SAXO INSTITUTE, UNIVERSITY OF COPENHAGEN
DEPARTMENT OF ARCHAEOLOGY

LASSE SØRENSEN

FROM HUNTER TO FARMER IN NORTHERN EUROPE

MIGRATION AND ADAPTATION DURING THE NEOLITHIC AND BRONZE AGE

VOLUME I

SUBMITTED AS PHD DISSERTATION 27TH OCTOBER 2014

Supervised by:
Professor Klavs Randsborg, University of Copenhagen
Curator Flemming Kaul, The National Museum of Denmark

PhD grant funded by:
The National Museum of Denmark and the research project "Northern Worlds"

ACTA ARCHAEOLOGICA

ACTA ARCHAEOLOGICA SUPPLEMENTA

Published by ACTA ARCHAEOLOGICA & Centre of World Archaeology (CWA), Director Klavs Randsborg
c/o Archaeology division, SAXO Institute, University of Copenhagen,
Karen Blixens Vej 4, DK-2300 Copenhagen, Denmark
Phone +45 35329478 randsb@hum.ku.dk
www.worldarchaeology.net

Editor Professor Klavs Randsborg and board

Front cover: A field of barley from the Draved experiment in 1954. After Steensberg 1979.
Back cover: Satelite image of Scandinavia, March 2002. NASA.

Type setting etc. by Rimas Steponaitis, rimas@rimas.info
Printing and binding Grafisk - Københavns Universitet
Publishing house Wiley, Oxford
Orders: Publishing house Wiley, 9600 Garsington Road, Oxford OX4 2DQ, UK
customerservices@oxon.blackwellpublishing.com

Printed in Denmark 2014
ISSN 0065-101X (print)
ISSN 1600-0390 (online)

ACTA
ARCHAEOLOGICA

Editor

KLAVS RANDSBORG

VOL. 85:1

OXFORD

WILEY
2014

ACTA ARCHAEOLOGICA SUPPLEMENTA

Editor
KLAVS RANDSBORG

VOL. XV:1

OXFORD

WILEY
2014

ACTA ARCHAEOLOGICA VOL. 85:1, 2014
ACTA ARCHAEOLOGICA SUPPLEMENTA XV:1
CENTRE OF WORLD ARCHAEOLOGY (CWA) - PUBLICATIONS 11

FROM HUNTER TO FARMER IN NORTHERN EUROPE

MIGRATION AND ADAPTATION DURING THE NEOLITHIC AND BRONZE AGE

Lasse Sørensen

OXFORD

WILEY
2014

ACTA ARCHAEOLOGICA

ACTA ARCHAEOLOGICA is founded in 1930 by a group of distinguished scholars from all the Nordic countries to allow Scandinavian archaeology an independent international voice, whether dealing with Northern Europe, the Mediterranean, the Arctic, or any other part of the globe. ACTA ARCHAEOLOGICA won its high prestige already with the first volumes. ACTA ARCHAEOLOGICA is a Class "A" periodical and series in the list of the European Science Foundation.

A substantial part of the contributions to ACTA ARCHAEOLOGICA are still on Northern European archaeology (including Baltic countries), others are on European and World themes of particular interest to the archaeology of Northern Europe. Emphasis is throughout on quality, originality of data and well documented and illustrated studies, as well as on methodological issues. Contributions by young scholars are invited.

The languages of ACTA ARCHAEOLOGICA are English, German, French, and Italian. All contributions are peer-reviewed by specialists (their names may be made available to the authors upon request). For preferred standards, see recent volumes. Contributors should produce separate electronic files for the text and each single illustration (in very high resolution).

The periodical and series of ACTA ARCHAEOLOGICA is published annually in one or two volumes, on paper as well as electronically. The high production quality of the volumes is a close match of their contents. "Originality and Lasting Value" is the dictum of ACTA ARCHAEOLOGICA.

ACTA ARCHAEOLOGICA has only seen three general editors since its foundation, but a long list of archaeologists have acted as assistant editors, board members, and advisors; a number of technicians have secured the high quality of illustrations and type-setting.

ACTA ARCHAEOLOGICA is financially independent, building on subscriptions, individual contributions and support from various institutions and private foundations. Authors should be prepared to contribute towards extra costs, e.g. illustrations in color and changes to the manuscript in proofs stage. Bound off-prints (a minimum of 25 copies) are made available at a fee.

CONTENTS

PREFACE

In 2010 the National Museum of Denmark launched a large-scale research initiative "Northern Worlds", which was financially supported by the Augustinus Foundation. "Northern Worlds" includes 20 different projects, ranging from investigations related to climate changes in the Late Palaeolithic and Mesolithic, to the Neolithisation of Shetland, and of Inuit and Norse Greenland. This work is part of a project, which is focused on an investigation into the spread of agriculture in Scandinavia during the Neolithic and Bronze Age.

PART I. INTRODUCTION

1. INTRODUCTION

The adoption of agriculture is one of the most fundamental changes in human prehistory, which is why the change from hunter-gatherers to farmers is one of the most debated research themes in archaeology. The transitional process still contains many unsolved questions and has been the subject of a continuous debate in Scandinavia for more than a century. This thesis will focus on a diachronic investigation of the agrarian expansion in Scandinavia from the early 4th millennium to end of the 1st millennium BC. The temporal and spatial extent of the study makes it possible to discuss some of the overall hypotheses, questions and patterns associated with the expansions of agriculture in Scandinavia.

The primary focus of this thesis will be the adoption of agrarian practices in South Scandinavia during the transition between the Late Ertebølle culture and the Early Funnel Beaker culture in the late 5th and early 4th millennium BC. Unfortunately many of the discussed transitional sites are mixed, which is why direct ^{14}C dates of agrarian evidence play a vital role in the discussions regarding the adoption of agriculture in South Scandinavia. The secondary focus is concentrated on later agrarian expansion to central and northern parts of Scandinavia in the late Middle to Late Neolithic and the Late Bronze Age. It is therefore important to emphasize that the thesis does not include any larger investigations of the Pitted Ware culture, Battle Axe culture or Corded Ware culture in connection with the agrarian expansions in Scandinavia, as such detailed explorations would go beyond the scope of this thesis.

