, 13745, 14186								X	66	10000 BP (iso. 75)		1926-28, 1930	SF	C
236	M&R	Rauma	Seljevold	T18059, 16532				1			1	X	c. 70	10100 BP (iso. 78)		1942, 1959	C	C
237	M&R	Rauma	Skålhamn	T12942-43, 13310	0-1		1	1-2	1				c. 30	9200 BP (iso. 65)		1924, 1926	C	C
238	M&R	Smøla	Båtnes	T9994, 10039-10040, 10138						1			5-10	9300-9500 BP (iso. 27)	LN/EBA?	1912	SF	A
239	M&R	Smøla	Dyrnesvatnet (Site 8/R16)	T23088						1			18-19	9900 BP (iso. 27)		2001	Su	A
240	M&R	Smøla	Dyrnesvågen	T10135	1											1912	SF	A
242	M&R	Smøla	Site 4 (R12)	T23084			1						c. 30	10500 BP (iso. 28)		2001	Su	A
241	M&R	Smøla	Nelvika, Nelvikberget	T9528-32						1			c. 30	9600 BP (iso. 48)		1910	C	A
244	M&R	Smøla	Vollane	T23445	1					1		X	20-25	10000-10200 BP (iso. 27)	MM/LM	2007		A
245	M&R	Smøla	Ørnetua ved Reira	C23620			1						c. 30	10000 BP (iso. 38)		1924	C	A
247	M&R	Sunndal	Innvik	T15509, 15582, 15783, 16390, 16758, 17122, 17220, 18220, 18671	5-6		2	1-2	1	4			75-100	9300-9700 BP (iso. 133)	LM/N?	1937-39, 1945, 1949, 1951-52, 1961, 1966	C	C
248	M&R	Sunndal	Reinsvatnet, R1	T23388	1		40	21		2	1	X	985	9495±65 BP		2006, 2009	E	D
249	M&R	Sunndal	Sandvatnet	n/a			5	2		1			850				C	D
250	M&R	Surnadal	Torvik, Vollan	T19378	1		1											C
251	M&R	Tingvoll	Langsethjellen	T12971, 14887						2			38-40	9300-9400 BP (iso. 70)		1924, 1934	SF	B
252	M&R	Tingvoll	Svartvorpa	T17226, 18097	1					1			c. 25	9000 BP (iso. 65)	MM/LM?	1952, 1959	C	B
253	M&R	Tingvoll	Ulset	T12780, 13014, 13239, 14237, 14886, 18093, 18834, 19616, 19617	7-8	6-10	3	6		14			35-40	9300-9400 BP (iso. 68)	X?	1923-25, 1930, 1934, 1959, 1967, 1975-76	E	B
254	M&R	Tingvoll	Ulset, Svanebukta	T17719		1				1			c. 25	8800 BP (iso. 68)		1956	SF	B
255	M&R	Tingvoll	Årsund, Myra	T13917, 14034, 17347		2					1	X			MM/LM	1929, 1953	SF	A

Abbreviations:

"Artifacts from later periods": MM = Middle Mesolithic; LM = Late Mesolithic; N = Neolithic; EN = Early Nesolithic; MN = Middle Neolithic; LN = Late Neolithic; EBA = Early Bronze Age; IA = Iron Age; X = Undecided period; ? = Uncertain.

"Year recovered / investigated": SF = Stray find, found by chance; C = Collected, systematically/from potential sites; Su = Surveyed, subsurface; E = Excavated.

"Zone": A = The outer archipelago; B = Around fjord heads or retracted channels; C = Inner fjord areas; D = Mountain

APPENDIX B

SITE INFORMATON					ARTIFACTS								DATING			INVESTIGATION		LOCATION
Site no	**County**	**Municipality**	**Site name**	**Identification numbers**	**Flake-adzes**	**Core-adzes**	**Tanged points**	**Microliths**	**Micro burins**	**Unifacial cores**	**Burins**	**Irregular blades**	**M asl**	**Age**	**Artifacts from later periods**	**Year recovered / investigated**	**Level of investigation**	**Zone**
256	M&R	Tingvoll	Årsund, Strømsneset	T9195, 9198, 13760, 14031	1								25-30	9000-9300 BP (iso. 63)	LM/N	1910, 1928-29	SF	A
257	M&R	Vestnes	Gjermundnes, Leikarnes (Legernes)	T12940-41			4-9	0-1		4	1	X	45	9800 BP (iso. 60)		1924	E	B
258	M&R	Vestnes	Gjermundnes, Saltkjelviken (2)	T12926	1	1-2		1		1		X	30	9300 BP (iso. 60)		1924	E	B
259	M&R	Vestnes	Nedre Sundet	T13287	1								43-45	9700-9800 BP (iso. 60)	MM/LM?	1924	C	B
265	N-T	Flatanger	Uran / Uranbrekka	T1569, 1933, 8740, 9549, 20075	2		0-1				1		80-84	9000-9200 BP		1875, 1877, 1908, 1910, 1978	E	A
266	N-T	Leka	Vassdalen	T21014	1		3	2					92-93		MM/LM?		Su	A
267	N-T	Leka	Vassdalen-Brekka, Site 1	T24262	6	1	4	5-7	14	10	2	X	87-91	9300-9500 BP		2008	E	A
268	S-T	Agdenes	Bakken	T19365				1									SF	A
269	S-T	Agdenes	Musdalsvik	T9706, 16484, 16677, 17098	0-1				1	1			>50	9000 BP (iso. 108)	MM/LM	1911, 1947-48, 1951	SF	A
270	S-T	Agdenes	Vikamoen (2)	T20229	1							X	70	9500 BP (iso. 108)		1981	SF	A
271	S-T	Frøya	Fallerheia	T19357		1						X	40-45	9800-10000 BP (iso. 53)		1970	SF	A
272	S-T	Frøya	Flatval III	T10231						1		X	c. 30	9500 BP (iso. 53)		1912	C	A
273	S-T	Frøya	Flatval IV	T10232				1								1912	C	A
274	S-T	Frøya	Hammarvatnet NV	T10227, 13536, 13939, 15392, 15693, 16942, C23617	2-3			1		2	1	X	36-42	9800-10000 BP (iso. 50)	MM/LM?	1912, 1927, 1929, 1937-38, 1950	C	A
275	S-T	Frøya	Hammarvatnet SV	T10225	1-2								c. 30	9600 BP (iso. 50)		1912	C	A
276	S-T	Frøya	Hammarvatnet V	T10226		1										1912	C	A
278	S-T	Frøya	Mellom Flatval og Skarsvåg	T14829			1						30	9700 BP (iso. 47)		1931-33	C	A
279	S-T	Frøya	Måøy	T17147	3								25-28	9900-10100 BP (iso. 33)		1951	SF	A
280	S-T	Frøya	Nord for Storfjorden	T14830						1	1	X	33	10000 BP (iso. 40)		1931-33	C	A
281	S-T	Frøya	Skarpnes	T10243-47						1		X				1912	C	A
282	S-T	Frøya	Skarsvåg I	T14832	3		6	3				X	40,6	10000 BP (iso. 48)		1931-33	C	A
283	S-T	Frøya	Skarsvåg III	T14834	1								34,6	9700 BP (iso. 48)		1931-33	C	A
284	S-T	Frøya	Storhallaren IV	T10239-41	1	0-1	0-1	0-1							MM?	1912	C	A
285	S-T	Frøya	Storhallaren V	T10242		1	0-1									1912	C	A
287	S-T	Hemne	Haugen av Vitsø (1)	T11579		1							40-50	8300-9000 BP (iso. 107)		1916	SF	B
289	S-T	Hemne	Kirksæter (1)	T11578, 13627, 14247	1	1	3	1		3			c. 60	9300 BP (iso. 107)		1916, 1927, 1930	C	B
291	S-T	Hemne	Stølan	T13355, 13862, 14248	1								c. 60	9300 BP (iso. 107)	MM/LM	1926, 1928, 1930	C	B
292	S-T	Hemne	Vinje	T15457, 17456-57, 17792		1									MM/LM	1937, 1953, 1956	C	B
293	S-T	Hitra	Asmundvåg	T15387	1								46,5-49,5	10000-10200 BP (iso. 54)		1937	C	A
294	S-T	Hitra	Asmundvåg og Hestnes	T15386			1						36,2	9800 BP (iso. 50)	MM/LM	1937	C	A
296	S-T	Hitra	Dolm prestegård	T14854		1				1			27,5	9400 BP (iso. 52)		1934	C	A
298	S-T	Hitra	Hestnes	T15385		1							35-37	9700-9800 BP (iso. 50)	LN	1937	C	A
300	S-T	Hitra	Hjertåsen, vestre skråning	T15106				2				X	35,6	9000 BP (iso. 82)		1935	C	A
302	S-T	Hitra	Merraberget	T19677						1			50-60	9400-9700 BP (iso. 83)		1976	SF	A
303	S-T	Hitra	Moa	T18467, 18752	2		2	3	1			X				1964, 1966	SF	A
304	S-T	Hitra	Moholtan	T16504, 16508			0-1	1					85	10400 BP (iso. 83)	MM/LM	1947	SF	A
305	S-T	Hitra	Mørkdalen	T14861	1								36,4	9800 BP (iso. 52)	MM/LM	1931-33	C	A
306	S-T	Hitra	Olsvik I	T14709	1			1					43,3-47,3	9300-9500 BP (iso. 75)		1933	SF	A
309	S-T	Hitra	Straum	T14865	1	1							44,3	9800 BP (iso. 60)		1931-33	C	A
310	S-T	Hitra	Svankilen	T14840	1								25,2	9400 BP (iso. 50)		1931-33	C	A
313	S-T	Hitra	Vikansvingen, Site 1	T24972	1								c. 25	9100 BP (iso. 60)	MM/LM	2009	E	A
314	S-T	Oppdal	Brannhaugen	T22059			8	9	13	11			c. 650			2001	E	D
315	S-T	Oppdal	Gjevilvatnet	T19413	1		1	2	3	2			c. 675			1974-76	SF	D
316	S-T	Oppdal	Skarvatnet	T16815			1						881			1949	C	D
317	S-T	Oppdal	Sprikletjørnin	T20156, 20814			1	1-2					870-880			1980-81	E	D
318	S-T	Orkdal	Geita	T21962	1								95-100	9400-9500 BP (iso. 147)		2008	C	B
319	S-T	Osen	Angen	T10747	0-1					1						1913	C	A
321	S-T	Roan	Smedplassen	T13642, 14787	1											1933	SF	A
322	S-T	Snillfjord	E-R5, Vollen	T22617			6-7	11	2	8			65-70	9600-9800 BP (iso. 90)		2000-2003	E	A
323	S-T	Snillfjord	Vorpbukta 1	T22192	1	1-2				1			c. 60	9500 BP (iso. 90)		2000	C	A
324	S-T	Stokksund	Botnmyren	T10712			1		2							1913	C	A
325	S-T	Åfjord	Bonenget	T18045, 18299, 18404, 18680	1-2		1		1	1	1	X	98-100	9800 BP (iso. 120)	MM/LM	1959, 1962-63, 1966	SF	B

Abbreviations:

"Artifacts from later periods": MM = Middle Mesolithic; LM = Late Mesolithic; N = Neolithic; EN = Early Nesolithic; MN = Middle Neolithic; LN = Late Neolithic; EBA = Early Bronze Age; IA = Iron Age; X = Undecided period; ? = Uncertain.

"Year recovered / investigated": SF = Stray find, found by chance; C = Collected, systematically/from potential sites; Su = Surveyed, subsurface; E = Excavated.

"Zone": A = The outer archipelago; B = Around fjord heads or retracted channels; C = Inner fjord areas; D = Mountain

Appendix C

Lists and site distribution maps of Early Mesolithic sites in Norway

APPENDIX C-1

List of sites in central Norway (Møre og Romsdal, Sør-Trøndelag, Nord-Trøndelag counties).

The list is the basis for Fig.3 and Table 2 in Paper 3 (Breivik 2014). Sorted alphabetically after county, municipality and site name.

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 32N)	Longitude (UTM 32N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
1	M&R	Aukra	Akerøtangen (Aukratangen)	T13766	6962304	393605		x	Oldsaksamlingens tilvekst 1928	NTNU	
2	M&R	Aukra	Bjørnerem (2)	T13663	6953901	379272	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1925, 1926; Oldsaksamlingens tilvekst 1927	NTNU	
3	M&R	Aukra	Breivik indre	T15356	6962923	392508		x	Oldsaksamlingens tilvekst 1937	NTNU	
4	M&R	Aukra	Bytningsvik	T12198, 12403, 14444, 15363	6969821	387502	x		Bjerck 1983	NTNU	
5	M&R	Aukra	Eikrem II / Storakerhaugen	T11752, 11774, 11819, 11902, 11957, 12084, 12096, 12254, 12383, 12538, 12873, 13083, 13272, 13808, 14225, 15953	6968684	395451	x		Bjerck 1983	NTNU	
6	M&R	Aukra	Eikrem III	T12536	6968453	395421	x		Bjerck 1983	NTNU	
7	M&R	Aukra	Eikrem, Grunnvikneset og Futvikhammeren	T18799	6969637	396225	x		Tilvekst 1967	NTNU	
8	M&R	Aukra	Futviken	T12539, 12944	6969954	396061	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1922, 1924	NTNU	
9	M&R	Aukra	Grunnvikbakken	T13459	6969249	395698	x		Bjerck 1983	NTNU	
10	M&R	Aukra	Gossen/Nyhamna, Blautvika Site 16	T22720	6969701	395992		x	Åstveit 2005; Årskog 2009	NTNU	1)
11	M&R	Aukra	Gossen/Nyhamna, Futvika Site 13	T22717	6969990	396169		x	Åstveit 2005; Årskog 2009	NTNU	
12	M&R	Aukra	Gossen/Nyhamna, Grynnvika Site 18	T22722	6969353	395824	x		Åstveit 2005; Årskog 2009	NTNU	1)
13	M&R	Aukra	Gossen/Nyhamna, Grynnvika Site 23	T22727	6969891	396140		x	Åstveit 2005; Årskog 2009	NTNU	
14	M&R	Aukra	Gossen/Nyhamna, Hasselvika Site 43	T22747	6970956	394199		x	Åstveit 2005; Årskog 2009	NTNU	
15	M&R	Aukra	Gossen/Nyhamna, Steinneset Site 21	T22725	6970470	396279		x	Åstveit 2005; Årskog 2009	NTNU	
16	M&R	Aukra	Gossen, Nyhamna, Steinneset Site 8	T22712	6970314	396401		x	Åstveit 2005; Årskog 2009	NTNU	
17	M&R	Aukra	Hagetun	T19773	6969638	394791	x		Tilvekst 1977	NTNU	
18	M&R	Aukra	Hardbraken	T10973	6962790	396647	x		Bjerck 1983	NTNU	
19	M&R	Aukra	Hellegata	T12400, 14778, 15674	6968177	389383	x		Bjerck 1983	NTNU	
20	M&R	Aukra	Hjellviken	T12004, 13706	6962756	396774	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1919, Oldsaksamlingens tilvekst 1928	NTNU	
21	M&R	Aukra	Hogsnes	T13265, 14607, 14449	6967672	395710	x		Bjerck 1983	NTNU	
22	M&R	Aukra	Hollingen	T11083	6962026	397427		x	Det Kongelige Norske Videnskabers Selskabs skrifter 1914	NTNU	
23	M&R	Aukra	Håneset	T14227	6968019	394724		x	Oldsaksamlingens tilvekst 1930	NTNU	
24	M&R	Aukra	Kleiven (1)	T10360	6963169	392421	x		Bjerck 1983	NTNU	
25	M&R	Aukra	Kleiven (2)	T14608	6963184	392248	x		Bjerck 1983	NTNU	
26	M&R	Aukra	Kraaknes	T12256	6968353	395877		x	Det Kongelige Norske Videnskabers Selskabs skrifter 1920	NTNU	
27	M&R	Aukra	Mellom Ljøvik og Oterhalsen	T10932	6969066	389392		x	Det Kongelige Norske Videnskabers Selskabs skrifter 1914	NTNU	
28	M&R	Aukra	Norli/Nordli	T12447, 12537, 13811	6969256	395766	x		Bjerck 1983	NTNU	
29	M&R	Aukra	Ormen Lange, SIte 31	T22753	6970540	395000	x		Bjerck 2008a	NTNU	
30	M&R	Aukra	Ormen Lange, Site 48	T22752	6970199	395784	x		Bjerck 2008b	NTNU	
31	M&R	Aukra	Ormen Lange, Site 49	T22735	6970284	395553	x		Meling 2008	NTNU	
32	M&R	Aukra	Ormen Lange, Site 51	T22755	6970138	395720	x		Bjerck 2008c	NTNU	
33	M&R	Aukra	Ormen Lange, Site 62	T22766	6969256	395681	x		Bjerck 2008d	NTNU	
34	M&R	Aukra	Ormen Lange, Site 72	T22772	6970198	395735	x		Bjerck 2008e	NTNU	
35	M&R	Aukra	Ormen Lange, Site 73	T22773	6970159	395772	x		Bjerck 2008f	NTNU	
36	M&R	Aukra	Ormen Lange, Site 76/76b	T22731	6970296	395653	x		Bjerck 2008g	NTNU	
37	M&R	Aukra	Riksfjord	T10845	6966977	392348	x		Bjerck 1983	NTNU	
38	M&R	Aukra	Røaelven	T13086	6967185	389089	x		Bjerck 1983	NTNU	
39	M&R	Aukra	Røds/Ljøviks utmark (2 Sites)	T14777	6968120	389020	x		Bjerck 1983	NTNU	
40	M&R	Aukra	Storhaugen	T13815	6967568	389566	x		Oldsaksamlingens tilvekst 1928	NTNU	
41	M&R	Aukra	Sundstad	T14610, 14776, 15001, 15354	6964501	394103	x		Bjerck 1983	NTNU	
42	M&R	Aure	Breivik (Golma)	T11716	7003509	445972	x		Svendsen 2007b	NTNU	
43	M&R	Aure	Fuglvåg midtre	T13206, 13337	7006206	466496		x	Det Kongelige Norske Videnskabers Selskabs skrifter 1925-26	NTNU	2)
44	M&R	Aure	Golma	T9461-68, 11071-75	7003497	445141	x		Bjerck 1983	NTNU	
45	M&R	Aure	Grisvåg	T11826	7021317	470040		x	Det Kongelige Norske Videnskabers Selskabs skrifter 1918	NTNU	
46	M&R	Aure	Grisvågøy, Valhall	T21123	7020708	472080	x		Pettersen et al. 1988	NTNU	
47	M&R	Aure	Gullsteindalen, Site 5	Uten museumsnr.	7006641	454838	x		Svendsen 2007b	NTNU	
48	M&R	Aure	Hushaugen	T12271	7022770	473873	x		Bjerck 1983	NTNU	
49	M&R	Aure	Ingeborgvikvatn	T18619	7015298	470100	x		Tilvekst 1965	NTNU	
50	M&R	Aure	Leira	T21598	7008130	450467		x	Svendsen 2007b	NTNU	
51	M&R	Aure	Lesund gård	T9514-17, UN157	7022624	473464	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1910	NTNU	

Abbreviations: S-T = Sør-Trøndelag County; N-T = Nord-Trøndelag County; M&R = Møre og Romsdal County. NTNU = NTNU University Museum, Trondheim; UiB = University Museum of Bergen, University of Bergen

APPENDIX C-1

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 32N)	Longitude (UTM 32N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
52	M&R	Aure	Nygården	T12754	7009849	458438		x	Det Kongelige Norske Videnskabers Selskabs skrifter 1923	NTNU	2)
53	M&R	Aure	Sandviken 2	T10339	7011212	456144	x		Bjerck 1983	NTNU	
54	M&R	Aure	Smedneset (R5)	T19488, 19585	7009214	458015	x		Pettersen 1975	NTNU	
55	M&R	Aure	Svensvik, Site II	T20858	7004373	447233	x		Svendsen 2007b	NTNU	
56	M&R	Aure	Tjeldbergodden, Kalvheiane 2 (2a and 2b)	T21626	7031316	484395	x		Søborg 1990; Berglund 2001	NTNU	
57	M&R	Aure	Tjeldbergodden, Kalvheiane 5	T21666	7031316	484395	x		Berglund 2001	NTNU	
58	M&R	Aure	Tjeldbergodden, Seterbekken 3	T22056	7030569	483406	x		Søborg 1990; Berglund 2001	NTNU	
59	M&R	Aure	Todal 2	T14287	7008150	484162		x	Bjerck 1983	NTNU	2)
60	M&R	Aure	Trollhaugekra/Hallarstøa	T19165, 21115	7014124	473771	x		Bjerck 1983	NTNU	
61	M&R	Aure	Trøhaugen (R3)	T19486, 19584	7009309	458137		x	Pettersen 1975	NTNU	
62	M&R	Aure	Ved øvre Lesundvann	T9505-09	7023678	475070	x		Bjerck 1983	NTNU	
63	M&R	Aure	Otnes	T17544	7001016	474574		x	Tilvekst 1954	NTNU	2)
64	M&R	Averøy	Ekkilsøy, Site 1 (Langmyra)	T20914, 20696, 21071	6994686	428889	x		Johansen 2008	NTNU	
65	M&R	Averøy	Ekkilsøy, Site 5	T21070, 21482, 21482	6994574	428715	x		Bjerck 1983; Johansen 2008	NTNU	
66	M&R	Averøy	Ekkilsøy, Site 6	T21069-69, 20989, 21272, 21481	6994478	429041	x		Bjerck 1983; Johansen 2008	NTNU	
67	M&R	Averøy	Ekkilsøy, vestsiden av øya	T9763-66	6994078	427293	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1911	NTNU	
68	M&R	Averøy	Futsæter 1	T9539	6998115	432170	x		Bjerck 1983	NTNU	
69	M&R	Averøy	Futsæter 2	T9802-07	6998120	432175	x		Bjerck 1983	NTNU	
70	M&R	Averøy	Gjengstøa, Site 2	T23133	6996146	431476	x		Svendsen 2007b	NTNU	
71	M&R	Averøy	Grønbukt/Løken (R12-84)	T20692, 20996	6996807	431622	x		Svendsen 2007b	NTNU	
72	M&R	Averøy	Grønnbakken	T17874	6991644	423859	x		Bjerck 1983	NTNU	
73	M&R	Averøy	Heimdal av Straum	T18504	6992095	430184		x	Svendsen 2007b	NTNU	
74	M&R	Averøy	Henda	T21480	6991998	423841	x		Svendsen 2007b	NTNU	
75	M&R	Averøy	Hestvikholmane, Site 1	T23435	6992241	432427	x		Svendsen 2007b	NTNU	
76	M&R	Averøy	Hestvikholmane, Site 2	T23436, 23111	6992241	432390	x		Svendsen 2007b	NTNU	
77	M&R	Averøy	Hestvikholmane, Site 2-2012	T25777	6992249	432222	x		Brede 2012	NTNU	
78	M&R	Averøy	Hestvikholmane, Site 3	T23112	6992200	432536	x		Svendsen 2007b	NTNU	
79	M&R	Averøy	Hestvikholmane, Site 4/5	T23408, 23113	6992279	432525	x		Svendsen 2007b	NTNU	
80	M&R	Averøy	Hestvikholmane, Site 6	T23409	6992275	432555	x		Svendsen 2007b	NTNU	
81	M&R	Averøy	Løkmyren 1	T9923-28	6996966	431758	x		Svendsen 2007b	NTNU	
82	M&R	Averøy	Løkmyren 2	T10334	6996940	431655	x		Bjerck 1983	NTNU	
83	M&R	Averøy	Løkmyren 3	T10335-38	6996984	431814	x		Svendsen 2007b	NTNU	
84	M&R	Averøy	Mellemset (2)	T17922	6992751	424404	x		Svendsen 2007b	NTNU	
85	M&R	Averøy	Mellemset (3)	T18031	6992910	424324	x		Svendsen 2007b	NTNU	
86	M&R	Averøy	Nedenfor Valseshulen	T9541, 9900-03	6995090	431483	x		Bjerck 1983	NTNU	
87	M&R	Averøy	NØ for oppkomme SV for Bremsneshatten	T9904-13, 10426-30, 11077, 19005	6994958	431105	x		Bjerck 1983; Svendsen 2007b	NTNU	
88	M&R	Averøy	Rausand	T9810-13	6993936	432291		x	Det Kongelige Norske Videnskabers Selskabs skrifter 1912	NTNU	
89	M&R	Averøy	Sandbukt nedre og øvre	T20690	6996735	432015	x		Svendsen 2007b	NTNU	
90	M&R	Averøy	Sanden R14	T20694	6996299	431595	x		Tilvekst 1984	NTNU	
91	M&R	Averøy	Stavneset, Område 1, Storseterhaugen	Uten museumsnr.	6998059	431768	x		Åstveit et al. 2005; Svendsen 2007b	NTNU	
92	M&R	Averøy	Stavneset, Site 1	T22682	6998218	432100	x		Åstveit at al. 2005	NTNU	1)
93	M&R	Averøy	Stavneset, Site 2	T22683	6998153	432029		x	Åstveit et al. 2005; Årskog 2009	NTNU	
94	M&R	Averøy	Stavneset, Site 3	T22684	6998662	432421		x	Åstveit et al. 2005; Årskog 2009	NTNU	
95	M&R	Averøy	Stavneset, Site 6	T22687	6998388	432221		x	Åstveit et al. 2005; Årskog 2009	NTNU	
96	M&R	Averøy	Stavneset, Site 11	T22692	6997918	431648		x	Åstveit et al. 2005; Årskog 2009	NTNU	
97	M&R	Averøy	Stavneset, Site 12	T22693	6997883	431696		x	Åstveit et al. 2005; Årskog 2009	NTNU	
98	M&R	Averøy	Stavneset, Site 13	T22694	6997710	431378		x	Åstveit et al. 2005; Årskog 2009	NTNU	
99	M&R	Averøy	Stavneset, Site 14	T22695	6997634	431274		x	Åstveit et al. 2005; Årskog 2009	NTNU	
100	M&R	Averøy	Stavneset, Site 16	T22697	6997560	431360		x	Åstveit et al. 2005; Årskog 2009	NTNU	
101	M&R	Averøy	Stavneset, Site 17	T22698	6997799	431314		x	Åstveit et al. 2005; Årskog 2009	NTNU	
102	M&R	Averøy	Stavneset, Site 19	n/a	6998088	431847	x		Åstveit et al. 2005; Årskog 2009	NTNU	
103	M&R	Averøy	Storvandet	T9157	6991142	429037		x	Bjerck 1983	NTNU	
104	M&R	Averøy	Sør for Bremsneshatten	T9542-47	6994902	431691	x		Svendsen 2007b	NTNU	
105	M&R	Averøy	Tøvikmyra	T21479	6985176	417311	x		Svendsen 2007b	NTNU	
106	M&R	Averøy	Volden	T20401	6991940	428872	x		Svendsen 2007b	NTNU	
107	M&R	Eide	Vevang	T15381	6985760	411204	x		Bjerck 1983	NTNU	
108	M&R	Fræna	Bud	T15396	6977226	394443	x		Oldsaksamlingens tilvekst 1937	NTNU	
109	M&R	Fræna	Digerhals	T11613	6971894	398206	x		Bjerck 1983	NTNU	
110	M&R	Fræna	Engelsæte	T10568, 10782, 11046	6974350	396825	x		Bjerck 1983	NTNU	
111	M&R	Fræna	Engelsæte / Stavik Ytre	T12413	6974345	396830	x		Bjerck 1983	NTNU	
112	M&R	Fræna	Fjellheim	T16367	6976650	395312	x		Oldsaksamlingens tilvekst 1945	NTNU	
113	M&R	Fræna	Gjerdet	T13323, 13840, 14459, 14467, 14513, 14737, 14758, 14915, 14934, 15062, 15111, 15163, 15290, 15395, 16294, 17002, 17597	6977194	394534	x		Møllenhus 1977	NTNU	
114	M&R	Fræna	Harøy indre	T12699, 13667, 13846	6974209	395859	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1923; Oldsaksamlingens tilvekst 1927, 1928	NTNU	

Abbreviations: S-T = Sør-Trøndelag County; N-T = Nord-Trøndelag County; M&R = Møre og Romsdal County. NTNU = NTNU University Museum, Trondheim; UiB = University Museum of Bergen, University of Bergen

APPENDIX C-1

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 32N)	Longitude (UTM 32N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
115	M&R	Fræna	Havnnes (1)	T10351, 10437, 10439, 10449, 11486, 11936, 11987, 12140, 12291, 12458, 12579, 13609, 13612, 13998, 14079, 14218	6969083	398122	x		Bjerck 1983	NTNU	
116	M&R	Fræna	Havnnes (3)	T12221	6969280	398080	x		Bjerck 1983	NTNU	
117	M&R	Fræna	Høgtun	T20507	6966627	403069	x		Tilvekst 1983	NTNU	
118	M&R	Fræna	Håset	T12516	6970046	403082		x	Det Kongelige Norske Videnskabers Selskabs skrifter 1922	NTNU	
119	M&R	Fræna	Kjørsvik (1)	T10399, 11561, 11757-58, 12847	6971745	398502	x		Bjerck 1983	NTNU	
120	M&R	Fræna	Kjørsvik (2)	T18406	6971498	398889	x		Bjerck 1983	NTNU	
121	M&R	Fræna	Knotten	T21218	6967325	398838	x		Johansen et al. 1988	NTNU	
122	M&R	Fræna	Lille Korsberget	T11627	6969246	397845	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1916	NTNU	
123	M&R	Fræna	Lærargården	T16295	6976378	395232	x		Bjerck 1983	NTNU	
124	M&R	Fræna	Løvåsen	T15373	6967415	410409		x	Oldsaksamlingens tilvekst 1937	NTNU	
125	M&R	Fræna	Myren	T14821	6976697	394491	x		Oldsaksamlingens tilvekst 1934	NTNU	
126	M&R	Fræna	Neo	T21221	6967579	399005		x	Johansen et al. 1988	NTNU	
127	M&R	Fræna	Sandblåst	T15376	6985047	411003	x		Bjerck 1983	NTNU	
128	M&R	Fræna	Skarhaug (1)	T11418, 11616, 11634, 11647, 12246, 13399, 13510-11, 13709	6969180	398360	x		Bjerck 1983	NTNU	
129	M&R	Fræna	Skarhaug (3)	T12899, 13657	6969109	398321	x		Bjerck 1983	NTNU	
130	M&R	Fræna	Solbakken	T12709	6969411	401802	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1923	NTNU	
131	M&R	Fræna	Stavik	T13982	6973331	397730	x		Bjerck 1983	NTNU	
132	M&R	Fræna	Stavik indre (1)	T12079	6973660	398079	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1919	NTNU	
133	M&R	Fræna	Stavik indre (3)	T13938	6973383	398054		x	Oldsaksamlingens tilvekst 1929	NTNU	
134	M&R	Fræna	Søholt	T13338	6973768	397547		x	Det Kongelige Norske Videnskabers Selskabs skrifter 1926	NTNU	
135	M&R	Fræna	Tornes	T10505, 11967, 12005	6969524	399132	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1913, 1919	NTNU	
136	M&R	Fræna	Tornes (i utmarken)	T14007	6969388	399137	x		Bjerck 1983	NTNU	
137	M&R	Fræna	Tornes (spredte funn)	T10067-68	6969477	399762	x		Bjerck 1983	NTNU	
138	M&R	Fræna	Tornes nedre (flere steder)	T10346-50, 10407-08	6972438	403604	x		Bjerck 1983	NTNU	
139	M&R	Fræna	Tornes nedre I	T9993, 10026, 10123	6969882	400163	x		Bjerck 1983	NTNU	
140	M&R	Fræna	Tornes nedre II	T9997	6969604	399424	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1912	NTNU	
141	M&R	Fræna	Tornes nedre III	T9999	6969886	400225	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1912	NTNU	
142	M&R	Fræna	Tornes nedre IV	T10011-16	6972440	403605	x		Bjerck 1983	NTNU	
143	M&R	Fræna	Tornes nedre VII	T10041-46	6972435	403600	x		Bjerck 1983	NTNU	
144	M&R	Fræna	Tornes øvre	T11890	6969455	399167	x		Bjerck 1983	NTNU	
145	M&R	Fræna	Tornes/Ausa	T9998	6969257	400995	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1912	NTNU	
146	M&R	Fræna	Vaagøy	T12133	6967796	399329	x		Bjerck 1983	NTNU	
147	M&R	Fræna	Vangen av Kalsnes	T17236	6976164	394950	x		Tilvekst 1952	NTNU	
148	M&R	Fræna	Vestavik	T11098, 11541, 12685	6975191	397384		x	Det Kongelige Norske Videnskabers Selskabs skrifter 1914, 1916, 1923	NTNU	
149	M&R	Halsa	Almli	T15909, 16174, 16262	7005116	487538	x		Bjerck 1983	NTNU	
150	M&R	Halsa	Flatø og Tøftene	T17602	7001293	471068		x	Tilvekst 1955	NTNU	
151	M&R	Haram	Baraldsnes, Baraldsneset Site 11	B16017	6945974	375295	x		Waraas 2005; Årskog 2009	UiB	
152	M&R	Haram	Baraldsnes, Baraldsneset Site 17	B16019	6945875	375220	x		Waraas 2005; Årskog 2009	UiB	
153	M&R	Haram	Baraldsnes, Baraldsneset Site 29	B16021	6945930	375262	x		Waraas 2005; Årskog 2009	UiB	
154	M&R	Haram	Baraldsnes, Baraldsneset Site 30	B16022	6945945	375258	x		Waraas 2005; Årskog 2009	UiB	
155	M&R	Haram	Baraldsnes, Baraldsneset Site 31	B16023	6945981	375228	x		Waraas 2005; Årskog 2009	UiB	
156	M&R	Haram	Baraldsnes, Baraldsneset Site 41	B16061	6945844	375244	x		Waraas 2005; Årskog 2009	UiB	
157	M&R	Haram	Baraldsnes, Baraldsneset Site 44	B16064	6945923	375290	x		Waraas 2005; Årskog 2009	UiB	
158	M&R	Haram	Baraldsnes, Baraldsneset Site 46	B16066	6945925	375265	x		Waraas 2005; Årskog 2009	UiB	
159	M&R	Haram	Baraldsnes, Haugen Site 58	B16060	6945527	375222	x		Waraas 2005; Årskog 2009	UiB	
160	M&R	Haram	Baraldsnes, Helland Site 13	B16047	6945939	375067	x		Waraas 2005; Årskog 2009	UiB	
161	M&R	Haram	Baraldsnes, Helland Site 15	B16045	6945187	369922		x	Waraas 2005; Årskog 2009	UiB	
162	M&R	Haram	Baraldsnes, Helland Site 33	B16043	6944669	370064	x		Waraas 2005; Årskog 2009	UiB	
163	M&R	Haram	Baraldsnes, Skårbreivik Site 10	B16030	6945884	375139	x		Waraas 2005; Årskog 2009	UiB	

Abbreviations: S-T = Sør-Trøndelag County; N-T = Nord-Trøndelag County; M&R = Møre og Romsdal County. NTNU = NTNU University Museum, Trondheim; UiB = University Museum of Bergen, University of Bergen

APPENDIX C-1

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 32N)	Longitude (UTM 32N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
164	M&R	Haram	Baraldsnes, Skårbreivik Site 20	B16031	6945687	375246		x	Waraas 2005; Årskog 2009	UiB	
165	M&R	Haram	Baraldsnes, Skårbreivik Site 24	B16035	6945760	375194		x	Waraas 2005; Årskog 2009	UiB	
166	M&R	Haram	Baraldsnes, Skårbreivik Site 25	B16036	6945701	375185		x	Waraas 2005; Årskog 2009	UiB	
167	M&R	Haram	Baraldsnes, Skårbreivik Site 36	B16053	6945997	375213	x		Waraas 2005; Årskog 2009	UiB	
168	M&R	Haram	Baraldsnes, Skårbreivik Site 40	B16055	6945821	375220		x	Waraas 2005; Årskog 2009	UiB	
169	M&R	Haram	Bjørøy	B13582	6939949	358117	x		Granados 2011	UiB	
170	M&R	Kristiansund	Allanenget I, II, VI	T10558, 11047-53, 11068, 11714, 12289	6998973	435936	x		Nummedal 1914	NTNU	
171	M&R	Kristiansund	Allanenget III, IV	T11054-67, 11266, 11433-34, 11713	6999065	435980	x		Nummedal 1914	NTNU	
172	M&R	Kristiansund	Blommen av Rensvik	T10314, 17493, 17824, 18263	6997432	440287	x		Bjerck 1983	NTNU	
173	M&R	Kristiansund	Bolga	T19227	6995220	437963	x		Bjerck 1983	NTNU	
174	M&R	Kristiansund	Bolgvåg	T12269	6995071	438111	x		Bjerck 1983	NTNU	
175	M&R	Kristiansund	Breivik på Nordlandet	T11070	6998072	438653	x		Svendsen 2007b	NTNU	
176	M&R	Kristiansund	Brunsvika, Sommerfjøsdalen	T9125, 9184-89, 9335-43	7000011	435176	x		Svendsen 2007b	NTNU	
177	M&R	Kristiansund	Christies Minde	T9158-68, 9611-9615, 9759, 9959, 10327-32, 10425	6999305	435705	x		Nummedal 1922; Bjerck 1983	NTNU	
178	M&R	Kristiansund	Clausenenget 1	T11097	6999625	435745	x		Bjerck 1983	NTNU	
179	M&R	Kristiansund	Clausenenget 3	T11712, 12267	6999620	435740	x		Bjerck 1983	NTNU	
180	M&R	Kristiansund	Dunkersundet	T11965	6999916	436887	x		Bjerck 1983	NTNU	
181	M&R	Kristiansund	Gartneriet "Roligheden"	T11709, 12916, 16576	6998971	435665	x		Bjerck 1983	NTNU	
182	M&R	Kristiansund	Gløsvåg I	T9443, 9151	7000315	441013	x		Bjerck 1983	NTNU	
183	M&R	Kristiansund	Kolvik I	T9446-50	7000565	441635	x		Svendsen 2007b	NTNU	
184	M&R	Kristiansund	Kolvik II (Neset)	T9618, 9960, 10341, 19737	7000578	441469	x		Bjerck 1983	NTNU	
185	M&R	Kristiansund	Kolvik III (Nordre Kolvik)	T11704	7000547	441565	x		Svendsen 2007b	NTNU	
186	M&R	Kristiansund	Kolvik IV	T11432	7000310	442675	x		Bjerck 1983	NTNU	
187	M&R	Kristiansund	Kolvik V	T11699	7000253	442735	x		Svendsen 2007b	NTNU	
188	M&R	Kristiansund	Kolvik VI	T11700	7000143	442813	x		Svendsen 2007b	NTNU	
189	M&R	Kristiansund	Kolvik VIII	T11702	7000592	441718	x		Bjerck 1983	NTNU	
190	M&R	Kristiansund	Kvennbergmyran	T23533	6999025	441733	x		Sauvage 2007	NTNU	
191	M&R	Kristiansund	Kvernberget, Site 1	T23522	6998836	441821	x		Fretheim 2008	NTNU	
192	M&R	Kristiansund	Kvernberget, Site 20	T23523	6999023	442195	x		Strøm and Breivik 2008	NTNU	
193	M&R	Kristiansund	Kvernberget, Site 24	T23525	6998785	442030	x		Svendsen 2007a	NTNU	
194	M&R	Kristiansund	Leithegården 2	T22573	6998008	439291	x		Haug 2003	NTNU	
195	M&R	Kristiansund	Mellom Røseren og Voldvatnet	T9929	6998900	438276	x		Bjerck 1983	NTNU	
196	M&R	Kristiansund	Minde, Strand	T10424, 11264, 11715	6999623	436373	x		Bjerck 1983	NTNU	
197	M&R	Kristiansund	Ner-Bolga	T18171, 18323	6995804	437283	x		Svendsen 2007b	NTNU	
198	M&R	Kristiansund	Omsund I	T9888-90	6998729	442007	x		Svendsen 2007b	NTNU	
199	M&R	Kristiansund	Omsund II	T9891-98, 10317-19	6999033	441756	x		Svendsen 2007b	NTNU	
200	M&R	Kristiansund	Omsund IV	T11797	6998815	442557	x		Bjerck 1983	NTNU	
201	M&R	Kristiansund	Omsund, Site 1	T19850	6998454	442374	x		Bjerck 1983	NTNU	
202	M&R	Kristiansund	Voldvatnet II	T9126, 9326, 9548, T9499-9503 , 10323, 19674	6998902	438650	x		Bjerck 1983	NTNU	
203	M&R	Kristiansund	Voldvatnet V	T11431	6998690	438453	x		Bjerck 1983	NTNU	
204	M&R	Kristiansund	Ødegården I	T9124, 9155, 9218 og 9418-23, 9608, 9919-22, 10261, 16246	6998185	439635	x		Bjerck 1983	NTNU	
205	M&R	Kristiansund	Ødegården II	T10253	6998180	439645	x		Bjerck 1983	NTNU	
206	M&R	Kristiansund	Ødegården III	T10254-60	6998195	439883	x		Bjerck 1983	NTNU	
207	M&R	Kristiansund	Øvrevågens reperbane I	T9190/9327/9486, 9488-93, 9609, 10322, 11705	6999900	435700	x		Bjerck 1983	NTNU	
208	M&R	Kristiansund	Øvrevågens reperbane II (søndenfor reperbanen)	T9325, 9486, 11706	6999910	435710	x		Bjerck 1983	NTNU	
209	M&R	Kristiansund	Øvrevågens reperbane III	T11707	6999920	435720	x		Svendsen 2007b	NTNU	
210	M&R	Kristiansund	Øvrevågens reperbane IV	T11708	6999905	435705	x		Svendsen 2007b	NTNU	
211	M&R	Midsund	Bjørnerem (1)	T9844	6953644	378831	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1911	NTNU	
212	M&R	Midsund	Bjørnerem (3)	T13663, 14342	6953705	379009	x		Oldsaksamlingens tilvekst 1927, 1931	NTNU	
213	M&R	Midsund	Blø	T16557	6951010	379188	x		Oldsaksamlingens tilvekst 1947	NTNU	
214	M&R	Midsund	Byttingsbøen	T13925	6951470	381100	x		Bjerck 1983	NTNU	
215	M&R	Midsund	Drynjesund a	B6556	6950025	376205	x		Bjerck 1983	UiB	
216	M&R	Midsund	Drynjesund b	B6557, 7248	6950020	376200	x		Bjerck 1983	UiB	
217	M&R	Midsund	Geitvika III	T21579	6954757	379524	x		Møllenhus 1977	NTNU	
218	M&R	Midsund	Granli	T17659	6952089	380861	x		Tilvekst 1955	NTNU	
219	M&R	Midsund	Gråmyra	T21571	6950959	380915	x		Møllenhus 1977	NTNU	
220	M&R	Midsund	Klauset søndre	T15723	6950975	383405	x		Bjerck 1983	NTNU	
221	M&R	Midsund	Korsvika II	T15713, 21582	6950213	381280	x		Møllenhus 1977	NTNU	
222	M&R	Midsund	Lyngbø	T17092, 17322, 17756	6951478	381108	x		Bjerck 1983	NTNU	
223	M&R	Midsund	Mellom Sundsbøen og Stavik, Otrøya	T15375	6959226	393630		x	Oldsaksamlingens tilvekst 1937	NTNU	
224	M&R	Midsund	Midtbø	T18313, 18546	6951280	380834	x		Tilvekst 1962, 1964	NTNU	
225	M&R	Midsund	Rakvaag	T10465, 10648	6956031	384684	x		Bjerck 1983	NTNU	
226	M&R	Midsund	Ramhella I	T9876-80	6955757	381990	x		Bjerck 1983	NTNU	

Abbreviations: S-T = Sør-Trøndelag County; N-T = Nord-Trøndelag County; M&R = Møre og Romsdal County. NTNU = NTNU University Museum, Trondheim; UiB = University Museum of Bergen, University of Bergen

APPENDIX C-1

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 32N)	Longitude (UTM 32N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
227	M&R	Midsund	Ramhella II	T9881-85	6955815	381820	x		Bjerck 1983	NTNU	
228	M&R	Midsund	Ramhella III	T9886	6955867	381907	x		Bjerck 1983	NTNU	
229	M&R	Molde	Draget	T7212 og 7302, T7539, 8394, 8561, 8864, 9728-33, 11178, 15699	6955985	412715	x		Bjerck 1983	NTNU	
230	M&R	Molde	Haukebø	T13387, 16979, 17137	6957676	400089	x		Bjerck 1983	NTNU	
231	M&R	Molde	Åsvang	T6820	6952502	418406	x		Bjerck 1983	NTNU	
232	M&R	Nesset	Sandgrovbotnen	T18787, 19054	6923982	454446	x		Gustafson 1988; Sjøvold 1970	NTNU	
233	M&R	Norddal	Langfjelldal	Askeladden ID 146721	6920939	430983	x		Ramstad 2014	UiB	
234	M&R	Rauma	Holm	T13559, 16602	6950319	426603	x		Oldsaksamlingens tilvekst 1927, 1948	NTNU	
235	M&R	Rauma	Sandnes ytre	T13336, 13476, 13745, 14186	6946081	423939	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1926; Oldsaksamlingens tilvekst 1927-28, 1930	NTNU	
236	M&R	Rauma	Seljevold	T18059, 16532	6943602	425488	x		Oldsaksamlingens tilvekst 1947; Tilvekst 1959	NTNU	
237	M&R	Rauma	Skålhamn	T12942-43, 13310	6944450	410676	x		Bjerck 1983	NTNU	
238	M&R	Smøla	Båtnes	T9994, 10039-10040, 10138	7033226	441878	x		Svendsen 2007b	NTNU	
239	M&R	Smøla	Dyrnesvatnet (Site 8/R16)	T23088	7032082	443903	x		Svendsen 2007b	NTNU	
240	M&R	Smøla	Dyrnesvågen	T10135	7033081	442924	x		Svendsen 2007b	NTNU	
241	M&R	Smøla	Nelvika, Nelvikberget	T9528-32	7025384	457614	x		Svendsen 2007b	NTNU	
242	M&R	Smøla	Site 4 (R12)	T23084	7032442	443216	x		Svendsen 2007b	NTNU	
243	M&R	Smøla	Tyrhaug	T9455-59	7020627	460600		x	Det Kongelige Norske Videnskabers Selskabs skrifter 1910	NTNU	
244	M&R	Smøla	Vollane	T23445	7031805	441372	x		Innkomstprotokoll 2007	NTNU	
245	M&R	Smøla	Ørnetua ved Reira	C23620	7035864	456612	x		Svendsen 2007b	NTNU	
246	M&R	Stranda	Lundaneset	n/a	6888821	393718	x		Johannesen 2009	UiB	
247	M&R	Sunndal	Innvik	T15509, 15582, 15783, 16390, 16758, 17122, 17220, 18220, 18671	6952180	474550	x		Bjerck 1983	NTNU	
248	M&R	Sunndal	Reinsvatnet, R1	T23388	6935868	467498	x		Svendsen 2007b	NTNU	
249	M&R	Sunndal	Sandvatnet	n/a	6924163	478258	x		Martin Callanan pers. comm. 2010	NTNU	
250	M&R	Surnadal	Torvik, Vollan	T19378	6980911	473708	x		Svendsen 2007b	NTNU	
251	M&R	Tingvoll	Langsethjellen	T12971, 14887	6988179	450007	x		Svendsen 2007b	NTNU	
252	M&R	Tingvoll	Svartvorpa	T17226, 18097	6990601	446463	x		Bjerck 1983	NTNU	
253	M&R	Tingvoll	Ulset	T12780, 13014, 13239, 14237, 14886, 18093, 18834, 19616, 19617	6989319	449556	x		Alterskjær and Pettersen 1975	NTNU	
254	M&R	Tingvoll	Ulset, Svanebukta	T17719	6989622	449029	x		Bjerck 1983	NTNU	
255	M&R	Tingvoll	Årsund, Myra	T13917, 14034, 17347	6996134	449432	x		Bjerck 1983	NTNU	
256	M&R	Tingvoll	Årsund, Strømsneset	T9195, 9198, 13760, 14031	6996418	447998	x		Bjerck 1983	NTNU	
257	M&R	Vestnes	Gjermundnes, Leikarnes (Legernes)	T12940-41	6945243	405162	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1924	NTNU	
258	M&R	Vestnes	Gjermundnes, Saltkjelviken (2)	T12926	6944970	406272	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1924	NTNU	
259	M&R	Vestnes	Nedre Sundet	T13287	6944489	406160	x		Bjerck 1983	NTNU	
260	M&R	Volda	Årset	B10650	6884242	368642	x		Tor Arne Waraas pers. comm. 2010	UiB	
261	M&R	Ørsta	Mele	B10009	6898235	351305	x		Bjerck 1983	UiB	
262	M&R	Ålesund	Litle Kalvøy	B9035	6930808	361035	x		Bjerck 1983	UiB	
263	M&R	Ålesund	Sæmundplassen, Larsgård	B9040	6929887	358751	x		Bjerck 1983	UiB	
264	M&R	Ålesund	(Location not specified - Nørve?)	B6488	6929878	354433	x		Granados 2011	UiB	
265	N-T	Flatanger	Uran / Uranbrekka	T1569, 1933, 8740, 9549, 20075	7144575	579065	x		Skrifter i det 19de Aarhundrede 1875, 1877; Det Kongelige Norske Videnskabers Selskabs skrifter 1908, 1910; Tilvekst 1980	NTNU	
266	N-T	Leka	Vassdalen	T21014	7218294	621938	x		Haug 1997	NTNU	
267	N-T	Leka	Vassdalen-Brekka, Site 1	T24262	7218227	621796	x		Svendsen 2009	NTNU	
268	S-T	Agdenes	Bakken	T19365	7045744	528858	x		Tilvekst 1974	NTNU	
269	S-T	Agdenes	Musdalsvik	T9706, 16484, 16677, 17098	7050021	528363	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1911; Oldsaksamlingens tilvekst 1947-48, Tilvekst 1951	NTNU	
270	S-T	Agdenes	Vikamoen (2)	T20229	7049967	528362	x		Tilvekst 1981	NTNU	
271	S-T	Frøya	Fallerheia	T19357	7063798	490177	x		Bjerck 1983	NTNU	
272	S-T	Frøya	Flatval III	T10231	7062586	488058	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1912	NTNU	
273	S-T	Frøya	Flatval IV	T10232	7062382	487851	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1912	NTNU	
274	S-T	Frøya	Hammarvatnet NV	T10227, 13536, 13939, 15392, 15693, 16942, C23617	7066537	490150	x		Bjerck 1983	NTNU	
275	S-T	Frøya	Hammarvatnet SV	T10225	7065437	489902	x		Bjerck 1983	NTNU	