The author carried out his own investigations of the numerous stray finds and conducted new ^{14}C dates of domesticated animals from the Mesolithic and Early Neolithic transition in South Scandinavia. These newly acquired data were then combined with the gathering of information and compiling of data from already published results relating to agrarian evidence, pollen diagrams, material culture, burials and larger structures connected with the expansion of the agrarian societies from Central Europe to South Scandinavia. The data obtained, associated with the later agrarian expansions during the Middle to Late Neolithic and the Late Bronze Age, mostly consists of previously published data, which in this thesis have been compiled and processed in order to create an overview of the information used in these investigations. In the following seven parts of this thesis the reasons for these expansions are discussed, together with how and when these agrarian practices were adopted in the different parts of Scandinavia.

Part I contains a short introduction and characterizations regarding the geographical boundaries, the chronology used in the thesis and characterizations of hunter-gatherers, farmers and their practices.

Part II of the thesis focuses on the landscape and the research history associated with the agrarian expansions. The variations in the landscape and vegetation zones would have created differing possibilities for the establishment of agricultural societies during the Stone Age and Bronze Age in Scandinavia. Furthermore, research has focused on the mechanisms behind the agrarian expansions, with a special emphasis on why and how agriculture was adopted in Scandinavia. The reason why hunter-gatherers became farmers still remains unclear, but three explanations always seem to reappear, concentrating upon population growth, resource availability and social changes within societies, or a combination of all three. The entrenched discussions in the history of research in this area have also concentrated on three major hypotheses, which have been used to explain how the expansion of agrarian societies occurred in Scandinavia and Europe. The first hypothesis argues that agriculture was introduced rapidly by migrating agrarian societies. The second hypothesis favours a gradual transition towards agriculture, in which agrarian practices could be adopted by hunter-gatherers as an idea through exchanges and social interaction with neighbouring agrarian societies. The third hypothesis argues that both migrating farmers and local hunter-gatherers integrated with each other in order to create successful agrarian societies. The perception of who were the primary carriers and movers of agrarian knowledge and practices therefore varies with each of the proposed hypotheses. In order to attempt to establish the identity of the primary carriers of agrarian practices, it is necessary to investigate the learning processes behind agriculture.

Part III of the thesis discusses whether or not it was an easy and simple task to learn about agrarian practices, which is primarily based upon ethnographic examples in which hunter-gatherers adopted agriculture. It is also investigated if the chanches of establishing an agrarian society is higher or limited, when agrarian practices would spread as an idea or through migration of farmers coming from Central Europe to South Scandinavia.

The theoretical approach discusses if incoming farmers and local hunter-gatherers became integrated in communities of practice and actively participated in large networks. Such behaviour would have resulted in a changed material culture, social power structures, ideology and identity. The emergence of such communities of practices is tested by investigating the primary and secondary evidences of agrarian societies in Scandinavia in the following parts of the thesis. Furthermore, searching for evidence of migration patterns, such as scouting expeditions, push and pull factors, objects from the place of origin, groups of sites located in desirable areas and objects showing return migrations is also of crucial importance. It is therefore possible to recognize migrations from their structure, even if their causes are poorly understood.

Part IV is a critical review of the methods, material and sampling of archaeological data used in this thesis. Firstly, the representativeness of sites and finds from the Early Funnel Beaker culture is biased by the lack of sites located on easily worked arable soils, which is why stray finds of certain types had to be integrated into the analysis. Secondly some focus is also placed upon the irregularities in the ^{14}C curve and pollen analysis, together with the misidentification of cereal pollen and grasses. And thirdly the taphonomic, taxonomic and stratigraphic problems with the faunal assemblages are discussed.

Part V of the thesis is an analysis of when and how fast the agrarian expansion occurred in South Scandinavia during the Late Ertebølle and Early Funnel Beaker cultures through an investigation of the primary and secondary evidence of agriculture. The primary evidence can be explored by compiling data of direct and contextual ^{14}C dates from the primary evidence of agriculture, which includes charred cereals, domesticated animals, threshing waste, quern stones, plough marks and pollen analysis. The secondary evidence involves an analysis of the changes of the new material culture and structures, which are contemporary with the introduction of an agrarian society. The aim is to present newly discovered evidence of crop cultivation and animal husbandry, together with a wide range of stray finds, in order to discuss whether the data represents a gradual introduction of agriculture, a migration of incoming farmers or a combination of both of these hypotheses. The emergence of the Funnel Beaker culture is considered in relation to the influences from migrating groups of pioneering farmers from the Michelsberg culture. Evidence of the structural patterns behind the migrations is also presented and discussed, together with an interpretation of the pioneering, consolidation and further expansion stages of the agrarian societies in South Scandinavia. Consequently, the idea of the Kujavia region as the place of origin for the Funnel Beaker culture is questioned.

Part VI involves a secondary focus upon the adoption of agriculture during the Battle Axe and Bell Beaker cultures in southern and central parts of Scandinavia during the 3rd millennium BC. Finally, the adoption of agrarian practices in northern Scandinavia from the Late Bronze Age in the 1st millennium BC is discussed. These examples have been integrated into the thesis in order to test if it is possible to observe the same patterns of migration as those found in the Early Funnel Beaker expansions, which involve push and pull factors, identifying objects from the place of origin, searching for groups of sites located in desirable areas and objects showing return migrations. However, it is important to note that the investigations of these examples are less extensive, as a detailed exploration would go beyond the scope of this thesis.

Part VII contains the general conclusions regarding the agrarian expansions in Scandinavia, in which the complexity of the agrarian expansions is discussed, together with the importance of immigrating groups as the primary carriers of agrarian knowledge and ideas. Thus, new considerations and perspectives are suggested regarding how, when and why the different expansions occurred in Scandinavia from the Early Neolithic to the Late Bronze Age.