Abbreviations: S-T = Sør-Trøndelag County; N-T = Nord-Trøndelag County; M&R = Møre og Romsdal County. NTNU = NTNU University Museum, Trondheim; UiB = University Museum of Bergen, University of Bergen

APPENDIX C-1

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 32N)	Longitude (UTM 32N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
276	S-T	Frøya	Hammarvatnet V	T10226	7066246	490139	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1912	NTNU	
277	S-T	Frøya	Klevdalsvatn	T14836-37	7065081	488559		x	Oldsaksamlingens tilvekst 1934	NTNU	
278	S-T	Frøya	Mellom Flatval og Skarsvåg	T14829	7062266	486107	x		Oldsaksamlingens tilvekst 1934	NTNU	
279	S-T	Frøya	Måøy	T17147	7081795	483596	x		Bjerck 1983	NTNU	
280	S-T	Frøya	Nord for Storfjorden	T14830	7061390	475972	x		Oldsaksamlingens tilvekst 1934	NTNU	
281	S-T	Frøya	Skarpnes	T10243-47	7061333	482455	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1912	NTNU	
282	S-T	Frøya	Skarsvåg I	T14832	7063201	484856	x		Bjerck 1983	NTNU	
283	S-T	Frøya	Skarsvåg III	T14834	7063169	484860	x		Oldsaksamlingens tilvekst 1934	NTNU	
284	S-T	Frøya	Storhallaren IV	T10239-41	7061183	480094	x		Bjerck 1983	NTNU	
285	S-T	Frøya	Storhallaren V	T10242	7060963	479153	x		Bjerck 1983	NTNU	
286	S-T	Hemne	Borchsminde nordre	T13629, 13857	7017657	502972		x	Bjerck 1983	NTNU	2)
287	S-T	Hemne	Haugen av Vitsø (1)	T11579	7018494	503783	x		Bjerck 1983	NTNU	
288	S-T	Hemne	Haugen av Vitsø (2)	T13865	7018499	503773		x	Bjerck 1983	NTNU	
289	S-T	Hemne	Kirksæter (1)	T11578, 13627, 14247	7017394	504124	x		Bjerck 1983	NTNU	
290	S-T	Hemne	Kirksæter (3)	T13852	7017809	504343		x	Oldsaksamlingens tilvekst 1928	NTNU	
291	S-T	Hemne	Stølan	T13355, 13862, 14248	7017806	503141	x		Bjerck 1983	NTNU	
292	S-T	Hemne	Vinje	T15457, 17456-57, 17792	7008772	499660	x		Bjerck 1983	NTNU	
293	S-T	Hitra	Asmundvåg	T15387	7050875	483531	x		Bjerck 1983	NTNU	
294	S-T	Hitra	Asmundvåg og Hestnes	T15386	7051842	482118	x		Oldsaksamlingens tilvekst 1937	NTNU	
295	S-T	Hitra	Bergtun	T18954	7054806	485243		x	Tilvekst 1969	NTNU	
296	S-T	Hitra	Dolm prestegård	T14854	7056220	485343	x		Bjerck 1983	NTNU	
297	S-T	Hitra	Granhaugen 2	T21177	7042497	499510		x	Hatleskog et al. 1988	NTNU	
298	S-T	Hitra	Hestnes	T15385	7052210	481556	x		Bjerck 1983	NTNU	
299	S-T	Hitra	Hjertåsen	T18238, 14904	7057181	487102		x	Oldsaksamlingens tilvekst 1934; 1961	NTNU	
300	S-T	Hitra	Hjertåsen, vestre skråning	T15106	7042845	501498	x		Oldsaksamlingens tilvekst 1935	NTNU	
301	S-T	Hitra	Melkestad	T10423, 11085	7036732	467004		x	Det Kongelige Norske Videnskabers Selskabs skrifter 1913-14	NTNU	
302	S-T	Hitra	Merraberget	T19677	7044498	504317	x		Tilvekst 1976	NTNU	
303	S-T	Hitra	Moa	T18467, 18752	7044829	505658	x		Tilvekst 1964, 1966	NTNU	
304	S-T	Hitra	Moholtan	T16504, 16508	7044798	505125	x		Oldsaksamlingens tilvekst 1947	NTNU	
305	S-T	Hitra	Mørkdalen	T14861	7054007	484366	x		Bjerck 1983	NTNU	
306	S-T	Hitra	Olsvik I	T14709	7040015	495736	x		Bjerck 1983	NTNU	
307	S-T	Hitra	Sandstad, forskjellige lokaliteter	T16400	7045110	505382		x	Oldsaksamlingens tilvekst 1946	NTNU	
308	S-T	Hitra	Sommerfjøsekra/Stien	T15570	7042957	502999		x	Oldsaksamlingens tilvekst 1938	NTNU	
309	S-T	Hitra	Straum	T14865	7048612	487259	x		Bjerck 1983	NTNU	
310	S-T	Hitra	Svankilen	T14840	7044141	471963	x		Oldsaksamlingens tilvekst 1934	NTNU	
311	S-T	Hitra	Tranvik	T17518, 17643, 17793 17915	7052023	501266		x	Møllenhus 1977	NTNU	
312	S-T	Hitra	Veaskaret	T13425, 14015, 14394, 14421	7050289	497643		x	Det Kongelige Norske Videnskabers Selskabs skrifter 1926; Oldsaksamlingens tilvekst 1929, 1931	NTNU	
313	S-T	Hitra	Vikansvingen, Site 1	T24972	7056142	491915	x		Kalseth in prep.	NTNU	
314	S-T	Oppdal	Brannhaugen	T22059	6950949	505949	x		Bjerck and Callanan 2005; Svendsen 2007b	NTNU	
315	S-T	Oppdal	Gjevilvatnet	T19413	6946259	525184	x		Bjerck 1983	NTNU	
316	S-T	Oppdal	Skarvatnet	T16815	6950359	527942	x		Svendsen 2007b	NTNU	
317	S-T	Oppdal	Sprikletjørnin	T20156, 20814	6958091	507548	x		Gustafson 1988; Svendsen 2007b	NTNU	
318	S-T	Orkdal	Geita	T21962	7033869	548253	x		Pettersen 2008	NTNU	
319	S-T	Osen	Angen	T10747	7142778	573532	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1913	NTNU	
320	S-T	Roan	Bjørnør prestegård	T18545	7117521	560273		x	Tilvekst 1964	NTNU	
321	S-T	Roan	Smedplassen	T13642, 14787	7110610	561466	x		Bjerck 1983	NTNU	
322	S-T	Snillfjord	E-R5, Vollen	T22617	7040112	505982	x		Dahl and Bergsvik 2001; Asprem and Skow 2002; Kalseth and Callanan 2003; Sjøstrand, Eikje and Myrholt 2004	NTNU	
323	S-T	Snillfjord	Vorpbukta 1	T22192	7040714	506021	x		Pettersen 1994	NTNU	
324	S-T	Stokksund	Botnmyren	T10712	7098302	546097	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1913	NTNU	
325	S-T	Åfjord	Bonenget	T18045, 18299, 18404, 18680	7101734	569267	x		Bjerck 1983	NTNU	

Abbreviations: S-T = Sør-Trøndelag County; N-T = Nord-Trøndelag County; M&R = Møre og Romsdal County. NTNU = NTNU University Museum, Trondheim; UiB = University Museum of Bergen, University of Bergen

Comments to the list of central Norway:

M&R: 3 sites were added after the publication of Paper 3 (Breivik 2014). Additionally, 4 sites were moved from the "certain" category (with typological markers/C14-dates) to the "uncertain" category (no certain typological markers). Number of sites in M&R in the present list: 264 (219 "certain" with typological markers/C14-dates; 45 "uncertain" without such markers).

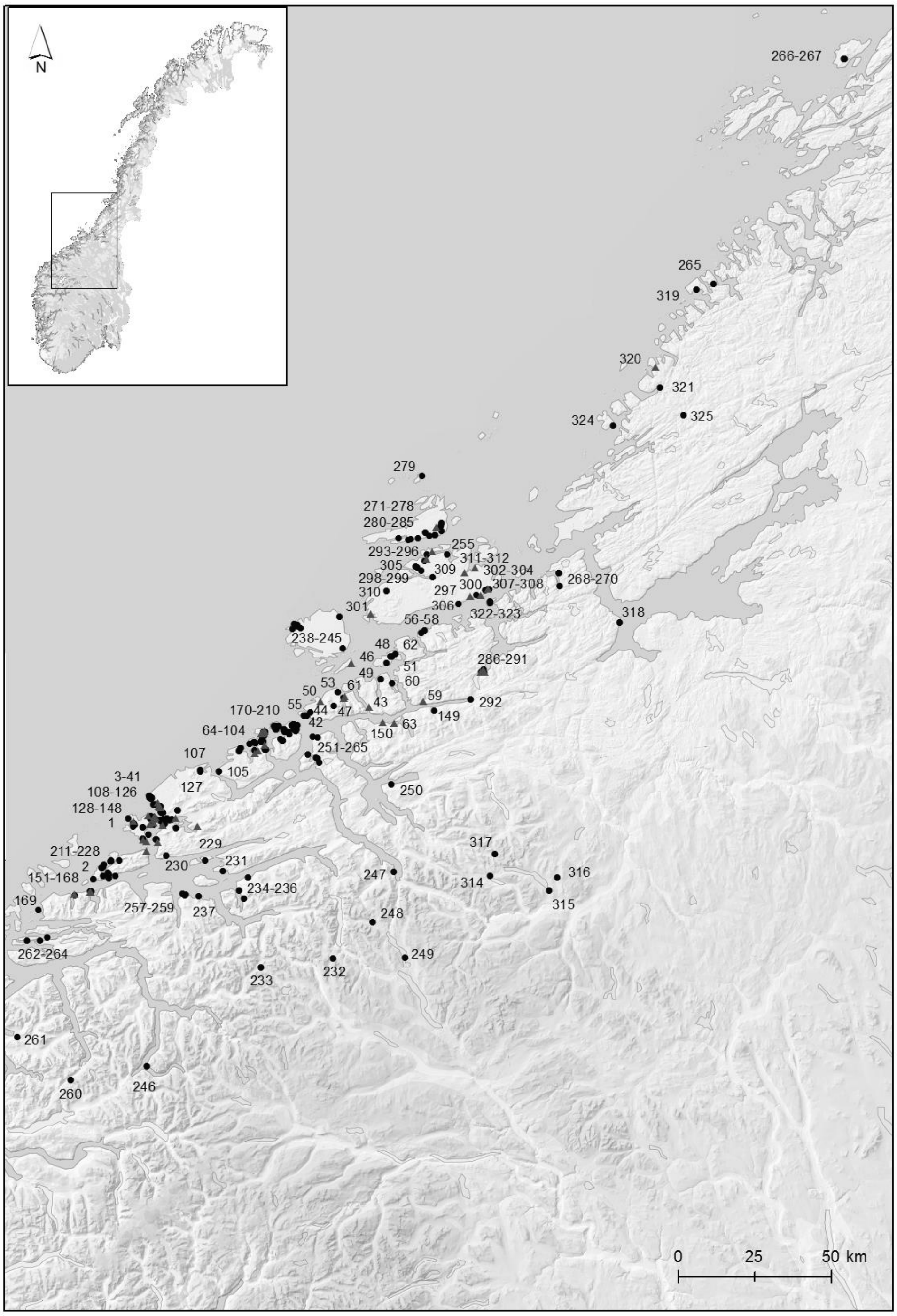
N-T: Number of sites in N-T in the present list: 3 (3 "certain" with typological markers/C14-dates).

S-T: 1 site was moved from the "certain" category (with typological markers/C14-dates) to the "uncertain" category (no certain typological markers) after the publication of Paper 3 (Breivik 2014). Number of sites in S-T in the present list: 58 (45 "certain" with typological markers/C14-dates; 13 "uncertain" without such markers).

Notes: 1) Added site; 2) Moved from "certain" to "uncertain" category; 3) Moved from "uncertain" to "certain" category

APPENDIX C-1

Map showing the distribution of Early Mesolithic sites in central Norway. "Certain" sites (sites containing diagnostic artefact(s) and/or radiocarbon dates) are marked with black dots; "uncertain" sites (sites without diagnostic artefacts but dated by shore-displacement curves/raw material/technological traits) are marked with grey triangles.



APPENDIX C-2

List of sites in west and southwest Norway (Rogaland, Hordaland, Sogn og Fjordane counties).

The list is the basis for Fig.3 and Table 2 in Paper 3 (Breivik 2014). Sorted alphabetically after county, municipality and site name.

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 32N)	Longitude (UTM 32N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
326	HO	Austrheim	Fosnstraumen, Site S7	B14543	6739912	280174		x	Bergsvik 1991	UiB	
327	HO	Austrheim	Fosnstraumen, Site S8	B14544	6739865	280220		x	Bergsvik 1991	UiB	
328	HO	Austrheim	Fosnstraumen, Site S9	B14545	6739891	280195	x		Bergsvik 1991	UiB	
329	HO	Austrheim	Fosnstraumen, Site S10	B14546	6739914	280155	x		Bergsvik 1991	UiB	
330	HO	Austrheim	Fosnstraumen, Site S11	B14547	6739819	280171		x	Bergsvik 1991	UiB	
331	HO	Bergen	Bjørge	B16371	6694634	298631	x		Tor Arne Waraas pers. comm. 2010	UiB	
332	HO	Bergen	Hjellestad 1	Askeladden ID 116660	6685318	291962	x		Tor Arne Waraas pers. comm. 2013	UiB	
333	HO	Bergen	Hjellestad 2	Askeladden ID 116661	6685149	291803	x		Tor Arne Waraas pers. comm. 2013	UiB	
334	HO	Bergen	Hjellestad 3	Askeladden ID 116663	6684866	291924	x		Tor Arne Waraas pers. comm. 2013	UiB	
335	HO	Bergen	Hjellestad 5/6	Askeladden ID 116665	6684829	291975	x		Tor Arne Waraas pers. comm. 2013	UiB	
336	HO	Bergen	Minde	B5215	6697908	298493	x		Granados 2011	UiB	
337	HO	Bømlo	Bergensleitet	B7456	6613622	286580	x		Bjerck 1983	UiB	
338	HO	Bømlo	Eidesvik, Eide	B9618	6612789	285134	x		Tor Arne Waraas pers. comm. 2010	UiB	
339	HO	Bømlo	Espevær	B7581	6612021	282665	x		Bjerck 1983	UiB	
340	HO	Bømlo	Gisøy II	B14398	6646320	280169	x		Kristoffersen 1990	UiB	
341	HO	Bømlo	Gulekro, Vespestad	B7558	6612922	285634	x		Tor Arne Waraas pers. comm. 2010	UiB	
342	HO	Bømlo	Lambhusdalen, Rubbstadneset	B12722	6636598	290647	x		Bjerck 1983	UiB	
343	HO	Bømlo	Langhamrahadlet	B11770	6613241	286562	x		Bjerck 1983	UiB	
344	HO	Bømlo	Litla Skiftesvika 142	B15423	6622386	284347	x		Waraas 2001	UiB	
345	HO	Bømlo	Naustbakken, Site 1	Askeladden ID 150752	6625761	294853		x	Tor Arne Waraas pers. comm. 2010	UiB	
346	HO	Bømlo	Naustbakken, Site 2	Askeladden ID 150756	6625803	294845		x	Tor Arne Waraas pers. comm. 2010	UiB	
347	HO	Bømlo	Røyksund	B7537	6627207	294309	x		Tor Arne Waraas pers. comm. 2010	UiB	
348	HO	Bømlo	Ulversøy II	B14384	6644767	281666	x		Kristoffersen 1990	UiB	
349	HO	Bømlo	Uratangen I, Hovland	B7454, 9021, 13150	6613205	286782	x		Bjerck 1983	UiB	
350	HO	Bømlo	Uratangen II, Hovland	B9022	6613896	288383		x	Granados 2011	UiB	
351	HO	Bømlo	Vespestad, Sokkemyren	B7117	6612998	285606		x	Granados 2011	UiB	
352	HO	Fjell	Bildøy 1	Askeladden ID 141405	6698066	284733	x		Tor Arne Waraas pers. comm. 2013	UiB	
353	HO	Fjell	Bildøy 2	Askeladden ID 141406	6698072	284751	x		Tor Arne Waraas pers. comm. 2013	UiB	
354	HO	Fjell	Bildøy 4	Askeladden ID 141409	6697952	285035	x		Tor Arne Waraas pers. comm. 2013	UiB	
355	HO	Fjell	Bildøy 8	Askeladden ID 141414	6697777	285220	x		Tor Arne Waraas pers. comm. 2013	UiB	
356	HO	Fjell	Bildøy 9	Askeladden ID 141415	6697758	285127	x		Tor Arne Waraas pers. comm. 2013	UiB	
357	HO	Fjell	Bjorøy, Nilsvika Site 17	B15011	6694658	288955		x	Kristoffersen 1995	UiB	2)
358	HO	Fjell	Bjorøy, Nilsvika Site 26	B15077/15263	6694658	288977		x	Kristoffersen 1995	UiB	2)
359	HO	Fjell	Bjorøy, Nilsvikdalen Site 20	B15013	6694415	288974		x	Kristoffersen 1995	UiB	2)
360	HO	Fjell	Hjartøy, Site 1	B16583	6690994	279497	x		Tor Arne Waraas pers. comm. 2013	UiB	
361	HO	Fjell	Hjartøy, Site 2	B16584	6691007	279456	x		Tor Arne Waraas pers. comm. 2013	UiB	
362	HO	Fjell	Hjartøy, Site 3	B16585	6690899	279471	x		Tor Arne Waraas pers. comm. 2013	UiB	
363	HO	Fjell	Knappskog 3	B14352	6700391	282711	x		Nærøy 1995a, 1998, 2000	UiB	
364	HO	Fjell	Kårtveit, Site 1	B12451	6702033	279540	x		Tor Arne Waraas pers. comm. 2013	UiB	
365	HO	Fjell	Kårtveit, Site 4	B12454	6701980	279545	x		Tor Arne Waraas pers. comm. 2013	UiB	
366	HO	Fjell	Kårtveit, Site 9	B12459	6702088	279698	x		Tor Arne Waraas pers. comm. 2013	UiB	
367	HO	Fjell	Vindenes, Site 58	B12629	6705285	279905	x		Ågotnes 1981	UiB	
368	HO	Fjell	Vindenes, Site 63	B12625	6707719	279164	x		Tor Arne Waraas pers. comm. 2013	UiB	
369	HO	Fjell	Ågotnes (4)	B13710	6703240	280550	x		Granados 2011	UiB	
370	HO	Fjell	Ågotnes (5)	B16696	6703245	280555	x		Granados 2011	UiB	
371	HO	Fjell	Ågotnes, Site 1 (1983)	B13476, 13477	6703714	280295	x		Tor Arne Waraas pers. comm. 2013	UiB	
372	HO	Fjell	Ågotnes, Site 2	Askeladden ID 127252	6704414	279792	x		Tor Arne Waraas pers. comm. 2013	UiB	
373	HO	Fjell	Ågotnes, Site 3	Askeladden ID 127253	6704456	279788	x		Tor Arne Waraas pers. comm. 2013	UiB	
374	HO	Os	Moberg	B12798	6677066	303292	x		Bjerck 1983	UiB	
375	HO	Os	Ved riksveien	B13552	6675373	303321	x		Granados 2011	UiB	
376	HO	Radøy	Flona 15	B16447	6730809	279259	x		Tor Arne Waraas pers. comm. 2013	UiB	
377	HO	Radøy	Fosnstraumen, Site R22	B14520	6739255	279884	x		Bergsvik 1991	UiB	
378	HO	Radøy	Kotedalen	B14501	6747932	275336	x		Olsen 1992	UiB	
379	HO	Radøy	Mongstad	B16110	6748014	283914	x		Tor Arne Waraas pers. comm. 2013	UiB	
380	HO	Radøy	Villanger	B14221	6739602	277383	x		Granados 2011	UiB	
381	HO	Stord	Digernes	B15205	6629440	298235	x		Tor Arne Waraas pers. comm. 2013	UiB	
382	HO	Stord	Djupedalen, Site 111	B15260	6641368	305112	x		Waraas 2001	UiB	
383	HO	Sund	Risøy I	B6826	6680051	281558	x		Bjerck 1983	UiB	
384	HO	Sund	Risøy II	B6827	6680050	281550	x		Bjerck 1983	UiB	
385	HO	Sund	Risøy III	B6828, 8067	6680040	281540	x		Bjerck 1983	UiB	
386	HO	Sund	Sele	B12449	6676674	282448	x		Granados 2011	UiB	
387	HO	Sund	Tyssøy, Site 4	B15073	6689923	287552	x		Kristoffersen 1995	UiB	
388	HO	Sveio	Kvalevåg, Site 3	B13829	6604302	298514	x		Granados 2011	UiB	

Abbreviations: HO = Hordaland County; ROG = Rogaland County; S&F = Sogn og Fjordane County. UiB = University Museum of Bergen, University of Bergen; UiS = Museum of Archaeology, University of Stavanger

APPENDIX C-2

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 32N)	Longitude (UTM 32N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
389	HO	Sveio	Nonsli	B13125	6609170	299498	x		Bjerck 1983	UiB	
390	HO	Sveio	Røykenes	B9671	6611236	303121	x		Bjerck 1983	UiB	
391	HO	Sveio	Tjernagel 6	B13655	6615312	293751	x		Bjerck and Ringstad 1985	UiB	
392	HO	Sveio	Tjernagel 32	B13681	6615310	293750	x		Bjerck and Ringstad 1985	UiB	
393	HO	Sveio	Tjernagel 34	B13683	6614827	292281	x		Bjerck and Ringstad 1985	UiB	
394	HO	Øygarden	Kollsnes, Budalen 14	B14625	6720249	272265	x		Nærøy 1994, 1995b, 1998, 2000	UiB	
395	HO	Øygarden	Kollsnes, Budalen 34	B14768	6720213	272315	x		Nærøy 1994, 1998, 2000	UiB	
396	HO	Øygarden	Kollsnes, Hidlaren 42	B14772	6713289	275705	x		Nærøy 1994, 1998, 2000	UiB	
397	HO	Øygarden	Kollsnes, Hidlaren 43	B14773	6713100	275722	x		Nærøy 1994, 1995b, 1998, 2000	UiB	
398	HO	Øygarden	Kollsnes, Revarvika 5	B14617	6720250	272270	x		Nærøy 1994, 1998, 2000	UiB	
399	HO	Øygarden	Kollsnes, Slåttevikane 40	B14770	6719768	270961	x		Nærøy 1994, 1998, 2000	UiB	
400	HO	Øygarden	Ingerdalen 16a	B13502	6709861	277047	x		Bjerck 1983; Waraas 2001	UiB	
401	HO	Øygarden	Karidalen 10	B13500	6708368	277971	x		Bjerck 1983; Waraas 2001	UiB	
402	HO	Øygarden	Rong, Site 4	Askeladden ID 91233	6715595	275327	x		Tor Arne Waraas pers. comm. 2013	UiB	
403	HO	Øygarden	Sture, Site 11B	B14311	6727491	273101	x		Granados 2011	UiB	
404	ROG	Bokn	Ogn, Site 1	n/a	6573896	298904	x		Nyland 2012a	UiS	
405	ROG	Bokn	Ogn, Site P-2	S10829	6573876	298852	x		Lindblom 1983; Bang-Andersen 1988a	UiS	
406	ROG	Eigersund	Hovland	S5740	6482233	323796	x		Granados 2011	UiS	
407	ROG	Finnøy	Dyrnes, Venja	S12392	6574844	321402	x		Floor 1989; Bang-Andersen 1988a, 1995	UiS	
408	ROG	Forsand	Oanes	S10359	6533144	331405	x		Bang-Andersen 1996b; Dugstad 2007	UiS	
409	ROG	Forsand	Store Fløyrlivatn, Site 1	S11681, 11786	6542623	356028	x		Tørhaug and Åstveit 2000	UiS	3)
410	ROG	Forsand	Store Fløyrlivatn, Site 2	S11682, 11787	6542416	355845	x		Tørhaug and Åstveit 2000	UiS	3)
411	ROG	Forsand	Store Fløyrlivatn, Site 3	S11683, 11788	6542126	355681	x		Tørhaug and Åstveit 2000	UiS	3)
412	ROG	Forsand	Store Fløyrlivatn, Site 6a	S11686, 11790	6539774	355081	x		Tørhaug and Åstveit 2000; Bang-Andersen 2003a, 2003b; Waraas 2001	UiS	
413	ROG	Forsand	Store Fløyrlivatn, Site 7	S11687, 11791	6541879	355767	x		Tørhaug and Åstveit 2000	UiS	3)
414	ROG	Forsand	Store Fløyrlivatn, Site 9	S11689	6539552	355731	x		Tørhaug and Åstveit 2000; Bang-Andersen 2003a, 2003b; Waraas 2001	UiS	
415	ROG	Forsand	Store Fløyrlivatn, Site 13	S11693, 11795	6541701	355783	x		Tørhaug and Åstveit 2000	UiS	3)
416	ROG	Forsand	Store Fløyrlivatn, Site 14	S11694, 11796	6541593	355644	x		Tørhaug and Åstveit 2000	UiS	3)
417	ROG	Forsand	Store Fløyrlivatn, Site 15	S11794	6539804	355354	x		Tørhaug and Åstveit 2000; Bang-Andersen 2003a, 2003b; Waraas 2001	UiS	
418	ROG	Gjesdal	Store Myrvatnet, Site A	S9875, 10161, 10437	6519871	354626	x		Bang-Andersen 1990	UiS	3)
419	ROG	Gjesdal	Store Myrvatnet, SIte B	S10162, 10428, 11892	6520094	354394	x		Bang-Andersen 1990	UiS	3)
420	ROG	Gjesdal	Store Myrvatnet, Site C	S10159, 10439, 11202	6520360	355112	x		Bang-Andersen 1990	UiS	3)
421	ROG	Gjesdal	Store Myrvatnet, Site D	S10160, 10440-43, 11203-04	6520920	355307	x		Bang-Andersen 1988a, 1988b, 1990, 2003a, 2003b; Waraas 2001	UiS	
422	ROG	Gjesdal	Store Myrvatnet, Site E		6520610	355184		x	Bang-Andersen 1990	UiS	
423	ROG	Gjesdal	Store Myrvatnet, Site F	S10445, 11205	6520852	355290	x		Bang-Andersen 1990	UiS	3)
424	ROG	Gjesdal	Store Myrvatnet, Site G	S10446, 11206	6520983	355447	x		Bang-Andersen 1990	UiS	3)
425	ROG	Gjesdal	Store Myrvatnet, Site H	S10447, 11893	6521050	355600	x		Bang-Andersen 1990	UiS	3)
426	ROG	Gjesdal	Store Myrvatnet, Site I	S10449, 10450, 11207	6520977	355356	x		Bang-Andersen 1988a, 1988b, 1990, 2003a, 2003b; Waraas 2001	UiS	
427	ROG	Gjesdal	Store Myrvatnet, Site J	S10451	6520892	355257	x		Bang-Andersen 1988a, 1988b, 1990	UiS	
428	ROG	Gjesdal	Store Myrvatnet, Site K	S11208	6521166	354537	x		Bang-Andersen 1988a, 1988b, 1990, 2003a, 2003b	UiS	
429	ROG	Hå	Obrestad	S3597	6507301	300888	x		Granados 2011	UiS	
430	ROG	Jæren?	(Location not specified)	S3827	6557798	332344	x		Granados 2011	UiS	
431	ROG	Karmøy	Breiviksklubben, Bratt-Helgaland	S11678	6580782	291479	x		Kutschera and Waraas 2000; Waraas 2001; Bang-Andersen 2003b	UiS	
432	ROG	Karmøy	Hellevik 3a	S12176	6581465	293893	x		Nyland 2011	UiS	
433	ROG	Karmøy	Moksheim	S3415	6586747	290170	x		Brøgger 1910; Bang-Andersen 1988a	UiS	
434	ROG	Karmøy	Snik	S7780	6584369	290937	x		Bang-Andersen 1988a	UiS	
435	ROG	Karmøy	Utvik	S10168-10170	6585915	288269	x		Hernæs 1979; Bang-Andersen 1988a; Waraas 2001	UiS	
436	ROG	Klepp	(Location not specified)	S3579	6514929	301628	x		Granados 2011	UiS	
437	ROG	Klepp	(Location not specified)	S5240	6521846	309754		x	Granados 2011	UiS	
438	ROG	Klepp	Austre Bore	S3612	6521715	303413	x		Granados 2011	UiS	
439	ROG	Klepp	Bore vestre/Bore austre	S4016	6521222	302696	x		Granados 2011	UiS	
440	ROG	Klepp	Gruda (1)	S5140	6522635	304847	x		Granados 2011	UiS	
441	ROG	Klepp	Gruda (2)	S8322	6521857	305278	x		Granados 2011	UiS	
442	ROG	Klepp	Kleppe	S3631	6519757	305609	x		Granados 2011	UiS	
443	ROG	Klepp	Revtangen	B3513	6518162	297890	x		Brøgger 1910	UiS	
444	ROG	Klepp	Rosland	S3696	6515811	302786	x		Granados 2011	UiS	
445	ROG	Klepp	Sele (1)	S3617	6524953	300823	x		Granados 2011	UiS	
446	ROG	Klepp	Sele (2)	S5776	6525000	301529	x		Granados 2011	UiS	
447	ROG	Klepp	Store Salte	S3599	6512542	303010	x		Granados 2011	UiS	
448	ROG	Klepp	Tjøtta	S3695	6516290	304586	x		Granados 2011	UiS	
449	ROG	Randaberg	(Location not specified)	S8782	6545395	303885	x		Granados 2011	UiS	
450	ROG	Randaberg	(Location not specified)	S8783	6545390	303890	x		Granados 2011	UiS	
451	ROG	Randaberg	(Location not specified)	S8784	6545385	303895	x		Granados 2011	UiS	
452	ROG	Randaberg	Viste	S2954	6543876	303838	x		Granados 2011	UiS	
453	ROG	Rennesøy	Galta 1	S10369	6560260	305641	x		Høgestøl 1990, 1995; Høgestøl et al. 1995; Prøsch-Danielsen and Høgestøl 1995; Waraas 2001	UiS	
454	ROG	Rennesøy	Galta 2	S10370	6559803	305688	x		Høgestøl 1990, 1995; Høgestøl et al. 1995; Prøsch-Danielsen and Høgestøl 1995	UiS	

Abbreviations: HO = Hordaland County; ROG = Rogaland County; S&F = Sogn og Fjordane County. UiB = University Museum of Bergen, University of Bergen; UiS = Museum of Archaeology, University of Stavanger

APPENDIX C-2

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 32N)	Longitude (UTM 32N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
455	ROG	Rennesøy	Galta 3	S10371	6559640	305635	x		Høgestøl 1990, 1995; Høgestøl et al. 1995; Prøsch-Danielsen and Høgestøl 1995; Waraas 2001; Fuglestvedt 2005, 2007, 2009	UiS	
456	ROG	Rennesøy	Galta 5	S10372	6559931	305639	x		Høgestøl 1990, 1995; Høgestøl et al. 1995	UiS	
457	ROG	Rennesøy	Galta 48	S10392	6560095	305267	x		Høgestøl 1990, 1995; Prøsch-Danielsen and Høgestøl 1995	UiS	
458	ROG	Rennesøy	Galta 79	S10512	6559630	305630	x		Høgestøl 1990, 1995; Høgestøl et al. 1995	UiS	
459	ROG	Rennesøy	Hesthammer, Site 1 (Galta)	S10426	6560600	305700	x		Høgestøl et al. 1995; Waraas 2001	UiS	
460	ROG	Rennesøy	Hesthammer, Site 2 (Galta)	S10427	6560608	305681	x		Høgestøl et al. 1995	UiS	
461	ROG	Rennesøy	Vestre Åmøy, Hegreberg, Site 1	S10523	6549333	310164	x		Granados 2011	UiS	
462	ROG	Sandnes	Hana	S6625	6528105	313335	x		Granados 2011	UiS	
463	ROG	Sandnes	Hommersåk	S10358	6536865	318147	x		Granados 2011	UiS	
464	ROG	Stavanger	Austbø 7/7, Site 3	S12006	6543856	312840	x		Hemdorff 2001; Dugstad 2007	UiS	
465	ROG	Stavanger	Austbø 7/7, Site 4	S12007	6543900	312878	x		Hemdorff 2001; Dugstad 2007	UiS	
466	ROG	Stavanger	Austbø 7/7, Site 5	S12008	6543946	312906	x		Hemdorff 2001; Dugstad 2007	UiS	
467	ROG	Stavanger	Austbø 7/7, Site 6	S12009	6543921	312919	x		Hemdorff 2001; Dugstad 2007	UiS	
468	ROG	Stavanger	Austbø 7/7, Site 7	S12010	6543979	312920	x		Hemdorff 2001; Dugstad 2002, 2007	UiS	
469	ROG	Stavanger	Austbø øst, Site 1	S10299	6543670	313424	x		Juhl 2001	UiS	
470	ROG	Stavanger	Austbø øst, Site 5	S10302	6543623	313259	x		Juhl 2001	UiS	
471	ROG	Stavanger	Austbø øst, Site 26	S10353	6543618	313196	x		Juhl 2001	UiS	
472	ROG	Stavanger	Jåttå	S9203	6534724	310553	x		Granados 2011	UiS	
473	ROG	Stavanger	Krosshaugen, Site 1	S11708	6544443	312518	x		Skjelstad 2000	UiS	
474	ROG	Stavanger	Krosshaugen, Site 3	S11710	6544430	312493	x		Skjelstad 2000	UiS	
475	ROG	Stavanger	Lindøy, Site 1C	S12352, 12280	6543320	316798	x		Skjelstad 2011a	UiS	
476	ROG	Stavanger	Lindøy, Site 5	S12179, 12204	6543339	316833	x		Skjelstad 2011b	UiS	
477	ROG	Stavanger	Lunde	S12151	6545276	313449	x		Dugstad 2007	UiS	
478	ROG	Stavanger	Meling, Dalen	S10916	6548813	313725	x		Bang-Andersen 1988a, 1996b	UiS	
479	ROG	Stavanger	Revheim	S9135	6539367	306885	x		Bang-Andersen 1996b	UiS	
480	ROG	Strand	Tau, Nordmarka, Site 3	S4199	6551380	324315	x		Gjerland 1986; Bang-Andersen 1988a	UiS	
481	ROG	Suldal	Jelsa	S6796	6580662	331813	x		Bang-Andersen 1996b	UiS	
482	ROG	Time	Re	S6153	6514796	305247	x		Granados 2011	UiS	
483	ROG	Tysvær	Leirvik	S10946	6577712	299359	x		Granados 2011	UiS	
484	ROG	Tysvær	Moldvika I, Årvik	S19954	6576111	304018	x		Gjerland 1990; Waraas 2001; Fuglestvedt 2005, 2009	UiS	
485	ROG	Utsira	Austrheim, Site 1	S12129	6582437	266795	x		Granados 2011	UiS	
486	S&F	Flora	Båtevik	B6572	6835050	289758	x		Tor Arne Waraas pers. comm. 2013	UiB	

Abbreviations: HO = Hordaland County; ROG = Rogaland County; S&F = Sogn og Fjordane County. UiB = University Museum of Bergen, University of Bergen; UiS = Museum of Archaeology, University of Stavanger

Comments to the list of west and southwest Norway:

HO: 2 sites were removed (doublets) after the publication of Paper 3 (Breivik 2014). Additionally, 3 sites were moved from the the "certain" category (typological markers/C14-dates) to the "uncertain" category (no typological markers). Number of sites in HO in the present list: 78 (68 "certain" with typological markers/C14-dates; 10 "uncertain" without such markers).

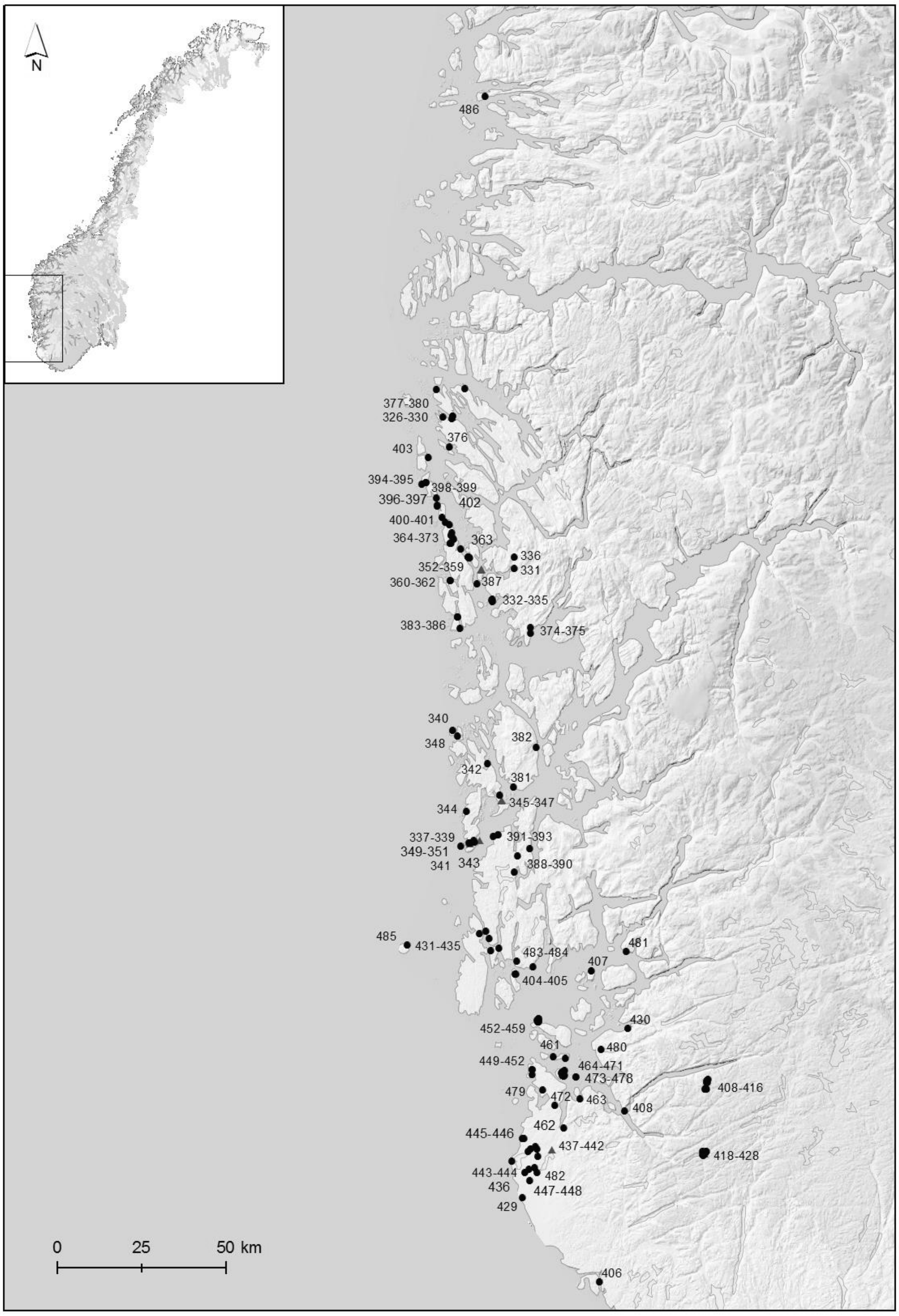
ROG: 1 site was removed (doublet) after the publication of Paper 3 (Breivik 2014). Additionally, 12 sites were moved from the "uncertain" category (without typological markers) to the "certain" category (typological markers/C14-dates). Number of sites in ROG in the present list: 83 (81 "certain" with typological markers/C14-dates; 2 "uncertain" without such markers).

S&F: Number of sites in S&F in the present list: 1 (1 "certain" with typological markers/C14-dates).

Notes: 1) Added site; 2) Moved from "certain" to "uncertain" category; 3) Moved from "uncertain" to "certain" category

APPENDIX C-2

Map showing the distribution of Early Mesolithic sites in west and southwest Norway. "Certain" sites (sites containing diagnostic artefact(s) and/or radiocarbon dates) are marked with black dots; "uncertain" sites (sites without diagnostic artefacts but dated by shore-displacement curves/raw material/technological traits) are marked with grey triangles.



APPENDIX C-3

List of sites in south and southeast Norway (Østfold, Akershus, Vestfold, Telemark, Aust-Agder counties).

The list is the basis for Fig.3 and Table 2 in Paper 3 (Breivik 2014). Sorted alphabetically after county, municipality and site name.