1.1. Areas of research

The geographical focus of this thesis is Scandinavia, with emphasis placed upon the southern, central and northern parts when discussing agrarian expansion during the Neolithic period and Bronze Age respectively. However, investigations of the distribution of sites and stray finds from Central Europe will also be included in the discussions of agrarian expansion in southern Scandinavia and neighbouring regions like Schleswig-Holstein, Mecklenburg-Vorpommern and northern Poland (Zachodnio-Pomorskie and Pomorskie). In this thesis the term South Scandinavia includes Denmark, South Sweden (Scania, Halland and Blekinge) central parts of Sweden (Småland, Västergötland, Östergötland, Öland, Gotland, Bohuslän, Dalsland, Värmland, Närke, Södermanland, Uppland and Västmanland) and southern parts of Norway (Akershus, Østfold, Vestfold, Telemark, Aust-Agder, Vest-Agder and Rogaland). Central Scandinavia consists of the following counties in Norway (Hordaland, Sogn og Fjordane, Møre og Romsdal, Buskerud, Oppland, Hedmark, Sør-Trøndelag and Nord-Trøndelag) and Sweden (Dalarna, Gästrikland, Härjedalen, Hälsingland, Medelpad, Jämtland and Ångermanland). North Scandinavia consists of the following counties (Nordland, Troms, Finnmark, Västerbotten, Norrbotten and Lappland) (Fig. I.1).

1.2. Chronology

The focus on agrarian expansion in the whole of Scandinavia also stretches the chronological perspective, as the adoption of agriculture appears rather late in its northern parts. Thus, the investigation involves a timescale spanning from the Late Mesolithic to the Pre-Roman Iron Age, from around 5500 until 0 cal BC. The cultures discussed in this thesis have been related to chronological developments in Central Europe, North Germany, Denmark and Scania, Central and West Sweden, South and Western Norway, Central Scandinavia and North Scandinavia. The chronological scheme does not contain any new phases or stages, as I have related the chronological stages in different regions of Scandinavia to one another in order to create an overview of the cultures discussed in this thesis (Fig. I.2). However, it is argued that the usage of the term Early Neolithic phase I (EN I) (4000 to 3500 cal BC) in South Scandinavia is not sufficiently detailed to show when the adoption of agrarian practices began. Dividing the EN I into an early EN I from 4000 to 3800 cal BC and a late EN I from 3800 to 3500 cal BC is preferred, thus supporting a three stage chronological system (early EN I, late EN I and EN II) for the Early Neolithic in southern Scandinavia.

1.3. Definitions of hunter-gatherers, farmers and their practices

Hunting, gathering and fishing is practised by both hunter-gatherers and farmers. What separates farmers from hunter-gatherers in a transitional situation is crop cultivation and managing animal husbandry all year round. Firstly, cultivation requires a whole new set of technology, involving slash-and-burn activities for opening up the landscape, preparing fields, sowing and growing crops, grain processing and storing seeds. Secondly, keeping domesticated animals all year round requires storage of food for the winter (Fig. I.3). However, the author does not see why Late Mesolithic or Early Neolithic hunter-gatherers could not have kept a few domesticated animals for meat reserves and prestige reasons. The managing of a few domesticated animals can be interpreted as initial herding activities by communities that still lived as hunter-gatherers.

Fig. I. 1. The geographical subdivision of Fennoscandinavia into various counties and districts. After Nordic Archaeological Abstracts 1997, 318 (www.naa.dk); Hallgren 2008, 16.

cal BC	Period	Central Europe	Period	Northern Germany	Period	Denmark/South Sweden
5500	EN	Linearbandkeramik culture	Mesolithic	Late Kongemose Culture	Mesolithic	Late Kongemose Culture
5400				Early Ertebølle Culture		Early Ertebølle Culture
5300						
5200						
5100						
5000	MN	Rössen Culture / Stichbandkeramik				Earliest cereals? (Pilbladet 1, Lockarp 7E)
4900		(Shoe-last axes)				
4800		Exchange of jade axes				
4700						
4600				Domesticated pig? (Rosenhof)		Late Ertebølle
4500		Chasséen				
4400		Bischeim/Michelsberg				
4300		Michelsberg I/Gatersleben				
4200	YN	Michelsberg I/Gatersleben	EN	Michelsberg/Funnel Beaker		
4100		Michelsberg II/Late Lengyel		Earliest sheep/goat		Cereal imprints on Ertebølle vessels (Löddesborg)
4000		Michelsberg III/Late Lengyel	EN Ia	Funnel Beaker	Early EN I	Funnel Beaker (Oxie)
3900		Michelsberg IV/Late Lengyel				
3800		Michelsberg IV/Baalberg	EN Ib	Sattrup/Siggeneben-Süd	Late EN I	Volling/Svaleklint/Svenstorp
3700		Michelsberg V/Baalberg				
3600		Michelsberg V/Baalberg				
3500	LN	Early Wartberg/Baalberg	EN II	Wolkenwehe 1/Brindley 1/2	EN II	Fuchsberg/Virum /Bellevuegården
3400		Early Wartberg/Baalberg				
3300		Early Wartberg/Baalberg	MN A (MN Ia)	Wolkenwehe 2/ Brindley 3-4	MN A (MN Ia)	Troldebjerg
3200		Early Wartberg/Salzmünde		(Less exchange of copper)	MN A (MN Ib)	Klintebakke
3100		Late Wartberg/Bernburg	MN II	Oldenburg/Brindley 5	MN II	Blandebjerg
3000		Late Wartberg/Bernburg	MN III-IV	Bostholm/Brindley 6	MN III-IV	Bundsø
2900		Late Wartberg/Bernburg	MN V	GA/Brindley 7	MN V	St. Valby
2800	FN	Early Corded Ware	YN 1	Early Single Grave groups	MN B	Single grave/Pitted Ware groups
2700						Early Battle Axe Culture
2600		Middle Corded Ware	YN 2	Middle Single Grave groups	Late MN B	
2500						
2400		Late Corded Ware/Bell Beakers	YN 3	Late Corded Ware / Bell Beakers	LN I	Early Bell Beakers
2300			LN I			
2200	BA	Early Aunjetitz/A1/Unetice		Early Aunjetitz/A1/Unetice		Aunjetitz influences
2100						
2000		Leubinge	LN II		LN II	Middle daggers III-V / Aunjetitz imports / first metal production
1900						
1800						
1700		A2	Periode I	Early Bronze Age	Periode I	Early Bronze Age
1600						
1500			Periode II		Periode II	
1400						
1300		D	Periode III		Periode III	
1200						
1100		Hallstatt A2	Periode IV	Late Bronze Age	Periode IV	Late Bronze Age
1000						
900		Hallstatt B3	Periode V		Periode V	
800						
700			Periode VI		Periode VI	
600	IA	Hallstatt D				
500		La Tène A	PRIA per. 1	Pre-Roman Iron Age	PRIA per. 1	Pre-Roman Iron Age
400		La Tène B				
300			PRIA per. 2		PRIA per. 2	
200		La Tène C				
100		La Tène D	PRIA per. 3		PRIA per. 3	

Fig. I. 2. Chronology of the 5th to the 1st millennium BC in Central Europe and Scandinavia. After Ågotnes 1986; Jørgensen & Olsen 1988; Østmo 1988; Baudou 1995, 52; Nielsen 1993; Olsen 1994; Hesjedal et al. 1996, 188; Kihlstedt et al. 1997; Larsson et al. 1997, 14ff; Lindgren & Nordqvist 1997; Bolin 1999; Ramstad 1999; Welinder 1999; Nielsen 2004; Hartz & Lübke 2004; Randsborg & Christensen 2006; Valen 2007; Hallgren 2008; Glørstad 2010, 36; Schier 2010, 33; Müller 2011b; Asprem 2012; Olsen 2012; Sjögren & Arntzen 2012; Lahtinen & Rowley-Conwy 2013.

See next pages.

cal BC	Central/Western Sweden	Southern/Western Norway	Central Scandinavia	Period	Northern Scandinavia
5500	Late Mesolithic	Mesolithic (Nøstvet phase)	Mesolithic (slate complex)	Early Stone Age	Mesolithic (slate complex)
5400					
5300					
5200					
5100					Comb Ware
5000					
4900					
4800	C-14 dates of cereals (Sjogerstad 106)				
4700		Late Mesolithic (Kjeøy phase)			
4600					
4500				Late Stone Age	
4400					
4300					
4200					
4100					
4000	Funnel Beaker (Vrå I-II)	Funnel Beaker (Twisted cord)	Funnel Beaker influences		Funnel Beaker influences
3900		Cerealia pollen?			
3800					
3700	Vrå III-IV	Cord stamp ceramics			
3600	Fagervik I				
3500					
3400	Fagervik II				
3300	Fagervik III/Pitted Ware culture				
3200					
3100					
3000	Fagervik IV/Pitted Ware culture	Pitted Ware culture	Pitted Ware influences		Pitted Ware influences
2900					
2800	Battle-Axe Culture	Battle-Axe influences	Battle-Axe influences		Battle-Axe influences
2700		Clearance layers/husbandry?			
2600					
2500					
2400	Bell Beaker influences	Bell Beaker influences	Bell Beaker influences		Bell Beaker influences (cerealia Kveøya)
2300	Late Neolithic				
2200	Aunjetitz influences	Aunjetitz influences			Copper age influences from Russia?
2100		Early Bronze Age			
2000					Pasvik/Lovozero ware
1900					
1800				Early Metal Age	Textile ware
1700	Early Bronze Age	Early Bronze Age	Early Bronze Age		Early Bronze Age influences
1600					
1500					
1400					
1300					Husbandry/Cultivation (Stiurhelleren, Høfsøy)
1200					
1100	Late Bronze Age	Late Bronze Age	Late Bronze Age		Late Bronze Age/Risvik ware
1000					Ananino Culture influences
900					
800					Kjelmøy ware
700					
600					
500	Pre Roman Iron Age	Pre Roman Iron Age	Pre Roman Iron Age		
400					
300					
200					
100					

Symbols
Agrarian practices: (red)
Domesticated animals: (blue)
Cerealia pollen: (green)

Fig. I. 2. *See previous pages.*

Hunting & gathering	Herding, hunting & gathering	Cultivating, herding, hunting & gathering
Knowledge about the environment	Knowledge about the environment, the domesticated animals and herding skills	Knowledge about the environment, cultivation of cereals, domesticated animals and herding skills
Search for food (higher spatial mobility)	Search for grazing areas and winter fodder (mostly lower spatial mobility)	Spatial stability (higher degree of sedentism)
Chance of finding meat (animals to hunt)	Guaranteed supply of meat	Guaranteed supply of meat and cereals
Relatively stable food supply	Greater fluctuation in food supply (from year to year)	Greater fluctuation in food supply (could create ressource crises depending on the population growth)
Sharing meat	Sharing, exchanging or trading meat	Sharing, exchanging or trading meat and cereals
Production for own use	Surplus food production for exchange or trade	Surplus food production for exchange or trade
Contain possibilities of being less time consuming	More time consuming	Much more time consuming
Few possessions (higher mobility)	Chance to acquire more possessions (lower mobility)	Chance to acquire even more possesions (leading to sedentary practices and social hierarchy)
Fewer worries about water	More worries about water	General worries about the weather and changing seasons (sun, rainfall, frost etc.)
Taking each day as it comes (planning for next place to stay) short term range	Planning for the future (winter storage)	Planning for the future (winter storage) long-term planning (expansion towards new arable land)
Low population growth	Potentially higher population growth	Higher population growth
Local networks with neighburing communities	Extented networks on a regional scale	Extented networks on a over regional and potentially continental scale
Larger social gatherings once or twice a year (alliances, marriage, feasts)	Social interaction on a regional scale several times a year (stock breeding practices)	Intensified social interaction several times a year on a regional and continental scale

Fig. I. 3. Presumed behavioural characteristics of hunter-gatherers, herders and farmers based on ethnographic observations. After Gregg 1988; Ember & Ember 1993; Barnard 2007.