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 32N)	Longitude (UTM 32N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
487	AKE	Enebakk	Durud	n/a	6626080	612625	x		Lasse Jaksland pers. comm. 2011	UiO	
488	AKE	Enebakk	Svartorbekken/Rausjø	C37780	6632513	615051	x		Lasse Jaksland pers. comm. 2011	UiO	
489	AKE	Ski	Stunner	C32239, 24341, 25523, 27366, 27367, 28536, 29645, 32239, 39271	6625173	608055	x		Gustafson 1999; Fuglestvedt 1999	UiO	
490	A-A	Arendal	E18 Tvedestrand-Arendal, Flørstad	Askeladden ID 171070	6488710	491271	x		Eskeland 2013	UiO	
491	A-A	Arendal	E18 Tvedestrand-Arendal, Fløystad og Fløistad	Askeladden ID 171073	6489227	491847		x	Eskeland 2013	UiO	
492	A-A	Arendal	E18 Tvedestrand-Arendal, Hørdalen og Oddersland Østre	Askeladden ID 161300	6488492	491146	x		Eskeland 2013	UiO	
493	A-A	Arendal	E18 Tvedestrand-Arendal, Merland Store (1)	Askeladden ID 171065	6484015	488282		x	Eskeland 2013	UiO	
494	A-A	Arendal	E18 Tvedestrand-Arendal, Merland Store (2)	Askeladden ID 172500	6484585	487960		x	Eskeland 2013	UiO	
495	A-A	Arendal	E18 Tvedestrand-Arendal, Merland Store (3)	Askeladden ID 171069	6485314	489016		x	Eskeland 2013	UiO	
496	A-A	Arendal	E18 Tvedestrand-Arendal, Merland Store (4)	Askeladden ID 172497	6483879	488547		x	Eskeland 2013	UiO	
497	A-A	Arendal	E18 Tvedestrand-Arendal, Oddersland nedre (1)	Askeladden ID 171075	6486840	491297		x	Eskeland 2013	UiO	
498	A-A	Arendal	E18 Tvedestrand-Arendal, Oddersland nedre (2)	Askeladden ID 171536	6486702	491337		x	Eskeland 2013	UiO	
499	A-A	Arendal	E18 Tvedestrand-Arendal, Oddersland nedre og Venild	Askeladden ID 171738	6487116	491349		x	Eskeland 2013	UiO	
500	A-A	Arendal	E18 Tvedestrand-Arendal, Syrdalen	Askeladden ID 171074	6490503	492525	x		Eskeland 2013	UiO	
501	A-A	Tvedestrand	E18 Tvedestrand-Arendal, Jorkjenn (1)	Askeladden ID 170969	6491090	492956		x	Eskeland 2013	UiO	
502	A-A	Tvedestrand	E18 Tvedestrand-Arendal, Jorkjenn (2)	Askeladden ID 170970	6490864	492749		x	Eskeland 2013	UiO	
503	A-A	Tvedestrand	E18 Tvedestrand-Arendal, Kvastad (1)	Askeladden ID 172344	6492038	494195	x		Eskeland 2013	UiO	
504	A-A	Tvedestrand	E18 Tvedestrand-Arendal, Kvastad (2)	Askeladden ID 172665	6491956	494101		x	Eskeland 2013	UiO	
505	A-A	Tvedestrand	E18 Tvedestrand-Arendal, Kvastad (3)	Askeladden ID 172669	6491982	494063		x	Eskeland 2013	UiO	
506	A-A	Tvedestrand	E18 Tvedestrand-Arendal, Kvastad (4)	Askeladden ID 172683	6492475	494298		x	Eskeland 2013	UiO	
507	TEL	Bamble	E18 Bamble, Site AMS 15	Askeladden ID 138127	6540526	536355		x	Scheffler, Svendsen and Dermuth 2011	UiO	
508	TEL	Bamble	E18 Bamble, Site AMS 17	Askeladden ID 138130	6540925	536938		x	Scheffler, Svendsen and Dermuth 2011	UiO	
509	TEL	Bamble	E18 Bamble, Site AMS 18	Askeladden ID 138147	6540565	535783		x	Scheffler, Svendsen and Dermuth 2011	UiO	
510	TEL	Bamble	E18 Bamble, Site AMS 19	Askeladden ID 138143	6540424	536090		x	Scheffler, Svendsen and Dermuth 2011	UiO	
511	TEL	Bamble	E18 Bamble, Site AMS 20	Askeladden ID 138153	6540271	535485		x	Scheffler, Svendsen and Dermuth 2011	UiO	
512	TEL	Bamble	E18 Bamble, Site AMS 21	Askeladden ID 138144	6539594	533508	x		Scheffler, Svendsen and Dermuth 2011	UiO	
513	TEL	Bamble	E18 Bamble, Site FS 13	Askeladden ID 138121	6539958	534507		x	Scheffler, Svendsen and Dermuth 2011	UiO	
514	TEL	Bamble	E18 Bamble, Site FS 20	Askeladden ID 138114	6540777	536552		x	Scheffler, Svendsen and Dermuth 2011	UiO	
515	TEL	Bamble	E18 Bamble, Site FS 21	Askeladden ID 138119	6540615	536538		x	Scheffler, Svendsen and Dermuth 2011	UiO	
516	TEL	Bamble	E18 Bamble, Site FS 22	Askeladden ID 138126	6541135	536943		x	Scheffler, Svendsen and Dermuth 2011	UiO	
517	TEL	Bamble	E18 Bamble, Site FS 23	Askeladden ID 138150	6540237	535479		x	Scheffler, Svendsen and Dermuth 2011	UiO	
518	TEL	Bamble	E18 Bamble, Site FS 24	Askeladden ID 138151	6540480	535817		x	Scheffler, Svendsen and Dermuth 2011	UiO	
519	TEL	Bamble	E18 Rugtvedt-Dørdal, Bjerkeset, Øvre Tinderholt	Askeladden ID 146871	6540684	535703		x	Olsen 2012	UiO	
520	TEL	Bamble	E18 Rugtvedt-Dørdal, Fostvedt Østre	Askeladden ID 146146	6536395	527466		x	Olsen 2012	UiO	
521	TEL	Bamble	E18 Rugtvedt-Dørdal, Skeid	Askeladden ID 145173	6541696	536723		x	Olsen 2012	UiO	
522	TEL	Bamble	E18 Rugtvedt-Dørdal, Tveitan Østre	Askeladden ID 145410	6540957	535901		x	Olsen 2012	UiO	
523	TEL	Bamble	E18 Rugtvedt-Dørdal, Vissestad	Askeladden ID 145175	6538932	532509		x	Olsen 2012	UiO	
524	TEL	Porsgrunn	Vestf.banenprosjektet, Site 10 Gunnarsrød	Askeladden ID 128958	6551757	546757		x	Demuth 2009	UiO	
525	TEL	Porsgrunn	Vestf.banenprosjektet, Site 11 Gaukåsen	Askeladden ID 128955	6551722	546681		x	Demuth 2009	UiO	
526	VES	Larvik	Austein 1	C36725, 52497-98, C52638-39, 52882-83	6543360	554212	x		Matsumoto 2004	UiO	
527	VES	Larvik	Austein 2	C52499, 52640	6543266	554261		x	Matsumoto 2004	UiO	
528	VES	Larvik	Bakke	C56295	6548565	552683	x		Nyland and Amundsen 2012	UiO	
529	VES	Larvik	E18 Bommestad-Sky (2013)	Askeladden ID 161238	6549786	559707		x	Steinar Solheim pers. comm. 2013	UiO	
530	VES	Larvik	E18 Bommestad-Sky (Anvik 4067/9) (1)	Askeladden ID 128552	6547290	556913		x	Solheim and Damlien 2013	UiO	
531	VES	Larvik	E18 Bommestad-Sky (Anvik 4067/9) (2)	Askeladden ID 118594	6547508	556980		x	Solheim and Damlien 2013	UiO	
532	VES	Larvik	E18 Bommestad-Sky (Anvik 4067/9) (3)	Askeladden ID 118596 1-3	6547492	557077		x	Solheim and Damlien 2013	UiO	
533	VES	Larvik	E18 Bommestad-Sky, massedeponier	Askeladden ID 150593	6549588	560028		x	Solheim and Damlien 2013	UiO	

Abbreviations: AKE = Akershus County; A-A = Aust-Agder County; TEL = Telemark County; VES = Vestfold County; ØST = Østfold County. UiO = Museum of Cultural History, University of Oslo

APPENDIX C-3

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 32N)	Longitude (UTM 32N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
534	VES	Larvik	E18 Bommestad-Sky, Site 10	Askeladden ID 119050	6546972	557444		x	Solheim and Damlien 2013	UiO	
535	VES	Larvik	E18 Bommestad-Sky, Site 11	Askeladden ID 119051	6546905	557515		x	Solheim and Damlien 2013	UiO	
536	VES	Larvik	Melau	C51709, 51727, 51938-39, 52370, 52372-74, 52884	6542615	553093	x		Matsumoto 2004	UiO	
537	VES	Larvik	Nedre Hobekk 1	C58366	6548320	552200		x	Eigeland 2014	UiO	
538	VES	Larvik	Nedre Hobekk 2	C58367	6548336	552189		x	Melvold and Persson 2014	UiO	
539	VES	Larvik	Pauler 1	C56286	6547906	554643	x		Åhrberg 2012a	UiO	
540	VES	Larvik	Pauler 2	C56287	6547946	554768	x		Nyland 2012b	UiO	
541	VES	Larvik	Pauler 3	C56288	6547759	555033	x		Amundsen 2012a	UiO	
542	VES	Larvik	Pauler 4	C56289	6547822	554878	x		Nyland 2012c	UiO	
543	VES	Larvik	Pauler 5	C56290	6547786	554924	x		Amundsen 2012b	UiO	
544	VES	Larvik	Pauler 6	C56291	6547815	554604	x		Jaksland 2012c	UiO	
545	VES	Larvik	Pauler 7	C56292	6547808	554720	x		Jaksland 2012d	UiO	
546	VES	Larvik	Sky 1	C56293	6547428	555278	x		Amundsen 2012c	UiO	3)
547	VES	Larvik	Sky 2	C56294	6547796	555922		x	Åhrberg 2012b	UiO	
548	VES	Larvik	Sky-Nøklegård, Site 3	Askeladden ID 97810	6546296	556643	x		Iversen 2006; Jaksland and Persson 2014	UiO	
549	VES	Larvik	Sky-Nøklegård, Site 05	Askeladden ID 97833	6548435	553225		x	Jaksland and Persson 2014	UiO	
550	VES	Larvik	Sky-Nøklegård, Site 6	Askeladden ID 97808	6547741	555300		x	Iversen 2006; Jaksland and Persson 2014	UiO	
551	VES	Larvik	Sky-Nøklegård, Site 7	Askeladden ID 97806	6547771	555189		x	Iversen 2006; Jaksland and Persson 2014	UiO	
552	VES	Larvik	Sky-Nøklegård, Site 14	Askeladden ID 97821	6547487	555792		x	Iversen 2006; Jaksland and Persson 2014	UiO	
553	VES	Larvik	Sky-Nøklegård, Site 15	Askeladden ID 97822	6547443	555747		x	Iversen 2006; Jaksland and Persson 2014	UiO	
554	VES	Larvik	Sky-Nøklegård, Site 16	Askeladden ID 97825	6547470	555482		x	Iversen 2006; Jaksland and Persson 2014	UiO	
555	VES	Larvik	Sky-Nøklegård, Site 18	Askeladden ID 97827	6547439	555226		x	Iversen 2006; Jaksland and Persson 2014	UiO	
556	VES	Larvik	Sky-Nøklegård, Site 19	Askeladden ID 97828	6547402	555211		x	Iversen 2006; Jaksland and Persson 2014	UiO	
557	VES	Larvik	Solum 1	C58369	6548449	550831	x		Fossum 2014	UiO	3)
558	VES	Larvik	Vestf.banenprosjektet, Pauler and Brekke	Askeladden ID 116143-1 & 2	6547272	554901		x	Lia 2008	UiO	
559	VES	Larvik	Vestf.banenprosjektet, Pauler 4071/1	Askeladden ID 116147	6547402	554928		x	Lia 2008	UiO	
560	VES	Re	Lærum	C53092	6590406	570899	x		Lasse Jaksland pers. comm. 2011	UiO	
561	ØST	Aremark	Aremarksjøen IV	C34932	6570312	651373	x		Lasse Jaksland pers. comm. 2011	UiO	
562	ØST	Aremark	Spondalen	n/a	6567541	657371		x	Westli 2009	UiO	
563	ØST	Buskerud	Nåbyvann	n/a	6614784	583393		x	Westli 2009	UiO	
564	ØST	Eidsberg	Gruveåsen 1	Askeladden ID 142014	6604676	624953		x	Westli 2009	UiO	
565	ØST	Eidsberg	Sameiga 4	Askeladden ID 142013	6600833	630832		x	Westli 2009	UiO	
566	ØST	Halden	Ganerød	C27186	6558833	644890		x	Lindblom 1984; Westli 2009	UiO	
567	ØST	Halden	Herrebøkasa	C27177	6550519	641674	x		Jaksland and Persson 2014	UiO	
568	ØST	Halden	Kjøler Ødegård I / Kjølødegården	C24748	6565680	639485	x		Lindblom 1984	UiO	
569	ØST	Halden	Sagholen/Iddebøen	C24883, 25193, 25380, 25381, 27375-76, 31111, 32492	6545181	642974	x		Mikkelsen 1975; Lindblom 1984	UiO	
570	ØST	Marker	Rødenessjøen 1	C32082	6608780	646057	x		Lasse Jaksland pers. comm. 2011	UiO	
571	ØST	Rakkestad	Brennåsen 6	Askeladden ID 142009	6577018	633834	x		Westli 2009	UiO	
572	ØST	Rakkestad	Buer	C34931, 34932	6590790	629505		x	Lindblom 1984; Westli 2009	UiO	
573	ØST	Rakkestad	Grasåsen 1	Askeladden ID 142010	6587700	643588		x	Westli 2009	UiO	
574	ØST	Rakkestad	Grasåsen 2	Askeladden ID 142011	6587407	644166		x	Westli 2009	UiO	
575	ØST	Rakkestad	Gåseby	C32082, 34937	6603428	648356		x	Lindblom 1984; Westli 2009	UiO	
576	ØST	Rakkestad	Høgeholtet 1	Askeladden ID 142017	6588749	644738		x	Westli 2009	UiO	
577	ØST	Rakkestad	Høgeholtet 2	Askeladden ID 142018	6588765	644715		x	Westli 2009	UiO	
578	ØST	Rakkestad	Kattebekk	Askeladden ID 29559	6581005	631203	x		Jaksland and Persson 2014	UiO	
579	ØST	Rakkestad	Kullbråtan	n/a	6575178	634089	x		Lasse Jaksland pers. comm. 2011	UiO	
580	ØST	Rakkestad	Nordre Breiholt	C25847, 25501, 25506, 31957	6579470	632211	x		Lindblom 1984	UiO	
581	ØST	Rakkestad	Rudskogen 1	Askeladden ID 105445	6582753	629360		x	Westli 2009	UiO	
582	ØST	Rakkestad	Rudskogen 3	n/a	6582573	629376		x	Westli 2009	UiO	
583	ØST	Rakkestad	Rudskogen 4	Askeladden ID 105450	6582432	629453		x	Westli 2009	UiO	
584	ØST	Rakkestad	Rudskogen 5	Askeladden ID 105451	6582376	629426		x	Westli 2009	UiO	
585	ØST	Rakkestad	Rudskogen 8	Askeladden ID 105486	6582512	629286		x	Westli 2009	UiO	
586	ØST	Rakkestad	Rudskogen 9	Askeladden ID 105506	6582495	629214		x	Westli 2009	UiO	
587	ØST	Rakkestad	Rudskogen 10	Askeladden ID 105518	6582554	629283		x	Westli 2009	UiO	
588	ØST	Rakkestad	Høgnipen, Mellommyr	Askeladden ID 62811	6574924	633244	x		Johansen 1964	UiO	
589	ØST	Rakkestad	Høgnipen, Rørmyr I	Askeladden ID 62812	6574917	633285	x		Johansen 1964	UiO	

Abbreviations: AKE = Akershus County; A-A = Aust-Agder County; TEL = Telemark County; VES = Vestfold County; ØST = Østfold County. UiO = Museum of Cultural History, University of Oslo

APPENDIX C-3

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 32N)	Longitude (UTM 32N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
590	ØST	Rakkestad	Høgnipen, Rørmyr II	C34058	6574915	633284	x		Johansen 1964; Mikkelsen 1975; Lindblom 1984; Skar and Coulson 1985, 1989	UiO	
591	ØST	Rakkestad	Sandbekk	C39851, 52646, 52880, 52881, 53516, 53517	6580952	631472	x		Matsumoto and Uleberg 2006	UiO	
592	ØST	Rakkestad	Skøttmåså	Askeladden ID 59040	6589280	640367		x	Westli 2009	UiO	
593	ØST	Rakkestad	Store Ertevatn I	C33658	6579096	635769		x	Lindblom 1984; Westli 2009	UiO	
594	ØST	Rakkestad	Sæterdalen	C25498, 25499, 25865	6574648	641948	x		Lindblom 1984	UiO	
595	ØST	Rakkestad	Søndre Breiholt	C25505, 25834, 25860	6577267	632627	x		Mikkelsen 1975; Lindblom 1984	UiO	
596	ØST	Rakkestad	Vesle Stomperudstykke	Askeladden ID 49206	6579007	636664		x	Westli 2009	UiO	
597	ØST	Rakkestad	Østby/Tue 1 (Nord)	n/a	6593137	636142		x	Westli 2009	UiO	
598	ØST	Rakkestad	Østby/Tue 2 (Sør)	n/a	6592916	636226		x	Westli 2009	UiO	
599	ØST	Rakkestad	Ådalen	C25494, 25835	6578792	631057	x		Mikkelsen 1975; Lindblom 1984	UiO	
600	ØST	Rakkestad	Åsedalen	n/a	6575532	632909	x		Jaksland and Persson 2014	UiO	
601	ØST	Rakkestad	Åserud	C25552, 25837	6589282	640376	x		Mikkelsen 1975; Lindblom 1984	UiO	
602	ØST	Sarpsborg	Rudskogen 2	Askeladden ID 105448	6582582	629471		x	Westli 2009	UiO	
603	ØST	Sarpsborg	Rudskogen 6	Askeladden ID 105452	6582479	629268		x	Westli 2009	UiO	
604	ØST	Sarpsborg	Rudskogen 7	Askeladden ID 105454	6582468	629269		x	Westli 2009	UiO	
605	ØST	Sarpsborg	Rudskogen 11	Askeladden ID 105520	6582461	629546		x	Westli 2009	UiO	
606	ØST	Sarpsborg	Stang	C31789	6582259	618108		x	Lindblom 1984; Westli 2009	UiO	
607	ØST	Spydeberg	Holstein 1 og 2	C11660, 17080, 10838, 12562, 13271, 13928	6599090	617172	x		Lindblom 1984	UiO	
608	ØST	Spydeberg	Mulerudbekken	n/a	6620168	616525	x		Jaksland and Persson 2014	UiO	

Abbreviations: AKE = Akershus County; A-A = Aust-Agder County; TEL = Telemark County; VES = Vestfold County; ØST = Østfold County. UiO = Museum of Cultural History, University of Oslo

<u>Comments to the list of south and southeast Norway:</u>

A-A: Number of sites in A-A in the present list: 17 (4 "certain" with typological markers/C14-dates, 13 "uncertain" without such markers).

AKE: Number of sites in AKE in the present list: 3 (3 "certain" with typological markers/C14-dates).

TEL: 16 sites were mistakenly taken to belong to VES instead of TEL in Paper 3 (Breivik 2014). These are in the present list moved to TEL; the georeferences of these sites were correct and thus remain. Number of sites in TEL in the present list: 19 (1 "certain" with typological markers/C14-dates; 18 "uncertain" without such markers).

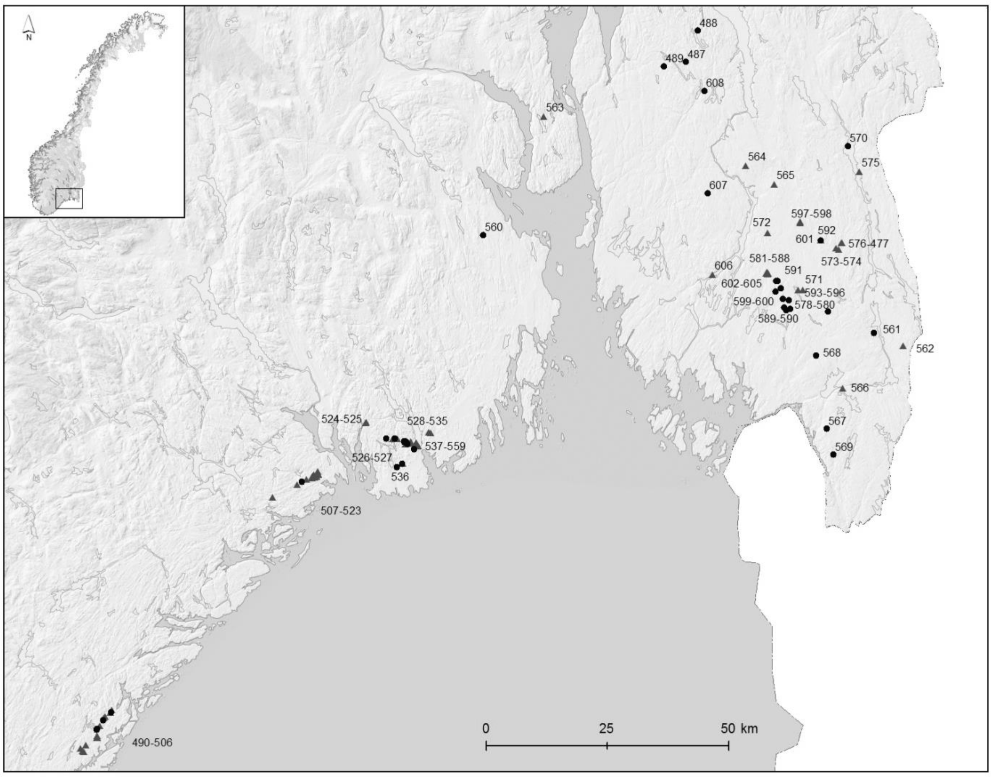
VES: 6 sites were removed (5 doublets, 1 younger site) after the publication of Paper 3 (Breivik 2014). Additionally, 2 sites were moved from the "uncertain" category (without typological markers) to the "certain" category (typological markers/C14-dates). Number of sites in VES in the present list: 36 (14 "certain" with typological markers/C14-dates, 22 "uncertain" without such markers).

ØST: Number of sites in ØST in the present list: 48 (20 "certain" with typological markers/C14-dates; 28 "uncertain" without such markers).

Notes: 1) Added site; 2) Moved from "certain" to "uncertain" category; 3) Moved from "uncertain" to "certain" category

APPENDIX C-3

Map showing the distribution of Early Mesolithic sites in south and southeast Norway. “Certain” sites (sites containing diagnostic artefact(s) and/or radiocarbon dates) are marked with black dots; “uncertain” sites (sites without diagnostic artefacts but dated by shore-displacement curves/raw material/technological traits) are marked with grey triangles.



APPENDIX C-4

List of sites in north Norway (Nordland, Troms and Finnmark counties).

The list is the basis for Fig.3 and Table 2 in Paper 3 (Breivik 2014). Sorted alphabetically after county, municipality and site name.