PART II. LANDSCAPES AND RESEARCH HISTORY

2. LANDSCAPES, CLIMATIC ZONES AND OPTIMAL AGRARIAN AREAS IN SCANDINAVIA

Investigation of the adoption and expansion of agrarian practices is closely associated with the landscapes and climatic zones in Scandinavia, which differ between the southern and the northern parts. By exploring the landscapes, the marked seasonal changes and climatic differences, we can discuss the conditions for initiating agrarian activities in the various regions of Scandinavia.

2.1. Land and sea

The landscape in Scandinavia went through some dramatic changes from the Atlantic to the Subboreal period. The Atlantic transgressions were caused by a warmer climate, which melted the North American ice cores (Fig. II.1). The flooding of land during the Atlantic period created the Danish islands and major archipelagos in central parts of Scandinavia (Björck 1995) (Fig. II.2). During the Early Neolithic (4000-3300 cal BC) the coastal regions of Central Scandinavia were below current sea levels and humans lived in large archipelagos (Østmo 1988; Kihlstedt et al. 1997; Persson 1999; Hallgren 2008; Glørstad 2010). Whilst in South Scandinavia sea levels of the Subboreal period are more or less the same as the levels of today (Strand Petersen 1976; 1992; Christensen 1995; Lübke 2004). The landscapes of northern Germany and southern Scandinavia are characterized by moraines and sandy coastal zones, which is ideal for agriculture, whereas the interior of the Scandinavian Peninsula is characterized by a rocky subsoil, resulting in very limited arable land (Fig. II.3). However, the coastal areas and inner fjords of the Scandinavian Peninsula represent uplifts of land, which have been exploited for agrarian activities, as the average annual temperature is higher near the coastal areas and inner fjords. Nonetheless, areas like the western parts of Norway (Rogaland, Hordaland, Sogn og Fjordane and Møre og Romsdal) have challenged both current and prehistoric farmers with their significant levels of precipitation (Moen 1999, 24). Today only three percent of the total area of Norway is considered suitable for agriculture. The main arable areas, making up over 90 percent, are concentrated near the coast and inner fjords of Vestfold, Østfold, Akershus, Rogaland and Trøndelag (Moen 1999, 159). The arable land reaches its limits today in the counties of Gästrikland, Västmanland and Värmland in Central Sweden (Oldeberg 1952). The border of arable land in Central Sweden and southern Norway also marks a climatic and vegetation boundary between the boreonemoral and the southern/middle boreal zones (Moen 1999, 169ff). The nemoral zone in southern Scandinavia is characterized by warm summers and mild winters, covering larger parts of Central Europe, Denmark, Scania, Halland, Blekinge and the southernmost part of Norway (Fig. II.4). However, the growing seasons of cereals are of a shorter duration in the southern/middle boreal zone compared to vegetation zones of the boreonemoral and nemoral zones further south (Moen 1999, 92ff) (Figs. II.5-7). The boundary between the boreonemoral and southern/middle boreal zones is marked by a change in topography and higher terrain between southern and central parts of Scandinavia. Furthermore, the bedrock results in poorer soils, there are shorter summers, colder winters and there is more snow, thus decreasing the possibilities of agrarian activities in the southern/middle boreal zones (Moen 1999, 98ff). This particular boundary has been named the “limes norrlandicus” and is considered to be one of the most marked regional boundaries in Scandinavia, which clearly would have affected the possibilities for agrarian activities in prehistoric times.

2.2. Seasonal changes

Marked seasonal changes are characteristic of Scandinavia. In northern Scandinavia the seasonal changes are most significant, with almost no sunlight during the winter and midnight sun in the summer. The colder climate in the inner parts of the Scandinavian Peninsula has made agrarian practices almost impossible, both today and in prehistoric times, despite the fact that the climate was slightly warmer in the Late Atlantic and early parts of the Subboreal compared to today (Christensen & Mortensen 2011) (Fig. II.1). Agrarian activities are also difficult along the coastal areas of the Bothnic Bay due to the longer duration of the ice season, thus limiting the possibilities of cereal cultivation (Fig. II.4). However, on the west coast of northern Norway the Gulf Stream makes the climate milder than the latitude would suggest, meaning that it was possible to undertake agrarian activities dur-

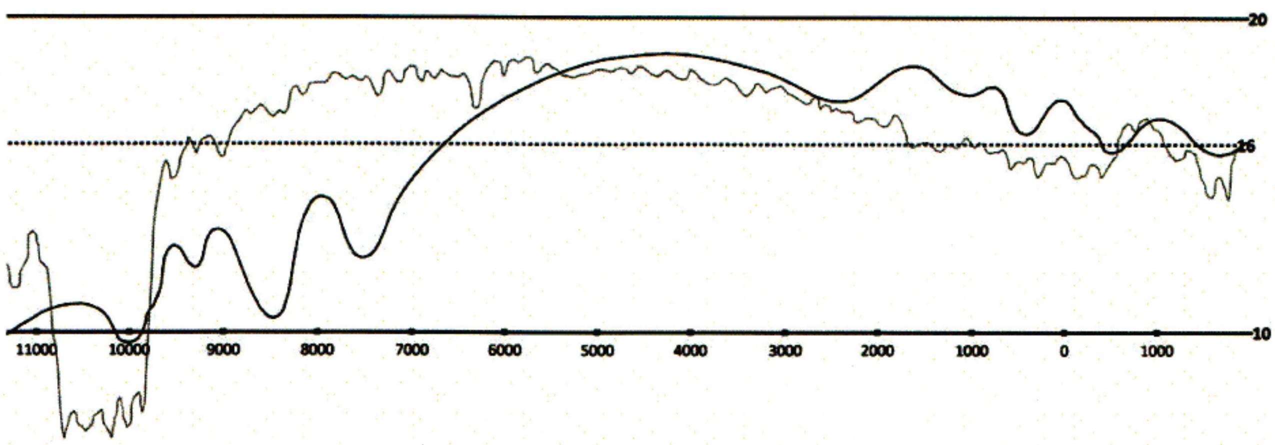


Fig. II. 1. Postglacial temperature curves for Greenland (grey) and Denmark (black). The data on which the Danish curve is based are unpublished, whereas the temperature curve for Greenland is based on data from the ice cores. After Christensen & Mortensen 2011, 25.

ing prehistoric times despite the long winters and short summers (Valen 2007; Arntzen 2013). Moreover, the interaction of the flows of the coastal surface waters and Atlantic streams has produced a rich marine life and created major opportunities for fishing (Eliasen 1983). Numerous historical records document that fishing was the main subsistence activity in northern Norway, whereas agrarian activities were regarded as supplementary, because crop yields could vary from year to year depending on the length of the growing seasons (Jørgensen 1983; Sandved 1995; Valen 2007, 7).