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 33N)	Longitude (UTM 33N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
609	FIN	Alta	Amtmannsneset	n/a	7786509	816062		x	Nummedal 1929, 1975; Bøe and Nummedal 1936; Simonsen 1974	UiT	
610	FIN	Alta	Bossekop I	C25143, 25467	7782372	814279	x		Bøe and Nummedal 1936; Nummedal 1975	UiT	
611	FIN	Alta	Melsvik	Ts12318-12321	7787546	805151	x		Niemi et al. in press	UiT	
612	FIN	Alta	Ovenfor Bossekop II	C25466	7783033	814533	x		Bøe and Nummedal 1936; Nummedal 1975	UiT	
613	FIN	Alta	Stenseng I	C23931, Ts10558 11010	7785275	816229	x		Nummedal 1929, 1975; Bøe and Nummedal 1936; Woodman 1993	UiT	
614	FIN	Alta	Stenseng II	C23932, Ts5958, 10933	7785730	815933	x		Nummedal 1929, 1975; Bøe and Nummedal 1936; Woodman 1993	UiT	
615	FIN	Alta	Tollevik	C25174	7784138	814716	x		Nummedal 1929, 1975; Bøe and Nummedal 1936; Simonsen 1974, Woodman 1993	UiT	
616	FIN	Berlevåg	Kjølnesaksla	n/a	7920729	1017127		x	Blankholm 2015, in press	UiT	
617	FIN	Berlevåg	Løkvika	n/a	7913058	1021980	x		Kleppe 2014	UiT	
618	FIN	Berlevåg	Skonsvika	Ts3238, C24189	7920810	1013321	x		Nummedal 1929; Bøe and Nummedal 1936; Woodman 1993	UiT	
619	FIN	Berlevåg	Storelva A	n/a	7920530	1011590		x	Blankholm 2015, in press	UiT	
620	FIN	Berlevåg	Styrflaten	n/a	7919428	1018553		x	Blankholm 2015, in press	UiT	
621	FIN	Berlevåg	Veddalselven/Storelva	C24187	7919562	1011687	x		Bøe and Nummedal 1936	UiT	
622	FIN	Berlevåg	Vest for Berlevåg	C24185	7922407	1011357	x		Bøe and Nummedal 1936	UiT	
623	FIN	Berlevåg	Zoar 3	n/a	7921861	1009625		x	Blankholm 2015, in press	UiT	
624	FIN	Berlevåg	Zoar 4	n/a	7922017	1009638		x	Blankholm 2015, in press	UiT	
625	FIN	Båtsfjord	Indre Syltevik 1	n/a	7898285	1065408		x	Blankholm 2015, in press	UiT	
626	FIN	Båtsfjord	Indre Syltevik 2	n/a	7898275	1065461		x	Blankholm 2015, in press	UiT	
627	FIN	Båtsfjord	Nordfjord 2	n/a	7896117	1055158		x	Blankholm 2015, in press	UiT	
628	FIN	Båtsfjord	Nordfjord 3	n/a	7896201	1055243		x	Blankholm 2015, in press	UiT	
629	FIN	Båtsfjord	Nordfjord 4	n/a	7896170	1055296		x	Blankholm 2015, in press	UiT	
630	FIN	Båtsfjord	Nordfjord 5	n/a	7896212	1055328		x	Blankholm 2015, in press	UiT	
631	FIN	Båtsfjord	Nordfjord 7	n/a	7896265	1055423		x	Blankholm 2015, in press	UiT	
632	FIN	Båtsfjord	Nordfjord 8	n/a	7896275	1055455		x	Blankholm 2015, in press	UiT	
633	FIN	Båtsfjord	Nordfjord 9	n/a	7896328	1055476		x	Blankholm 2015, in press	UiT	
634	FIN	Båtsfjord	Skjåvika 1	n/a	7900770	1074423		x	Blankholm 2015, in press	UiT	
635	FIN	Båtsfjord	Skjåvika 2	n/a	7900730	1074426		x	Blankholm 2015, in press	UiT	
636	FIN	Båtsfjord	Skjåvika 3	n/a	7900741	1074466		x	Blankholm 2015, in press	UiT	
637	FIN	Båtsfjord	Skjåvika 4	n/a	7900722	1074439		x	Blankholm 2015, in press	UiT	
638	FIN	Båtsfjord	Veineset	C24550	7902088	1039402	x		Bøe and Nummedal 1936	UiT	
639	FIN	Båtsfjord	Ytre Syltefjord 12	n/a	7899830	1059151		x	Blankholm 2015, in press	UiT	
640	FIN	Båtsfjord	Ytre Syltefjord 13	n/a	7900269	1059230		x	Blankholm 2015, in press	UiT	
641	FIN	Båtsfjord	Ytre Syltefjord 14	n/a	7900459	1059558		x	Blankholm 2015, in press	UiT	
642	FIN	Båtsfjord	Ytre Syltevik 1	n/a	7899031	1066765		x	Blankholm 2015, in press	UiT	
643	FIN	Båtsfjord	Ytre Syltevik 3	n/a	7898899	1066775		x	Blankholm 2015, in press	UiT	
644	FIN	Båtsfjord	Ytre Syltevik 4	n/a	7898867	1066791		x	Blankholm 2015, in press	UiT	
645	FIN	Båtsfjord	Ytre Syltevik 5	n/a	7898846	1066812		x	Blankholm 2015, in press	UiT	
646	FIN	Båtsfjord	Ytre Syltevik 6	n/a	7899015	1066971		x	Blankholm 2015, in press	UiT	
647	FIN	Båtsfjord	Ytre Syltevik 7	n/a	7898772	1067061		x	Blankholm 2015, in press	UiT	
648	FIN	Båtsfjord	Ytre Syltevik 8	n/a	7898772	1067061		x	Blankholm 2015, in press	UiT	
649	FIN	Båtsfjord	Ytre Syltevik 9	n/a	7899168	1066860		x	Blankholm 2015, in press	UiT	
650	FIN	Gamvik	Elvevågen 3	n/a	7937162	975637		x	Blankholm 2015, in press	UiT	
651	FIN	Gamvik	Elvevågen 4	n/a	7937152	975606		x	Blankholm 2015, in press	UiT	
652	FIN	Gamvik	Elvevågen 5	n/a	7937147	975585		x	Blankholm 2015, in press	UiT	
653	FIN	Gamvik	Elvevågen 6	n/a	7937353	975336		x	Blankholm 2015, in press	UiT	
654	FIN	Gamvik	Elvevågen 7	n/a	7937459	975029		x	Blankholm 2015, in press	UiT	
655	FIN	Gamvik	Elvevågen 8	n/a	7937570	974886		x	Blankholm 2015, in press	UiT	
656	FIN	Gamvik	Elvevågen 9	n/a	7937596	974908		x	Blankholm 2015, in press	UiT	
657	FIN	Gamvik	Elvevågen 10	n/a	7937490	975267		x	Blankholm 2015, in press	UiT	
658	FIN	Gamvik	Elvevågen 11	n/a	7937459	975315		x	Blankholm 2015, in press	UiT	
659	FIN	Gamvik	Gamvik 1	n/a	7936401	976235		x	Blankholm 2015, in press	UiT	
660	FIN	Gamvik	Gamvik 2	n/a	7936919	975960		x	Blankholm 2015, in press	UiT	
661	FIN	Gamvik	Vardnesodden 1	n/a	7939601	973606		x	Blankholm 2015, in press	UiT	
662	FIN	Hammerfest	Melkøya, Sundfjæra Midtre (1)	Ts11416	7865075	816809	x		Thuestad 2005; Hesjedal, Ramstad and Niemi 2009	UiT	
663	FIN	Hammerfest	Melkøya, Sundfjæra Midtre (2)	Ts11417	7865065	816839	x		Hesjedal, Ramstad and Niemi 2009	UiT	
664	FIN	Hammerfest	Slettnes (IVA)	Ts9422, 9434	7857047	800598	x		Hesjedal et al. 1996	UiT	
665	FIN	Hammerfest	Slettnes (VII)	Ts9418, 9443	7856898	800840	x		Hesjedal et al. 1996	UiT	
666	FIN	Lebesby	Sjåholmen	C24487	7871593	941360	x		Universitetets Oldsaksamling Årbok 1929	UiT	
667	FIN	Lebesby	Sjånes (Skjånes)	C25469	7870779	942565	x		Bøe og Nummedal 1936	UiT	
668	FIN	Nesseby	Čåkki-1	Ts11888	7833267	1021303	x		Grydeland 2006; Rankama and Kankaanpää 2011	UiT	
669	FIN	Nesseby	Fállegoahtesajeguolbba	Ts7597, 11169	7833055	1021514	x		Rankama and Kankaanpää 2011	UiT	
670	FIN	Nesseby	Hana-oaive	Ts4806, 4944, 5228, 5229	7836329	1010835	x		Hans Peter Blankholm, pers. comm. 2011	UiT	
671	FIN	Nesseby	Karlebotn A	n/a	7836463	1010380		x	Blankholm 2015, in press	UiT	
672	FIN	Nesseby	Karlebotn B	n/a	7836547	1010491		x	Blankholm 2015, in press	UiT	
673	FIN	Nesseby	Karlebotn C	n/a	7836590	1010523		x	Blankholm 2015, in press	UiT	
674	FIN	Nesseby	Karlebotn D	n/a	7836632	1010491		x	Blankholm 2015, in press	UiT	
675	FIN	Nesseby	Karlebotn E	n/a	7836542	1010412		x	Blankholm 2015, in press	UiT	
676	FIN	Nesseby	Karlebotn F	n/a	7836489	1010348		x	Blankholm 2015, in press	UiT	
677	FIN	Nesseby	Karlebotn SV, Øvre	Ts4950, 5227	7835435	1012078	x		Woodman 1993	UiT	
678	FIN	Nesseby	Klubbvik I	n/a	7842361	1030929	x		Kleppe 2010	UiT	
679	FIN	Nesseby	Lagesiid'bakti	Ts11885	7837202	1010957	x		Grydeland 2006; Rankama and Kankaanpää 2011	UiT	
680	FIN	Nesseby	Nesseby I	Ts6287	7842639	1021207	x		Odner 1966	UiT	
681	FIN	Nesseby	Nesseby IB	Ts6289	7842449	1021567	x		Odner 1966	UiT	
682	FIN	Nesseby	Nii’beræppen-3	Ts11884	7833711	1028771	x		Grydeland 2006; Rankama and Kankaanpää 2011	UiT	
683	FIN	Nesseby	Ovenfor Gropbakkeengen	Ts3902, 5225-5227	7835327	1011573	x		Woodman 1993	UiT	
684	FIN	Nesseby	Ovenfor ungdomslokalet Nesseby	C24212	7842483	1022411	x		Universitetets Oldsaksamling Årbok 1928	UiT	

Abbreviations: FIN = Finnmark County; NOR = Nordland County; TRO = Troms County. NTNU = NTNU University Museum, Trondheim; UiT = Tromsø University Museum, UiT, The Arctic University of Norway

APPENDIX C-4

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 33N)	Longitude (UTM 33N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
685	FIN	Nesseby	Starehnjunni	n/a	7835034	1010873	x		Woodman 1993; Thuestad 2005; Kankaanpää and Rankama 2012	UiT	
686	FIN	Nordkapp	Sarnes B4	Ts10189	7909455	890703	x		Thommessen 1996a; Blankholm 2004; Thuestad 2005	UiT	
687	FIN	Porsanger	Børselvnesset I	C24183	7835403	889264	x		Nummedal 1929; Bøe and Nummedal 1936	UiT	
688	FIN	Porsanger	Repvåg	C24173	7883495	891431		x	Nummedal 1929, 1975; Bøe and Nummedal 1936; Simonsen 1974	UiT	
689	FIN	Porsanger	Vedbotneidet	C24174	7883601	888645		x	Nummedal 1929, 1975; Bøe and Nummedal 1936; Simonsen 1974; Woodman 1993	UiT	
690	FIN	Sør-Varanger	Kattugleelva	C24548	7896278	1054835	x		Bøe and Nummedal 1936	UiT	
691	FIN	Sør-Varanger	Kobbholmfjord I	C24549, 24857	7818135	1100825	x		Bøe and Nummedal 1936	UiT	
692	FIN	Sør-Varanger	Kobbholmfjord II	C24858	7817479	1101078	x		Bøe and Nummedal 1936	UiT	
693	FIN	Sør-Varanger	Prestestua I / Grense Jakobselv	C24579	7819951	1104554	x		Bøe and Nummedal 1936; Woodman 1993	UiT	
694	FIN	Sør-Varanger	Prestestua II	C25172, 24866	7819785	1102221	x		Bøe and Nummedal 1936; Woodman 1993	UiT	
695	FIN	Sør-Varanger	Reinøya I	n/a	7814446	1078340	x		Odner 1966	UiT	
696	FIN	Sør-Varanger	Seilmerket II	C24380, 24875, 24382, 24541, 24876, 25169	7805633	1078414	x		Bøe and Nummedal 1936; Woodman 1993	UiT	
697	FIN	Vadsø	Melkevarden	C25215, 24202, Ts8053	7842199	1058625	x		Nummedal 1929; Bøe and Nummedal 1936	UiT	
698	FIN	Vadsø	Mellom Vadsø by og skihytten (pr 1927)	Ts3240	7842167	1056245	x		Hans Peter Blankholm, pers. comm. 2011	UiT	
699	FIN	Vadsø	Skallbukta 1	n/a	7861435	1072532		x	Blankholm 2015, in press	UiT	
700	FIN	Vadsø	Skallbukta 2	n/a	7856937	1068798		x	Blankholm 2015, in press	UiT	
701	FIN	Vadsø	Skittenelv, V. Jakobselv	C24365	7842583	1037995	x		Bøe and Nummedal 1936; Woodman 1993	UiT	
702	FIN	Vadsø	Vest for Skytterhuset, Vadsø	C24206, 25216	7842715	1054154	x		Bøe and Nummedal 1936	UiT	
703	FIN	Varanger	Mortensnes, R10, fornminne 2	Ts8327	7841110	1028073		x	Schanche 1988	UiT	
704	FIN	Varanger	Mortensnes, R10, fornminne 8	Ts8486	7841121	1028035		x	Schanche 1988	UiT	
705	FIN	Varanger	Mortensnes, R8	Ts8324	7841702	1026653	x		Schanche 1988; Hauglid 1993	UiT	
706	FIN	Varanger	Mortensnes, R9	Ts8459	7841617	1027097	x		Schanche 1988	UiT	
707	FIN	Vardø	Komagnes 1	n/a	7865053	1076882		x	Blankholm 2015, in press	UiT	
708	FIN	Vardø	Molvika	Ts7961	7880617	1097054		x	Bøe and Nummedal 1936; Hauglid 1993; Woodman 1993	UiT	
709	FIN	Vardø	Smellroren	C25468, 25836, 25151	7888782	1093796	x		Bøe and Nummedal 1936; Woodman 1993	UiT	
710	FIN	Vardø	Smelror (1)	n/a	7888039	1093459		x	Blankholm 2015, in press	UiT	
711	FIN	Vardø	Smelror (2)	n/a	7888039	1093517		x	Blankholm 2015, in press	UiT	
712	FIN	Vardø	Smelror (3)	n/a	7888018	1093480		x	Blankholm 2015, in press	UiT	
713	FIN	Vardø	Smelror (4)	n/a	7888002	1093517		x	Blankholm 2015, in press	UiT	
714	FIN	Vardø	Smelror (5)	n/a	7887991	1093580		x	Blankholm 2015, in press	UiT	
715	FIN	Vardø	Ytre Kiberg I	C25464, 25465	7876701	1095701	x		Bøe and Nummedal 1936	UiT	
716	NOR	Bodø	Saltstraumen Evjen 1-6	Ts10001-10006	7454292	480566	x		Hauglid 1993	UiT	
717	NOR	Bodø	Saltstraumen, Godøynes	Ts10011	7460988	488838		x	Hauglid 1993	UiT	
718	NOR	Bodø	Saltstraumen, Laukeng	Ts10007	7455948	483428		x	Hauglid 1993	UiT	
719	NOR	Bodø	Saltstraumen, Tuv 1-3	Ts10008-10010	7455880	483787	x		Hauglid 1993	UiT	
720	NOR	Leirfjord	Kvefsnhaugen	T24973	7335110	403067	x		Berglund 2006	NTNU	
721	NOR	Lødingen	Nes	Ts1987/61	7586151	537311		x	Hauglid 1993	UiT	
722	NOR	Rødøy	Øvre Tjong	n/a	7397420	432226	x		Hauglid 1993	UiT	
723	NOR	Steigen	Fure 1	Ts10014	7528229	507605	x		Hauglid 1993	UiT	
724	NOR	Steigen	Skjenaustet	Ts10013	7530870	505217		x	Hauglid 1993	UiT	
725	NOR	Sømna	Ljøshaugen	T13315	651200	7250803*	x		Det Kongelige Norske Videnskabers Selskabs skrifter 1926	NTNU	
726	NOR	Tysfjord	Leiknes	Ts3868, 4149	7569977	543996		x	Hauglid 1993	UiT	
727	NOR	Vega	Guldsvåg	T15536	631351	7287265*	x		Oldsaksamlingens tilvekst 1938	NTNU	
728	NOR	Vega	Moen II/III/Ljøsåsen	T19790	630708	7283157*	x		Tilvekst 1977	NTNU	
729	NOR	Vega	Mohalsen	T18254	630783	7283130*	x		Tilvekst 1961	NTNU	
730	NOR	Vega	Mohalsen 2012-I	T19464, 25950, 26109	631244	7283522*	x		Pettersen 1982; Lorentzen 2012, 2013	NTNU	
731	NOR	Vega	Mohalsen 2012-II	T26053	631291	7283287*	x		Bjerck et al. 2012	NTNU	
732	NOR	Vega	Mohalsen, Moen søndre	T21057	630860	7283253*	x		Bjerck 1987	NTNU	
733	TRO	Harstad	Stangnes syd (1)	Askeladden ID 119808	7630397	563721		x	Ragnhild Myrstad pers. comm. 2013	UiT	
734	TRO	Harstad	Stangnes syd (2)	Askeladden ID 119809	7630180	563619		x	Ragnhild Myrstad pers. comm. 2013	UiT	
735	TRO	Harstad	Stangnes syd (3)	Askeladden ID 130322	7630161	563615		x	Ragnhild Myrstad pers. comm. 2013	UiT	
736	TRO	Ibestad	Sørrollnes	Askeladden ID 150629	7625746	574890		x	Larsen 2011	UiT	
737	TRO	Karlsøy	Finkroken Sør	Ts7984	7754407	670828	x		Sandmo 1986; Barlindhaug 1996	UiT	
738	TRO	Karlsøy	Kvalshausen	Ts3736, 5459-60, 7985	7779583	681946	x		Sandmo 1986; Barlindhaug 1996	UiT	
739	TRO	Karlsøy	Kvitnes	Askeladden ID 157962	7784140	692872		x	Ragnhild Myrstad pers. comm. 2013	UiT	
740	TRO	Karlsøy	Lille Skorøya	Ts8026	7791102	691474		x	Sandmo 1986; Barlindhaug 1996	UiT	
741	TRO	Karlsøy	Nord-Grunnfjord	Ts10902	7774992	675200		x	Barlindhaug 1996	UiT	
742	TRO	Kvænangen	Pilvågen	Ts8022	7790550	748956		x	Barlindhaug 1996	UiT	
743	TRO	Kvænangen	Reinfjord(botn)	Ts7988/8030	7790922	750608	x		Sandmo 1986; Barlindhaug 1996	UiT	
744	TRO	Kvænangen	Segelvik	Ts8031	7800740	734803		x	Barlindhaug 1996	UiT	
745	TRO	Målselv	Målsnes 1	Ts11172	7697564	639448	x		Thuestad 2005; Blankholm 2008	UiT	
746	TRO	Skjervøy	Kobbpollen	Ts8177	7774637	726459		x	Sandmo 1986; Barlindhaug 1996	UiT	
747	TRO	Skjervøy	Vorterøyskagen	Ts7989	7771903	715161		x	Barlindhaug 1996	UiT	
748	TRO	Tromsø	Farstad av Storslett	J.nr. 237/1968	7724956	618901	x		Sandmo 1986; Barlindhaug 1996	UiT	
749	TRO	Tromsø	Høghaugen	Ts7987	7755951	645171	x		Sandmo 1986; Barlindhaug 1996	UiT	
750	TRO	Tromsø	Håkøybotn	Askeladden ID 116679	7729270	644273		x	Ramberg 2008	UiT	
751	TRO	Tromsø	Krabbelv	Ts8032	7743457	655237	x		Barlindhaug 1996	UiT	
752	TRO	Tromsø	Kraknes	Ts7990	7744812	655881		x	Sandmo 1986; Barlindhaug 1996	UiT	
753	TRO	Tromsø	Kårvik	Ts7986	7757132	649387		x	Sandmo 1986	UiT	

Abbreviations: FIN = Finnmark County; NOR = Nordland County; TRO = Troms County. NTNU = NTNU University Museum, Trondheim; UiT = Tromsø University Museum, UiT, The Arctic University of Norway

APPENDIX C-4

Site no	County	Municipality	Site name	Identification number	Latitude (UTM 33N)	Longitude (UTM 33N)	"Certain" site	"Uncertain" site	References	Assemblage deposited	Note
754	TRO	Tromsø	Kårvikelva	Ts8027 (blandet med Stongsnes)	7756673	651801	x		Sandmo 1986; Barlindhaug 1996	UiT	
755	TRO	Tromsø	Lanes	Ts8024	7737752	651840	x		Sandmo 1986; Barlindhaug 1996	UiT	
756	TRO	Tromsø	Movika, Site 1	Askeladden ID 116938	7738353	658416		x	Ragnhild Myrstad pers. comm. 2013	UiT	
757	TRO	Tromsø	Movika, Site 2	Askeladden ID 117533	7738376	658420		x	Ragnhild Myrstad pers. comm. 2013	UiT	
758	TRO	Tromsø	Movika (3)	Askeladden ID 117000	7739007	658515		x	Ragnhild Myrstad pers. comm. 2013	UiT	
759	TRO	Tromsø	Naustvoll	Ts6094, 8023	7725415	620177	x		Sandmo 1986; Barlindhaug 1996	UiT	
760	TRO	Tromsø	Oldervikeidet	Ts8021	7727930	622687		x	Barlindhaug 1996	UiT	
761	TRO	Tromsø	Rakknes	Ts7988 (blandet med Rakkneskjosen)	7751651	651470	x		Sandmo 1986; Barlindhaug 1996	UiT	
762	TRO	Tromsø	Sandvika	Ts10192, 10189	7723117	617662	x		Thuestad 2005	UiT	
763	TRO	Tromsø	Simavik (1)	Ts7983	7751910	654559	x		Sandmo 1986; Barlindhaug 1996	UiT	
764	TRO	Tromsø	Simavik (2)	Askeladden ID 119953	7752176	654462		x	Tømmervåg 2008	UiT	
765	TRO	Tromsø	Skulgam gartneri (Skolehaugen/Kråklia)	Askeladden ID 118738	7747548	657886		x	Stensrud 2008	UiT	
766	TRO	Tromsø	Storneset	Ts8034	7749176	662593	x		Barlindhaug 1996	UiT	
767	TRO	Tromsø	Svarvaren (1)	Ts7982	7749086	673081	x		Sandmo 1986; Barlindhaug 1996	UiT	
768	TRO	Tromsø	Svarvaren (2)	Askeladden ID 117995	7748911	673058		x	Ragnhild Myrstad pers. comm. 2013	UiT	
769	TRO	Tromsø	Sørhella	n/a	7748432	654809		x	Barlindhaug 1996	UiT	
770	TRO	Tromsø	Tønsnes, Site 2b	Ts11912	7742100	659368	x		Skandfer 2010	UiT	
771	TRO	Tromsø	Tønsnes, Site 10	Askeladden ID 105042	7742302	659607	x		Hood and Kjellman 2012	UiT	

Abbreviations: FIN = Finnmark County; NOR = Nordland County; TRO = Troms County. NTNU = NTNU University Museum, Trondheim; UiT = Tromsø University Museum, UiT, The Arctic University of Norway

Comments to the list of north Norway:

FIN: Number of sites in FIN in the present list: 107 (46 "certain" with typological markers/C14-dates; 61 "uncertain" without such markers).

NOR: Number of sites in NOR in the present list: 17 (12 "certain" with typological markers/C14-dates; 5 "uncertain" without such markers).

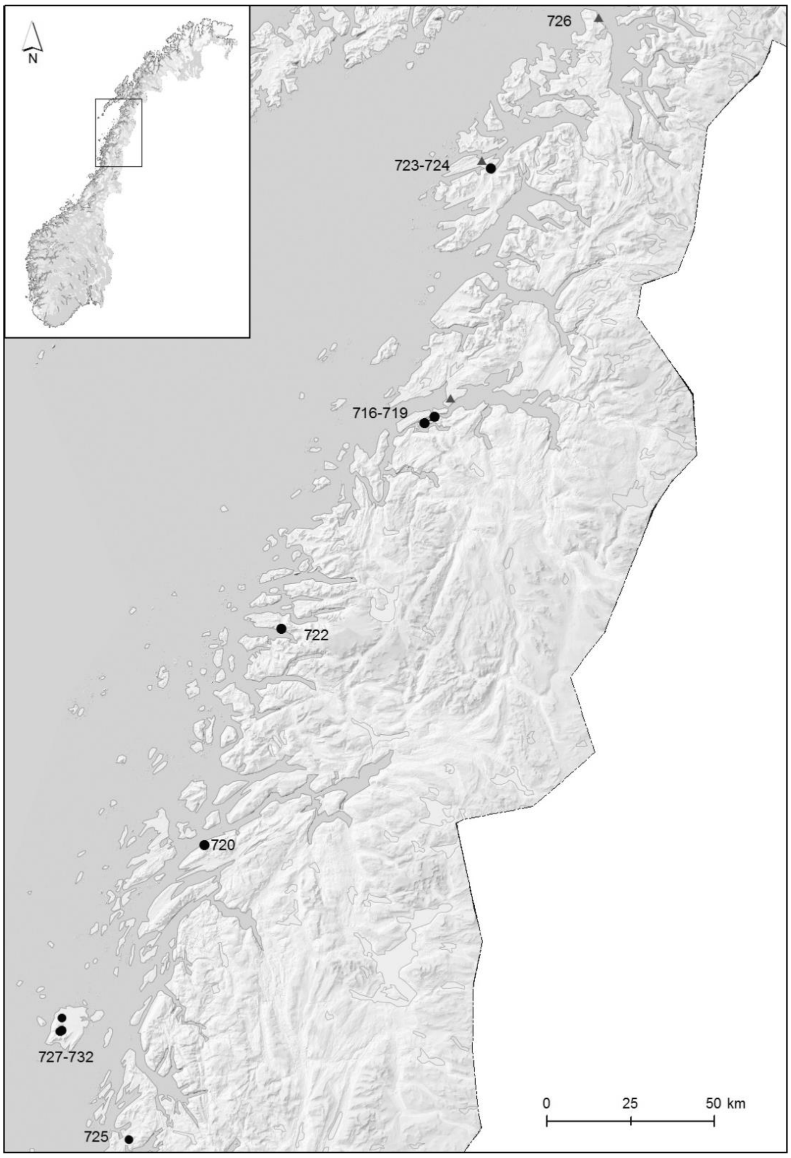
TRO: 1 site was removed (doublet) after the publication of Paper 3 (Breivik 2014). The number of sites in TRO in the present list: 39 (17 "certain" with typological markers/C14-dates; 22 "uncertain" without such markers).