2.3. Growing seasons for cereals

The start and end of the cereal growing seasons vary considerably by up to several months from southern to northern parts of Scandinavia (Tveito et al. 2001). In the south the growing season normally begins in April and ends in October, whereas in the north it begins in May or June and ends in mid-September (Figs. II.6-7). The number of days above 5°C is therefore higher in South Scandinavia, which is of significance as cereals germinate at 6°C and therefore need around 175-200 days above 5°C in order to ripen. Calculations made by Tveito et al. (2001) of the present average growing season in northern Scandinavia show that it is particularly difficult to grow crops in this region, because the growing season is often below 150 days in total (Fig. II.5). However, the investigation by Tveito et al. (2001) does not take into account the increased hours of sunshine from the midnight sun north of the Arctic Circle. Secondly, it does not contain detailed information regarding the milder (Norwegian west coast due to the Gulf Stream) or colder climate (Bothnic Bay) in many regions. Thirdly, increased rainfall, a milder climate during certain periods of prehistory and variations in cereal species may have affected different areas, making cultivation of crops possible. A more precise method for measuring the growing season of certain cereals is by

Fig. II. 2. The Littorina Sea transgressions during the Late Atlantic (6000-4000 cal BC) in Scandinavia. After Björck 1995; Jensen 2001, 137.

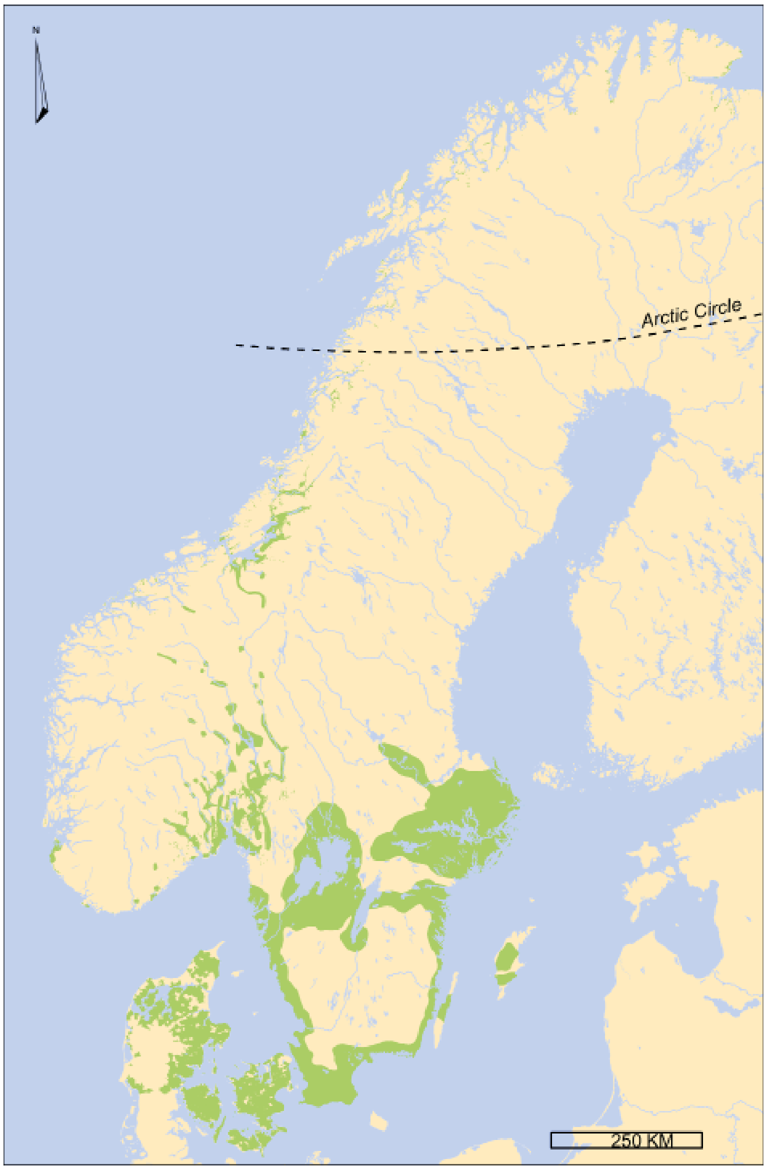


Fig. II. 3. Areas marked in green indicate a high concentration of arable land in Scandinavia, both today and in historical times. After Oldeberg 1952, abb. 313; Baudou 1985, 65; Moen 1999, 159.

calculating the ratio between the average temperature and the number of days above 5 °C, which is known as day degrees (Fjærvoll 1961; Stamnes 2008; Pihl 2013). For example, an average temperature of 12 degrees over 100 days gives a day degree of 1200. But if the average temperature in a given region is 10 degrees, then at least 120 days of achieving a day degree of 1200 is required, this indicating the difficulties of crop cultivation when temperatures are low in certain regions. The focus on 1200 day degrees is particularly important, as many crops require a minimum of at least a 1200 day degree for the grains to mature. Calculations made in the past indicate that it was more difficult to grow crops in northern Scandinavia than in South Scandinavia due to the limited growing season (Fjærvoll 1961). It is important to emphasize that it is only possible to sow and harvest once a year in Scandinavia.

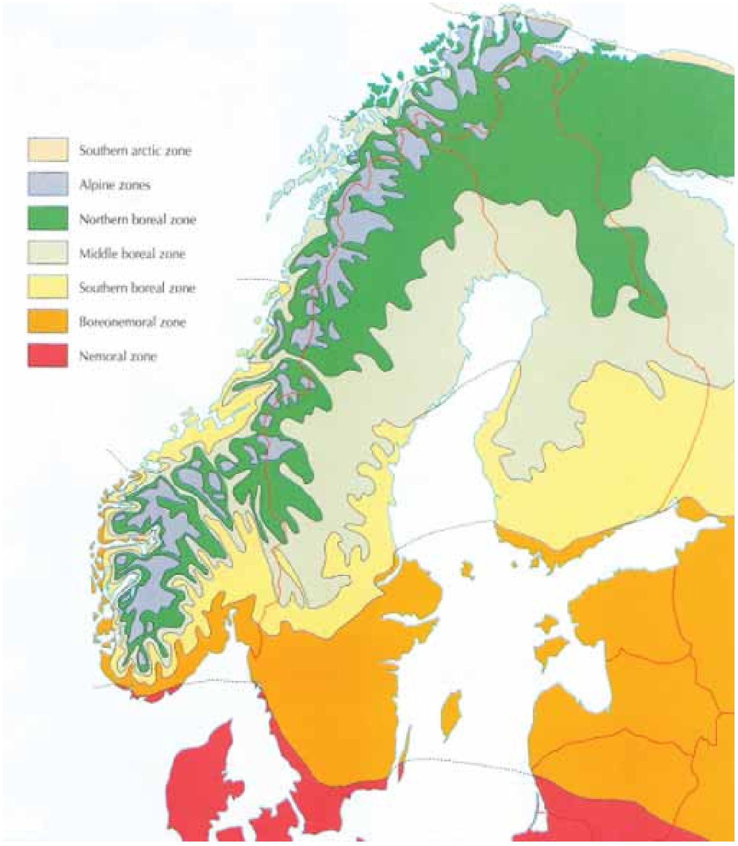


Fig. II. 4. The distribution of the current vegetation zones in Scandinavia. After Moen 1999.

3. RESEARCH HISTORY RELATING TO THE ADOPTION AND EXPANSION OF AGRARIAN PRACTICES AND SOCIETIES

The domestication of livestock and crops was a long process, which began in several areas of the Fertile Crescent around 9000 cal BC (Fuller 2008; Larson et al. 2014). Around 7000 cal BC the first evidence of agrarian practices was found outside the Fertile Crescent in South-East Europe. These expansions continued during the following millennia throughout Europe, reaching certain parts of southern Scandinavia around 4000 cal BC and northern Scandinavia during the Bronze Age and Pre-Roman Iron Age. It is these agrarian expansions in Scandinavia, which are the primary focus of this thesis. The emergence of agrarian practices and societies has been associated with a constant growth and exploitation of nature (Boserup 1965). People today are connected to the choices prehistoric people made in a distant past. It is thus understandable that the emergence and expansions of agrarian practices and societies has been the subject of intensive exploration and led to the formation of theories since the birth of archaeology. The intensified investigations during the 19th and 20th centuries also raised new questions concentrating on the speed of the agrarian expansions and who the primary carriers of agrarian practices and ideas were. These are some of the reasons why the origin and spread of agriculture still attracts much attention in current archaeological, biological, anthropological and historical research.

3.1. Identifying farmers

The first discussions regarding the emergence of agrarian practices and societies did not concentrate on their expansion, but rather on the identification of hunter-gatherers and farmers in the earlier and later part of the Stone Age. South Scandinavia was one of the first places where a dividing up of the Stone Age was discussed in a debate between Worsaae (1861, 233ff) and Steenstrup (1861, 305ff). Their disagreement regarding the division of the Early and Late Stone Age was based on the results of the first "Køkkenmødding Kommission" (Ørsted 1848). Worsaae argued for dividing up, whilst Steenstrup argued against a division of the Stone Age. The ongoing discussions lead to the second "Køkkenmødding Kommission", which concluded that hunter-fishers were succeeded by farmers, thus supporting a division of the Stone Age (Madsen et al. 1900). Division of the Stone Age was also suggested by Lubbock (1865), who was the first to use the terms Palaeolithic and Neolithic, thus creating a typological subdivision of C. J. Thomsen's (1836) three-age system in archaeology. The Neolithic was, according to Lubbock, defined by specific technological features, such as the polishing of stone tools. The elements behind the Neolithic term were expanded at the beginning of the 20th century, when V. Gordon Childe claimed that the transition towards an agrarian society involved a Neolithisation process. He argued that agriculture, pottery, polished stone tools, grinding stones and increasing sedentary behaviour were integrated parts of an agrarian lifestyle, which formed a "package" of Neolithic innovations (Childe 1929). However, the emergence of processual archaeology during the 1960s changed the meaning behind the Neolithisation and "Neolithic package", from a concept that included a broad range of evidence (houses, religious objects and structures) to a focus entirely upon agrarian subsistence practices, as this theoretical approach concentrated on ecological changes. A counter reaction came with post-processual archaeology during the 1980s, in which the concept of the Neolithisation was expanded to include ideological changes, where a different structure of ideas could be manifested in a new material culture (Cilingiroĝlu 2005). Currently, the Neolithic and Neolithisation can be interpreted as a period or phase in time, a cultural phase, an evolutionary step, a change in social structure, which causes problems when trying to understand the transitional processes. Obtaining detailed knowledge of when agrarian practices were introduced to certain regions is therefore of fundamental importance. Only then is it possible to discuss the speed of these processes, together with the mechanisms behind the agrarian expansion. I will therefore initially focus upon the primary evidence of agrarian activities and when this appears for the first time in different regions of Scandinavia.