* UTM 32N

Notes: 1) Added site; 2) Moved from "certain" to "uncertain" category; 3) Moved from "uncertain" to "certain" category

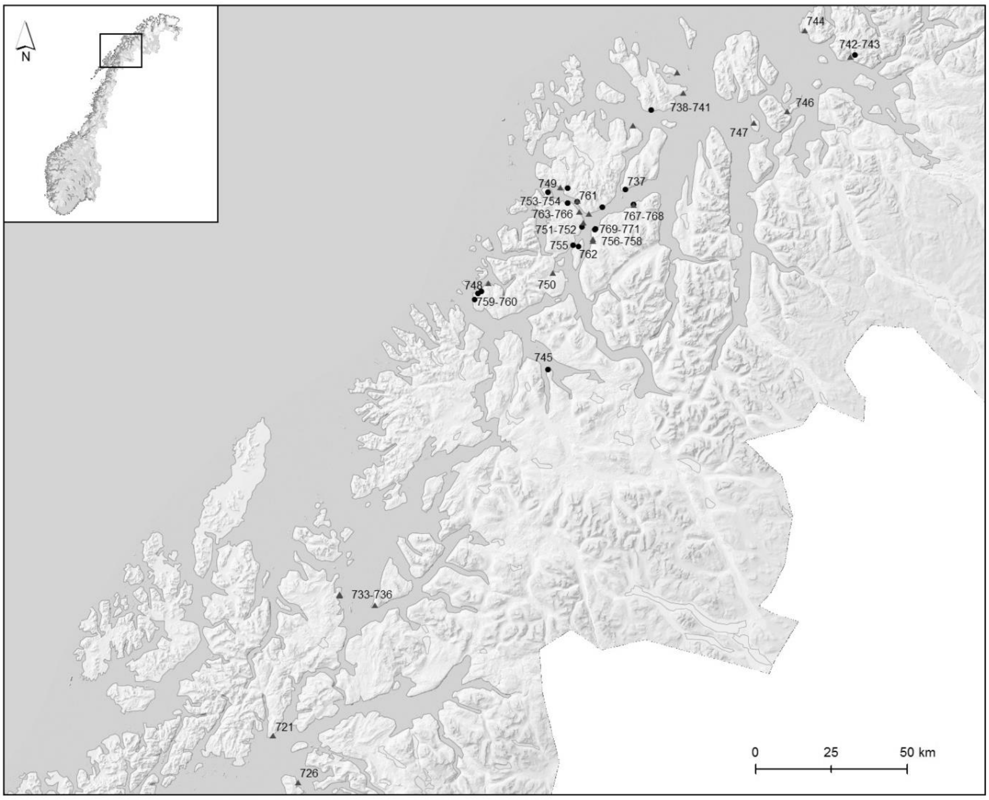
APPENDIX C-4

Map showing the distribution of Early Mesolithic sites in Nordland County, northern Norway. "Certain" sites (sites containing diagnostic artefact(s) and/or radiocarbon dates) are marked with black dots; "uncertain" sites (sites without diagnostic artefacts but dated by shore-displacement curves/raw material/technological traits) are marked with grey triangles.



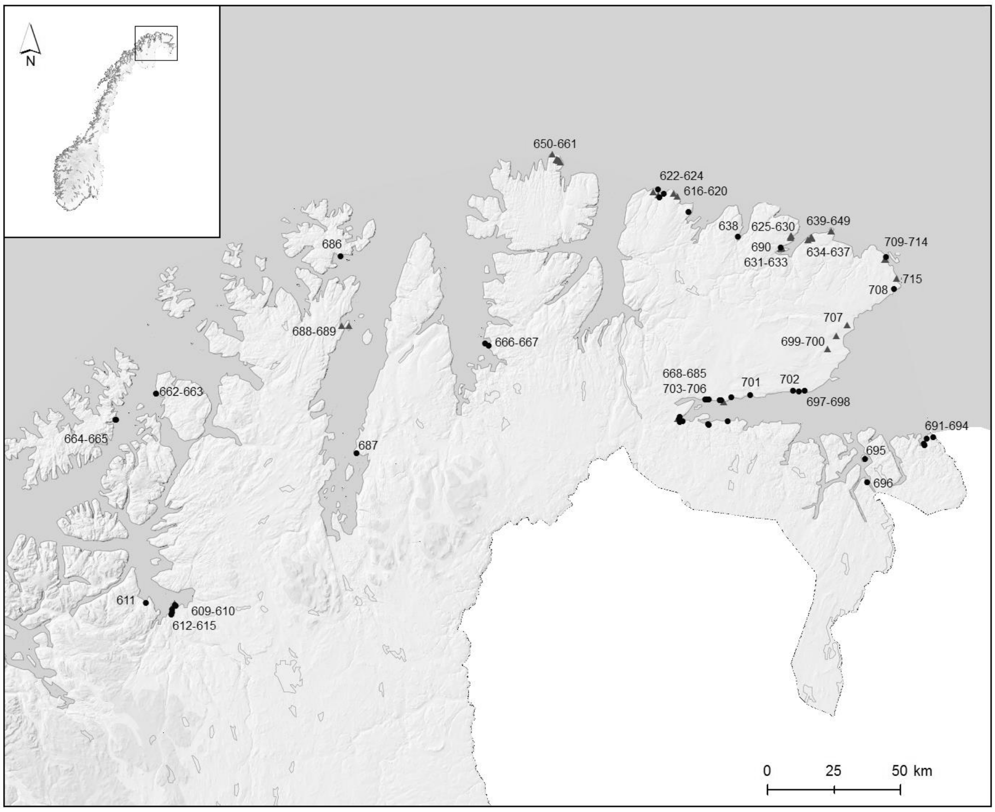
APPENDIX C-4

Map showing the distribution of Early Mesolithic sites in Troms County, northern Norway. "Certain" sites (sites containing diagnostic artefact(s) and/or radiocarbon dates) are marked with black dots; "uncertain" sites (sites without diagnostic artefacts but dated by shore-displacement curves/raw material/technological traits) are marked with grey triangles.



APPENDIX C-4

Map showing the distribution of Early Mesolithic sites in Finnmark County, northern Norway. "Certain" sites (sites containing diagnostic artefact(s) and/or radiocarbon dates) are marked with black dots; "uncertain" sites (sites without diagnostic artefacts but dated by shore-displacement curves/raw material/technological traits) are marked with grey triangles.



Appendix D

Complete overview of artefacts recovered on the sites presented and analyzed in Paper 4 (Breivik and Callanan in press)

APPENDIX D

Complete overview of artefacts recovered on the sites presented and analyzed in Paper 4 (Breivik and Callanan in press)

	COASTAL SITES									MOUNTAIN SITES		
ALL ARTEFACTS	**Ormen Lange Site 48**				**Ormen Lange Site 72**		**Hestvikholmane**		**Kvernberget**	**Reinsvatnet R1**	**Sandgrovbotnen**	**Brannhaugen**
	Unit A	**Unit G**	**Unit I**	**Unit J**	**Unit X**	**Unit Y**	**Site 3**	**Site 2-2012**	**Site 20**			
Flakes and tool production debris												
Flakes (regular flakes, bladelike flakes, platform rejuvenation)	10608	8796	2399	744	1659	483	3865	3495	719	3897	669	636
Tool production debris (micro burins, burin spalls, projectile/adze production, edge rejuvenation)	30	42	4	4	35	8	15	8	1	23	9	15
Total	**10638**	**8838**	**2403**	**748**	**1694**	**491**	**3880**	**3503**	**720**	**3920**	**678**	**651**
Cores												
Unifacial cores with acute striking angle	4	6	3	8		1	2		1	5	1	11
Other platform cores and core fragments	5	7	4	2	3		4	1	4	24	2	1
Bipolar cores and core fragments								6		11	7	1
Other cores (including unspecified)	16	12	6	3	5	1	3	44	2	13	5	12
Total	**25**	**25**	**13**	**13**	**8**	**2**	**9**	**51**	**7**	**53**	**15**	**25**
Blades												
Macroblades	88	107	45	12	5	7	2	1	3	104	51	43
Medioblades	88	109	56	32	5	1	11	4	5	115	33	65
Microblades	55	101	38	27	6	1	28	4	1	92	22	41
Other blades (cortex, hinged, plunged)	61	82	32	11	6	2	8		2	25	7	16
Total	**292**	**399**	**171**	**82**	**22**	**11**	**49**	**9**	**11**	**336**	**113**	**165**
Tanged points												
Single-edged point	8	2	4	2	3			1	1	24	5	4
Tanged point	5	6	3		1	3		4	1	9	2	1
Obliquely edged points		1										
Other points (including unspecified)										1		
Point fragment	3	19	4	1					1			3
Mid fragment		1								2		
Tang fragment									1	4	1	
Total	**16**	**29**	**11**	**3**	**4**	**3**		**5**	**4**	**40**	**8**	**8**
Microliths												
Lancet microliths	3	6	1		2	2	1			21	2	9
Rhombic microliths	1											
Other microliths (including unspecified)						1					1	
Total	**4**	**6**	**1**		**2**	**3**	**1**			**21**	**3**	**9**
Adzes												
Flake-adzes / flake chisels	7	7	1	1	1		1			1		
Core-adzes												
Total	**7**	**7**	**1**	**1**	**1**		**1**		**0**	1		
Scrapers												
Scrapers	1		3				1			6	11	7
Total	**1**		**3**				**1**			**6**	**11**	**7**
Other formal tools												
Høgnipen-points							2		2			
Burins	4	6	2						1	3	2	5
Bladeknives / retouched flakeknives	1	3		1						5		
Borers										3		
Total	**5**	**9**	**2**	**1**			**2**		**3**	**11**	**2**	**5**
Informal tools												
Retouched blades	4	10	6		2		2			29	18	24
Retouched flakes	11	22	6	2	4	1	8		6	71	33	9
Flakes with use-wear	16	18	14	3	5		3		2	33	17	15
Total	**31**	**50**	**26**	**5**	**11**	**1**	**13**		**8**	**133**	**68**	**48**
Grand total	**11019**	**9363**	**2631**	**853**	**1742**	**511**	**3956**	**3568**	**753**	**4515**	**898**	**918**

TOOLS	**Ormen Lange Site 48**				**Ormen Lange Site 72**		**Hestvikholmane**		**Kvernberget**	**Reinsvatnet R1**	**Sandgrovbotnen**	**Brannhaugen**
	Unit A	**Unit G**	**Unit I**	**Unit J**	**Unit X**	**Unit Y**	**Site 3**	**Site 2-2012**	**Site 20**			
Formal tools	33	51	18	5	7	6	5	5	7	79	24	29
Informal tools	31	50	26	5	11	1	13		8	133	68	48
Total	**64**	**101**	**44**	**10**	**18**	**7**	**18**	**5**	**15**	**212**	**92**	**77**

FORMAL TOOLS	**Ormen Lange Site 48**				**Ormen Lange Site 72**		**Hestvikholmane**		**Kvernberget**	**Reinsvatnet R1**	**Sandgrovbotnen**	**Brannhaugen**
	Unit A	**Unit G**	**Unit I**	**Unit J**	**Unit X**	**Unit Y**	**Site 3**	**Site 2-2012**	**Site 20**			
Tanged points	16	29	11	3	4	3		5	4	40	8	8
Microliths	4	6	1	0	2	3	1			21	3	9
Adzes	7	7	1	1	1		1			1		
Scrapers	1		3				1			6	11	7
Other formal tools	5	9	2	1			2		3	11	2	5
Total	**33**	**51**	**18**	**5**	**7**	**6**	**5**	**5**	**7**	**79**	**24**	**29**

Appendix E

Complete list of projectiles recovered from the presented and analyzed sites in Paper 4 (Breivik and Callanan in press)

APPENDIX E

Complete list of projectiles recovered from the presented and analyzed sites in Paper 4 (Breivik and Callanan in press).

Ormen Lange Site 48, Unit A (T22752)

Sub no	Type	Length	Width	Point	Fracture	Comment	In analysis	Photographed
Complete points								
4802	Single-edged	1,6	0,9		Fragment			
6708	Single-edged	1,2	0,9		Fracture in point and basis			
6720	Single-edged	1,7	0,7		Fracture in point			
6740	Single-edged	1,8	0,8		Fracture in point and tang			
6748	Single-edged	1,8	0,9		Fracture in point	Made on flake		x
7890	Single-edged	2,3	0,8		Fracture in point			x
8611	Single-edged	2,1	0,9		Fracture on side			
8612	Single-edged/microlith rejuvenation	1,7	0,8		Fragment			
595	Tanged point/single-edged	1,3	0,7	Distal	Fracture in point			
1617	Tanged point/single-edged	2,1	0,9	Proximal			x	
1667	Tanged point/single-edged	2,3	0,9	Proximal			x	
405	Tanged point	1,6	0,7	Proximal			x	
4834	Tanged point/tang fragment	1,7	1,4	Proximal				
Point fragments								
4833	Point fragment	1	0,6					
6773	Point fragment	1	0,7		Fracture in point			
7931	Point fragment	1,2	0,8					
Microliths								
7770	Lancet microlith	2,2	0,9		Fracture in point	Made on hinged blade/flade-like flake		
7932	Lancet microlith	1,7	0,9	Proximal	Fracture in point			x
1610	Lancet microlith	2,2	1,2			Atypical	x	
8610	Rhombic microlith	n/a	n/a		Possible fracture in point			

Ormen Lange Site 48, Unit G (T22752)

Sub no	Type	Length	Width	Point	Fracture	Comment	In analysis	Photographed
Complete points								
272	Single-edged	n/a	n/a	Proximal	Fracture in basis			
4357	Single-edged	1,4	0,9		Fracture in point			
4323	Tanged point/single-edged	2,2	1,5	Distal	Fracture in point			
238	Tanged point	n/a	n/a	Proximal			x	
278	Tanged point	1,7	0,9	Proximal	Fracture along side			
372	Tanged point	2,2	0,9	Proximal	Fracture in basis			x
1302	Tanged point	n/a	n/a	Distal	Fracture on edge			
8428	Tanged point	n/a	n/a	Proximal			x	
267	Obliquely edged	2	1,1	Proximal	Fracture			
Point fragments								
264	Point fragment	1	0,7			Uncertain		
4419	Point fragment	0,9	0,6	Proximal		Possible		
4430	Point fragment	1,5	0,5					
4435	Point fragment	0,8	0,6			Possible		
4520	Point fragment	1	0,7		Fracture in point			
8261	Point fragment	0,5	0,5					
8276	Point fragment	1,5	1,4					
8286	Point fragment	0,8	0,7					
8297	Point fragment	0,6	0,3					
8360	Point fragment	0,8	0,4			Possible		
8371	Point fragment	0,9	0,4					
8383	Point fragment	1	0,4					
8388	Point fragment	1,3	0,4					
8441	Point fragment	0,9	0,5					
8442	Point fragment	0,4	0,6					
8443	Point fragment	0,6	0,4					
248	Point fragment, tanged point	0,9	1,5		Fracture in point and base			
4395	Point fragment, single-edged	0,9	0,7					
4437	Point fragment, single-edged	1	0,5					
8296	Mid fragment	0,7	0,8					
Microliths								
285	Lancet microlith	2,2	1				x	x
1298	Lancet microlith	2,3	0,8				x	x
7440	Lancet microlith	1,3	0,7	Proximal	Possible fracture			
8466/8467	Lancet microlith	3,5	1,5		Fractured	Two fragments	x	
7389	Lancet microlith/knife	2,6	0,7					

APPENDIX E

Ormen Lange Site 48, Unit I (T22752)

Sub no	Type	Length	Width	Point	Fracture	Comment	In analysis	Photographed
Complete points								
2067	Single-edged	2,2	0,9			Made on flake	x	x
2114	Single-edged	1,6	0,7				x	x
2115	Single-edged	1,8	0,6		Fracture in base			
5077	Single-edged	2,1	0,9			Use-wear along edge	x	x
2051/2052	Tanged point	2,6	1,3		Fractures in point and base	Two fragments		
2147	Tanged point	n/a	n/a	Proximal				
Point fragments								
2022	Point fragment	1	0,5					
2066	Point fragment	0,6	0,4					
5089	Point fragment	1,2	1					
9127	Point fragment	1,9	1,3					
Microliths								
2145	Lancet microlith	1,4	1		Fractured along edge			

Ormen Lange Site 48, Unit J (T22752)

Sub no	Type	Length	Width	Point	Fracture	Comment	In analysis	Photographed
Complete points								
4055	Single-edged	1,9	0,8	Distal	Possible fracture in point			x
4099	Single-edged	1,5	0,9		Fracture in point			
Point fragments								
637	Point fragment	1	0,7			Possible		

Ormen Lange Site 72, Unit X (T22772)

Sub no	Type	Length	Width	Point	Fracture	Comment	In analysis	Photographed
Complete points								
134	Single-edged	3	1,2			Made on flake	x	x
153	Single-edged	1,5	0,7	Distal?	Possible fracture in point	Possibly made on flake		x
199	Single-edged	1,5	0,8	Distal			x	
132	Tanged point	1,8	1,1	Distal			x	
Microliths								
106	Lancet microlith	2	0,9	Distal	Possible fracture in base		x	x
117	Lancet microlith/micro burin	2,1	1,1	Distal				

Ormen Lange Site 72, Unit Y (T22772)

Sub no	Type	Length	Width	Point	Fracture	Comment	In analysis	Photographed
Complete points								
258	Tanged point	3,6	0,9	Proximal		Uncomplete?		
293	Tanged point/single-edged	2,4	1,3	Proximal		Possibly made on flake	x	x
246	Tanged point/lancet microlith	2,7/5,3	1,2	Proximal		Three fragments. Uncomplete?		
Microliths								
292	Lancet microlith	2,3	1	Proximal			x	x
251	Lancet microlith/tanged point	2	1,1	Distal	Fracture in base			
309	Microlith	2,2	1,2	Proximal?			x	

Hestvikholmane Site 3 (T23112)

Sub no	Type	Length	Width	Point	Fracture	Comment	In analysis	Photographed
Microliths								
306	Lancet microlith	1,7	0,7				x	x

Hestvikholmane Site 2-2012 (T25777)

Sub no	Type	Length	Width	Point	Fracture	Comment	In analysis	Photographed
Complete points								
569	Single-edged	1,8	0,9	Distal	Fracture in base			x
214	Tanged point	2,4	0,7				x	
267	Tanged point	1,9	0,6				x	
442	Tanged point	1,9	0,8				x	x
338	Tanged point/tang fragment	1,7	1					

APPENDIX E

Kvernberget Site 20 (T23523)

Sub no	Type	Length	Width	Point	Fracture	Comment	In analysis	Photographed
Complete points								
189	Single-edged	1,8	0,7				x	x
82	Tanged point	1,5	0,7				x	x
Point fragments								
201	Point fragment, single-edged	1	0,8					
95	Tang fragment	0,9	1,9					

Reinsvatnet R1 (T23388)

Sub no	Type	Length	Width	Point	Fracture	Comment	In analysis	Photographed
Complete points								
40	Single-edged	2,6	1,2	Proximal			x	x
107	Single-edged	2,1	1	Distal			x	x
135	Single-edged	1,8	1,1	Distal	Fracture in base			
182	Single-edged	2,4	0,9	Distal			x	
185	Single-edged	2,5	1,6	Distal	Fracture in edge			
287	Single-edged	2,4	0,7	Proximal	Fracture on edge			
404	Single-edged	1,9	0,9	Proximal	Fracture in point			
428	Single-edged	2,2	1,1		Fracture in point	Uncertain		
464	Single-edged	2,1	1,1	Proximal			x	
519	Single-edged	2,6	1	Proximal?	Fracture in tang			
540	Single-edged	2,6	1,5			Unfinished? Made on flake		
541	Single-edged	1,9	1				x	
574	Single-edged	2,4	1	Distal			x	
695	Single-edged	1,6	0,7				x	x
716	Single-edged	1,5	0,6				x	
739	Single-edged	1,9	0,9				x	x
784	Single-edged	1,7	0,8	Distal			x	
807	Single-edged	2,3	1,1	Distal	Fracture along tang			
808	Single-edged	2,1	1,3	Proximal	Fracture in point			
845	Single-edged	3,1	1,3	Distal			x	
909	Single-edged	1,8	1		Fracture in base			
932	Single-edged	2,2	0,9		Fracture in point	Made on flake		
966	Single-edged	2	0,9		Possible fracture in base			
520	Single-edged/lancet microlith	1,5	1		Fracture in base			
934	Tanged point/single-edged point	2,2	0,8		Fracture along edge			
6	Tanged point	1,8	1,1	Distal			x	x
67	Tanged point	3,6	1,2	Proximal			x	x
417	Tanged point	2,7	1,4	Distal	Fracture in point			
521	Tanged point	1,5	0,8	Proximal	Fracture in point			
605	Tanged point	1,6	1		Fracture in point			
715	Tanged point	2,1	1,4	Distal	Fracture in point			
814	Tanged point	1,6	1,1		Fracture in point or base	Irregular		
935	Tanged point	1,8	1			Made on flake. Uncertain		
97	Obliquely edged	1,4	0,7				x	
Point fragments								
542	Point fragment	0,9	0,7		Fracture in base			
813	Point fragment	1,2	0,9		Fracture in base			
429	Tang fragment	0,9	0,9		Fracture in point			
463	Tang fragment	1,5	0,6		Fracture in point	Uncertain		
870	Tang fragment	0,9	0,6					
877	Tang fragment	0,7	0,6					
Microliths								
15	Lancet microlith	3,1	1,4	Proximal			x	x
134	Lancet microlith	2	1	Distal			x	x
171	Lancet microlith	1,6	0,6	Proximal	Fracture in point			
222	Lancet microlith	2,5	1,5	Distal	Fracture in base		x	
223	Lancet microlith	3	1,1	Proximal			x	x
230	Lancet microlith	1,4	0,9				x	
328	Lancet microlith	3	1,5			Atypical. Uncertain		
372	Lancet microlith	1,6	1	Proximal			x	x
382	Lancet microlith	2,2	1,3	Proximal			x	
604	Lancet microlith	2	1,7	Proximal	Fractures in point and base			
725	Lancet microlith	2,5	1,2			Unfinished?		
737	Lancet microlith	3	1,5			Atypical	x	
738	Lancet microlith	2,4	0,8				x	
801	Lancet microlith	2,1	0,8				x	
823	Lancet microlith	3,4	1,8			Made on blade-like flake. Uncertain		
831	Lancet microlith	2,2	1,1	Proximal		Unsuccessful?		
161	Lancet microlith/single-edged point	2	1	Distal	Fracture in tang			
712	Lancet microlith/single-edged point	2	1		Fractures in point and base			
606	Lancet microlith/tanged point	1,8	0,9	Distal	Fracture in base			
435	Lancet microlith/unfinished point	3,3	2					
314	Lancet microlith/knife	2,6	0,9					

APPENDIX E

Sandgrovbotnen (T18787, T19054)

Sub no	Type	Length	Width	Point	Fracture	Comment	In analysis	Photographed
Complete points								
T18787:1	Single-edged	3,2	1	Distal			x	x
T18787:2	Single-edged	3,1	1,1	Proximal			x	x
T19054:1	Single-edged	1,9	0,9	Proximal?			x	x
T19054:20	Single-edged	1,9	0,8	Proximal	Fracture in point			
T19054:21	Single-edged/tanged point	2	1,3		Fracture in point			
T19054:2	Tanged point	2	1			Possible		
T19054:4	Tanged point	3,2	1,8			Possible		
Point fragments								
T19054:23	Tang fragment	1,2	0,9			Possible		
Microliths								
T19054:22	Lancet microlith	1,8	1,2	Proximal		Made on hinged blade	x	
T19054:3	Lancet microlith	2,2	1,5	Proximal	Fracture		x	x
T18787:9	Rhombic lancet microlith/single-edged point	2	0,9				x	

Brannhaugen (T22059)

Sub no	Type	Length	Width	Point	Fracture	Comment	In analysis	Photographed
Complete points								
135	Single-edged	2,1	0,9	Proximal			x	
296	Single-edged	1,9	1	Proximal	Fracture in point			x
258	Single-edged/lancet microlith	1,8	0,7				x	
343	Single-edged/lancet microlith	2,4	1,2	Proximal	Fracture in base			
320	Tanged point	2,2	1,1	Distal			x	
Point fragments								
352	Point fragment/micro burin?	1,2	0,6	Proximal				
123	Point fragment/lancet microlith	1,8	1,3		Fracture in base			
260	Point fragment/lancet microlith	1,3	0,8		Fracture in point and base			
Microliths								
91	Lancet microlith	1,8	1		Fracture in base		x	x
169	Lancet microlith	2,3	1,3	Proximal		Made on flake?	x	
176	Lancet microlith	1,6	0,7				x	
255	Lancet microlith	3,2	1,3	Proximal			x	x
256	Lancet microlith	2,1	1,2	Proximal			x	x
257	Lancet microlith	1,5	0,5	Proximal			x	x
259	Lancet microlith	2	0,9	Proximal			x	
291	Lancet microlith	1,8	1,1	Proximal			x	
321	Lancet microlith	2,4	1	Proximal			x	x

Appendix F

List of Early Mesolithic search terms (Norwegian)

APPENDIX F

List of Early Mesolithic search terms (Norwegian)

The left column presents the actual number of entries found for each search term. The right column (**bolded**) presents the number of entries that remained after sorting out artifacts from evidently later periods, as well as previous search hits. The remaining entries, and the additional artifacts associated with the same identification numbers, were inspected by the author.

Økser og økseproduksjon (adzes and adze production)

Skivemeisel:		**0**
Skiveøks:		**29**
Skivespalter:	252	**251**
Kjerneøks:	119	**116**
Kjernespalter:		**1**
Lerberg:		**0**
Kjernemeisel:		**2**
Spalter:	330	**63**
Eggavslag:		**9**
Flintøks:	47	**6**
Kanttilhug:	8	**4**
Tverøks:	113	**4**
Tverrøks:	102	**3**

Spisser og spissproduksjon (projectiles and projectile production)

Enegg:	916	**154**
Tveegg:	964	**7**
Skjevpil:	1	**0**
Skjevegg:		**3**
Ahrensburg:		**2**
Tangepil:		**3**
Tangespiss:	10	**1**
Tangespids:	2	**0**
Lansespiss:	2	**0**
Bromme:		**0**
Lyngby:		**0**
Mikrolit:	67	**45**
Lansett:	48	**0**
Lancet:	90	**5**
Romb:	179	**6**
Høgnipen:		**0**
Zonhoven:		**0**
Flekkepil:	56	**32**
Flekkespids:	12	**9**

APPENDIX F

Flekkespiss:	8	**5**
Spånpil:	7	**4**
Spaanpil:	11	**7**
Flintspiss:	14	**3**
Flintspids:	10	**0**
Ensidig (pilspisser):	48	**3**
Mikrostik:		**1**
Mikroburin:		**1**
Microburin:		**1**
Tveregg:	247	**51**
Tverregg:	165	**9**
Tverrpil:	5	**3**
Tverpil:		**0**
Skafttunge:	48	**10**
Skaftstykke:	87	**5**
Kant retusjert:	3	**1**
Kanter retusjert:	1	**0**
Kantavslag:		**1**

Kjerner og kjernepreparering (cores and core preparation)

Ensidig kjerne:		**2**
Ensidig flintkjerne:		**1**
Ensidig (kjerne):	48	**1**
Kjerneskraper:	49	**43**
Høvelskraper:		**5**
Kjernehøv:	62	**60**
Kjølskraper:	32	**30**
Blokkskraper:		**7**
Blokskraper:		**0**
Pyramideform:	35	**14**
Plattform:	52	**20**

Stikler (burins)

Gravstikke:	183	**147**
Gravsstikke:		**1**
Burin:	62	**30**
Stikkel:	35	**29**
Stikler:	1	**0**

Appendix G

Database sheet for the recording of Early Mesolithic sites in central Norway

APPENDIX G

General information

Site name | Identification number | Coordinate N | Coordinate E

County | Municipality | Name of farm/property | Farm no/parcel no | Coordinate presision | M asl

Location

Description of site location

☐ Island
☐ Mountain

Exposed towards

Sheltered towards

Map

Other information

About the site

Description of stratigraphy and features

☐ Dwelling traces
☐ Fireplaces

☐ Several artifact units
☐ One artifact unit
☐ Scattered artifact finds

Other information

sq.m. excavated | Total size

Artifacts

Description of the artifact inventory

Diagnostic EM artifacts — No

☐ Flake-adzes
☐ Core-adzes
☐ Unifacial cores
☐ Tanged points
☐ Microliths
☐ Micro burins
☐ Burins
☐ Irregular blades

Finds from later periods

☐ MM ☐ LM
☐ N ☐ BA
☐ Other periods

Number

Total amount

EM | Other

Other information

☐ Inspected

Raw materials

APPENDIX G

Dating

General information

- [ ] Clean EM site
- [ ] EM site with younger elements
- [ ] Longer time span
- [ ] Younger site with EM elements
- [ ] Several occupation phases
- [ ] Mixed/undecided

Isobase and sea-level dating

C14 dates

Other samples

Other information

Find circumstances

Type of investigation

Discovered by

Year

About the survey/excavation

Literature

References

Description from collection catalog

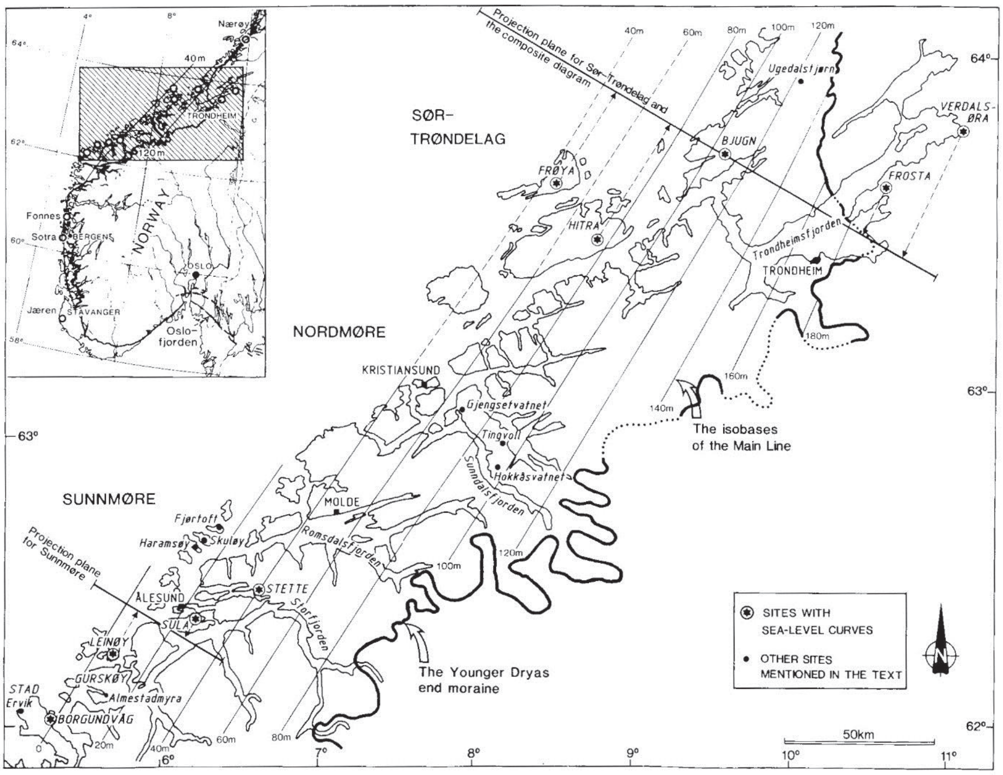
Link to web page, documents etc.

Appendix H

Isobases and shore-displacement curves in central Norway

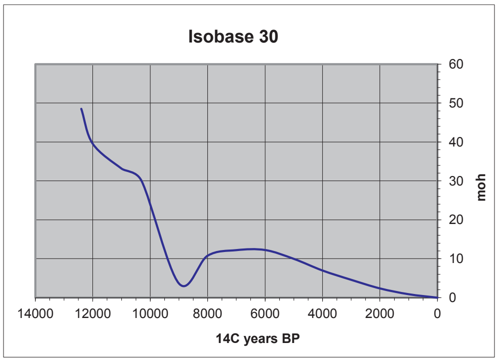
APPENDIX H

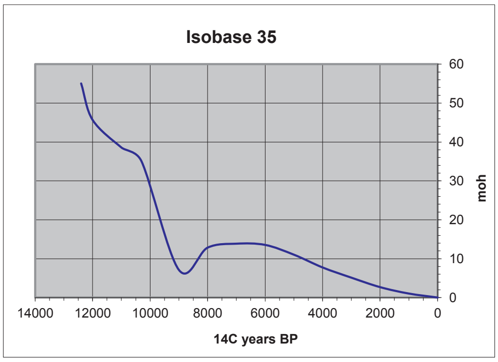
Isobases and shore-displacement curves in central Norway



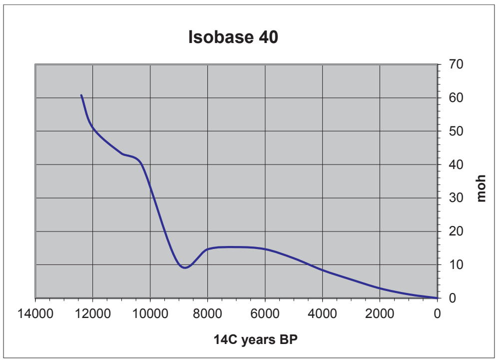
Above: Map showing isobase lines in central Norway. After Svendsen and Mangerud 1987:115, Fig.2.

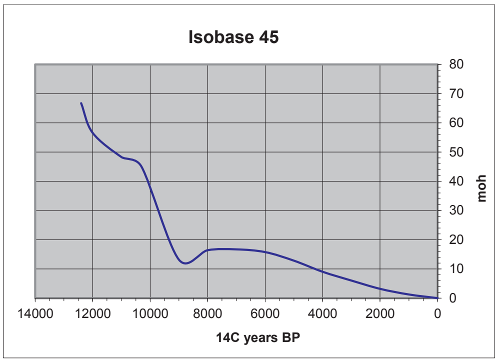
Below: Shore-displacement curves calculated by using SeaLevelCurveSunm-STrondelag_v2.xls, 2003, designed by David Simpson.

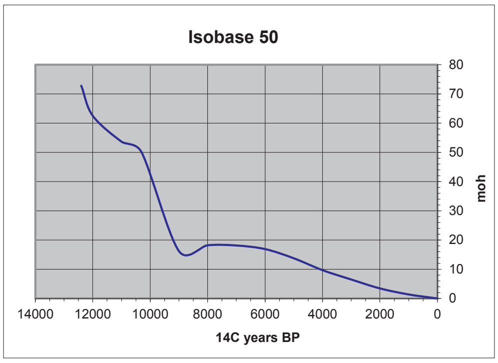


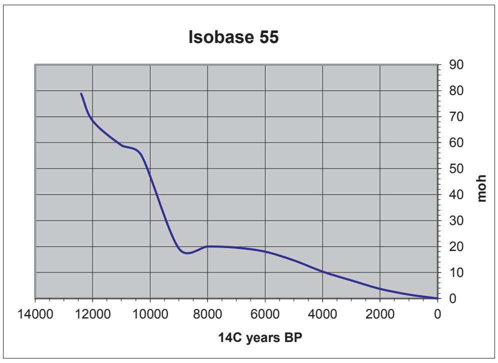


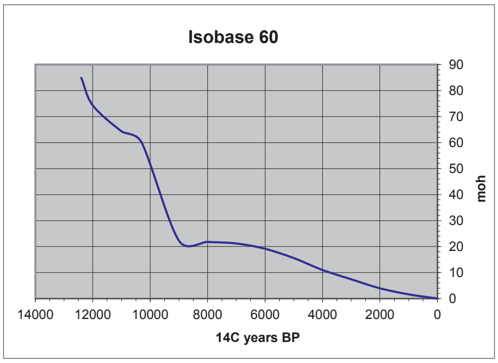
APPENDIX H

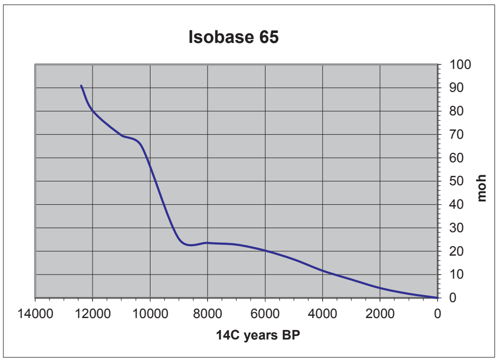

Isobase 40
70
60
50
40
30
20
10
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

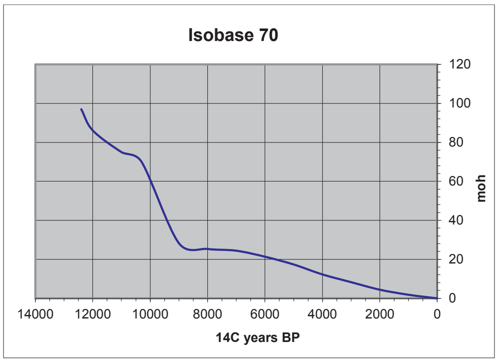

Isobase 45
80
70
60
50
40
30
20
10
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

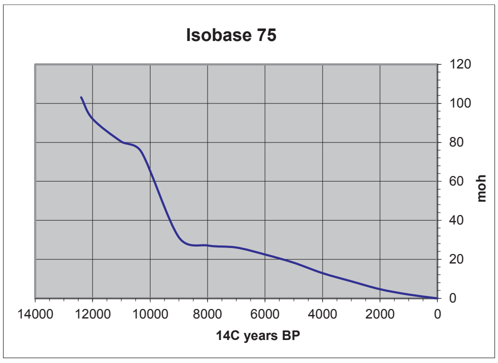

Isobase 50
80
70
60
50
40
30
20
10
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP


Isobase 55
90
80
70
60
50
40
30
20
10
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

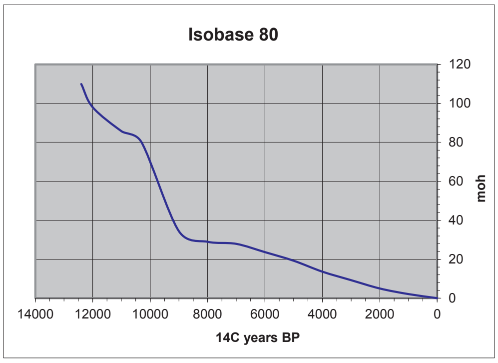

Isobase 60
90
80
70
60
50
40
30
20
10
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

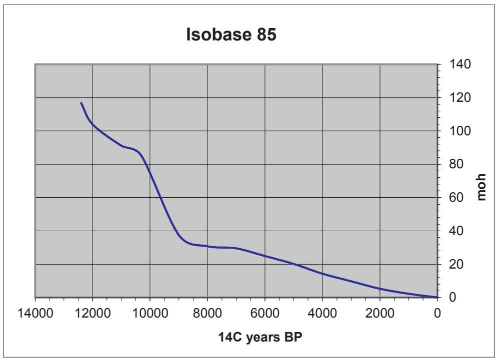

Isobase 65
100
90
80
70
60
50
40
30
20
10
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

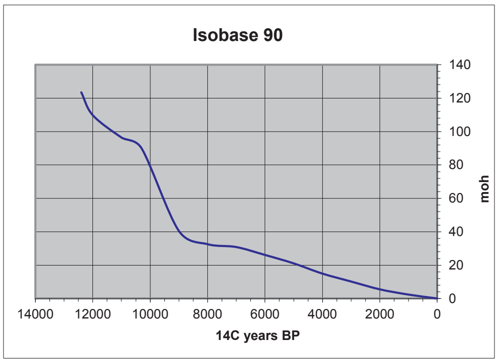

Isobase 70
120
100
80
60
40
20
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

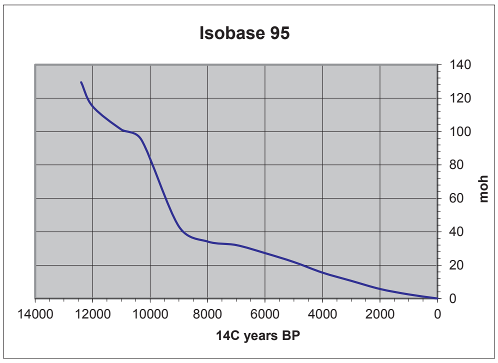

Isobase 75
120
100
80
60
40
20
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

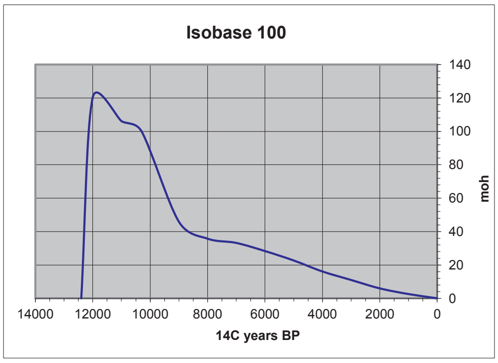
APPENDIX H

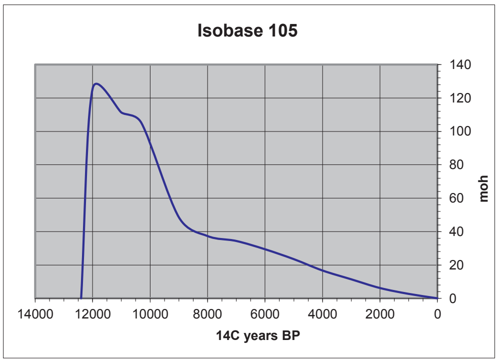

Isobase 80
120
100
80
60
40
20
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

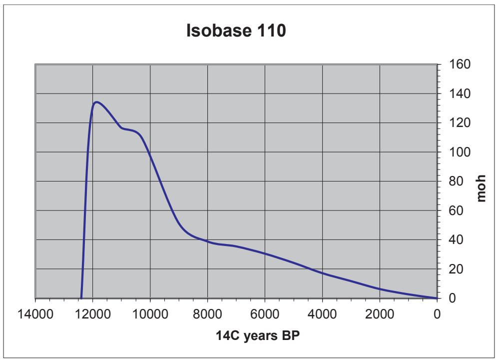

Isobase 85
140
120
100
80
60
40
20
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

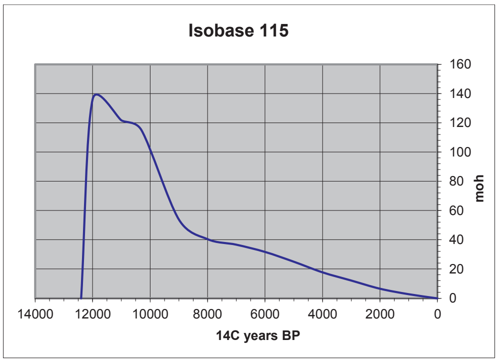

Isobase 90
140
120
100
80
60
40
20
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP


Isobase 95
140
120
100
80
60
40
20
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

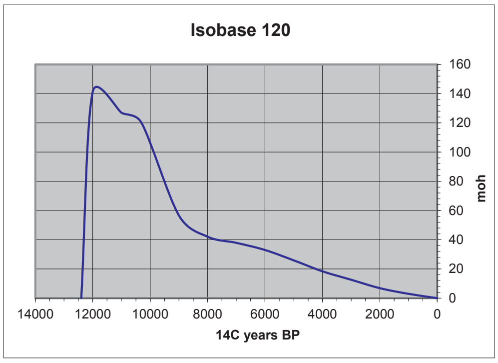

Isobase 100
140
120
100
80
60
40
20
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

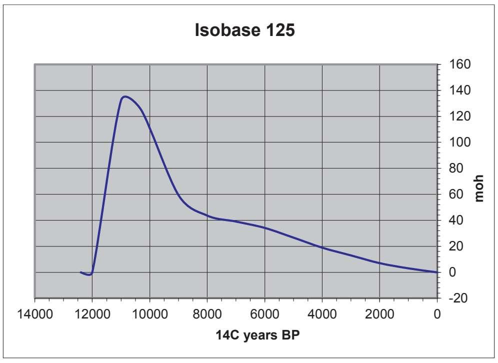

Isobase 105
140
120
100
80
60
40
20
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

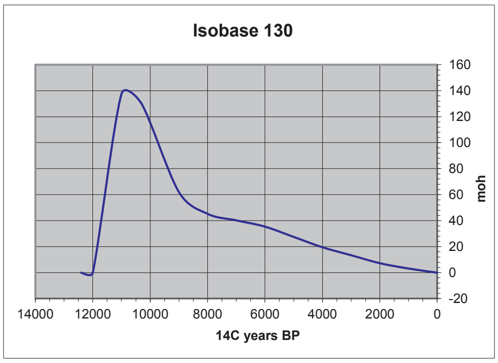

Isobase 110
160
140
120
100
80
60
40
20
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

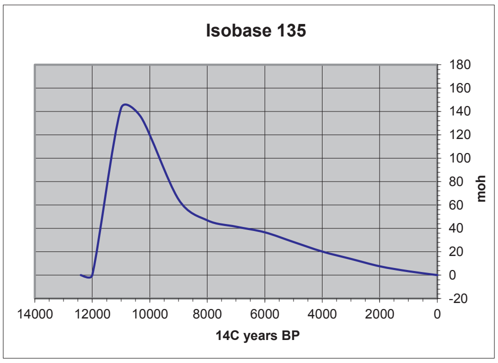

Isobase 115
160
140
120
100
80
60
40
20
0
moh
14000 12000 10000 8000 6000 4000 2000 0
14C years BP

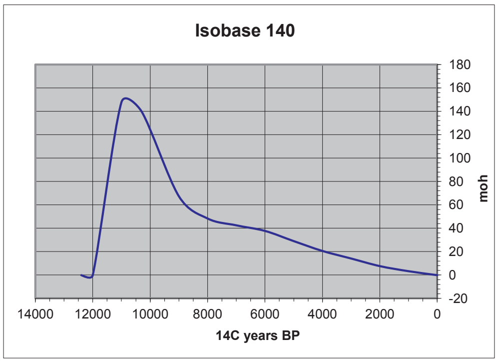
APPENDIX H

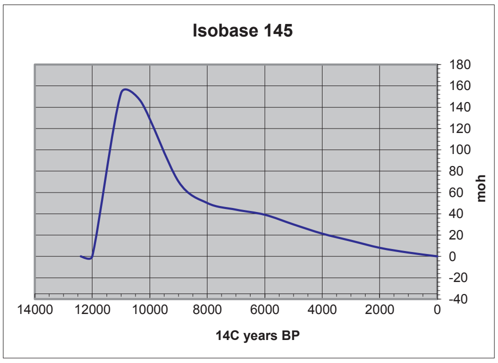

Isobase 120
160
140
120
100
80
60
40
20
0
moh
14000
12000
10000
8000
6000
4000
2000
0
14C years BP

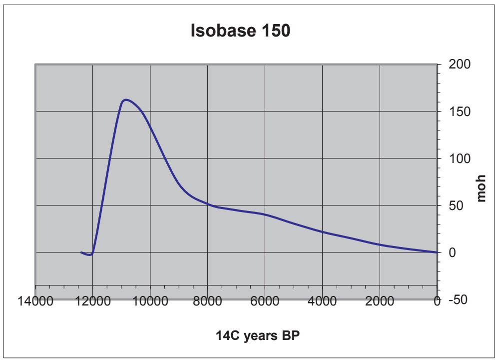

Isobase 125
160
140
120
100
80
60
40
20
0
-20
moh
14000
12000
10000
8000
6000
4000
2000
0
14C years BP


Isobase 130
160
140
120
100
80
60
40
20
0
-20
moh
14000
12000
10000
8000
6000
4000
2000
0
14C years BP


Isobase 135
180
160
140
120
100
80
60
40
20
0
-20
moh
14000
12000
10000
8000
6000
4000
2000
0
14C years BP


Isobase 140
180
160
140
120
100
80
60
40
20
0
-20
moh
14000
12000
10000
8000
6000
4000
2000
0
14C years BP


Isobase 145
180
160
140
120
100
80
60
40
20
0
-20
-40
moh
14000
12000
10000
8000
6000
4000
2000
0
14C years BP


Isobase 150
200
150
100
50
0
-50
moh
14000
12000
10000
8000
6000
4000
2000
0
14C years BP