3.2. The mechanisms behind the agrarian expansion – migrationism, indigenism or integrationism

The varying expansion of agrarian activity in Central Europe and Scandinavia should be investigated from a long-term diachronic perspective in order to discuss the overall patterns, tendencies and consequences associated with the spread of farming (Kaul & Sørensen 2012). However, past European research generally indicates that the overall mechanisms behind this agrarian expansions in different periods of prehistory can be associated with three major hypotheses: migrationism, indigenism and integrationism (Kossinna 1922; Childe 1929; Nummedal 1929; Jażdżewski 1936; Becker 1947; Troels-Smith 1954; Skaarup 1973; Lichardus 1976; Fischer 1982; 2002; Jennbert 1984; P. O. Nielsen 1985; 1994; Madsen 1987; Kristiansen 1988; 1991; Solberg 1989; Damm 1993; Baudou 1995; Bogucki 1996; 2003; Prescott 1996; Zvelebil 1998; Welinder 1999; Bolin 1999; Persson 1999; Price 2000; Zilhão 2001; Fischer & Kristiansen 2002; Myhre & Øye 2002; Skak-Nielsen 2003; Whittle 2003; Klassen 2004; 2005; Scharl 2004; Vandkilde 2005; Bergsvik 2006; Glørstad 2006; Louwe Kooijmans 2007; Gronenborn 2007; Sarauw 2007b; Valen 2007; Hallgren 2008; Bramanti et al. 2009; Brinch Petersen & Egeberg 2009; Kind 2010; Sheridan 2010; Rowley-Conwy 2011; Asprem 2012; Lavento 2012; Olsen 2012; Sjögren & Arntzen 2012; Solheim 2012; Vander Linden 2012; Brandt et al. 2013; Lahtinen & Rowley-Conwy 2013; Thomas 2013).

3.3. The rise of migrationism

Migrationism argues that people were the primary carriers of agrarian practices and societies, who through migration and colonization expanded into new territories, where they could teach hunter-gatherers about agriculture. One of the first methods to document migrations involved the identification of particular lead artefacts, together with their distribution patterns, in a region that was being colonized from a neighbouring area. It was hereby possible, using the concept of a cultural circle or "Kulturkreis", to identify a migrating people as an intrusive unit in the region that was being colonized (Kossina 1922). A cultural circle or "Kulturkreis" was interpreted as when the same lead types occurred in two neighbouring cultures, which could then be used to define a group of a single culture or several cultures making up one cultural circle or "Kulturkreis". In principle, these cultural

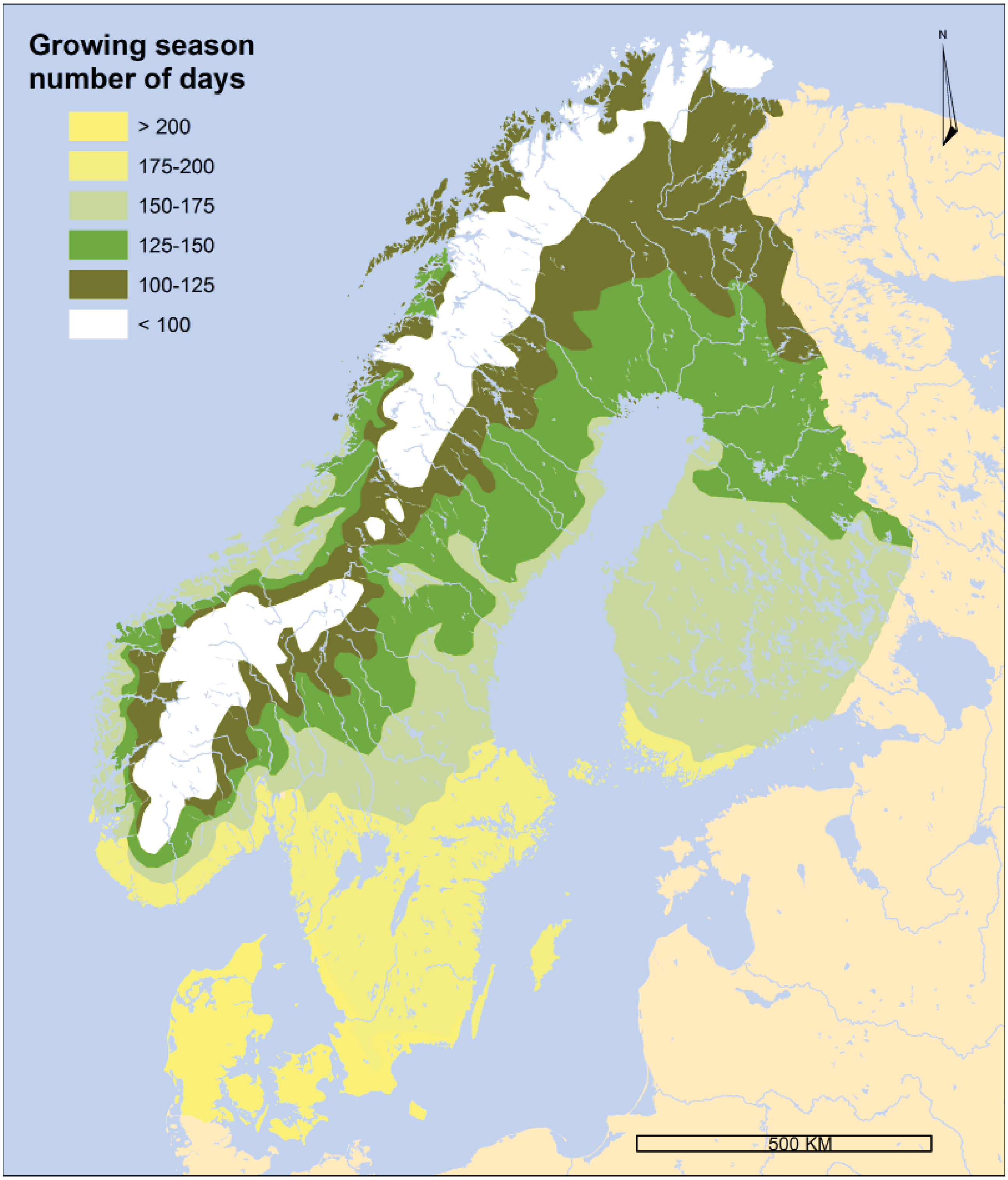


Fig. II. 5. Map showing the potential growing areas for crops in Scandinavia today, calculated using the number of days above 5ºC, as cereals germinate at 6ºC and the ripening of grains stops at 10ºC. Some overall tendencies seem to emerge, and in particular 175-200 days above 5ºC mark the time limit for many species of cereals to ripen. After Tveito et al. 2001.

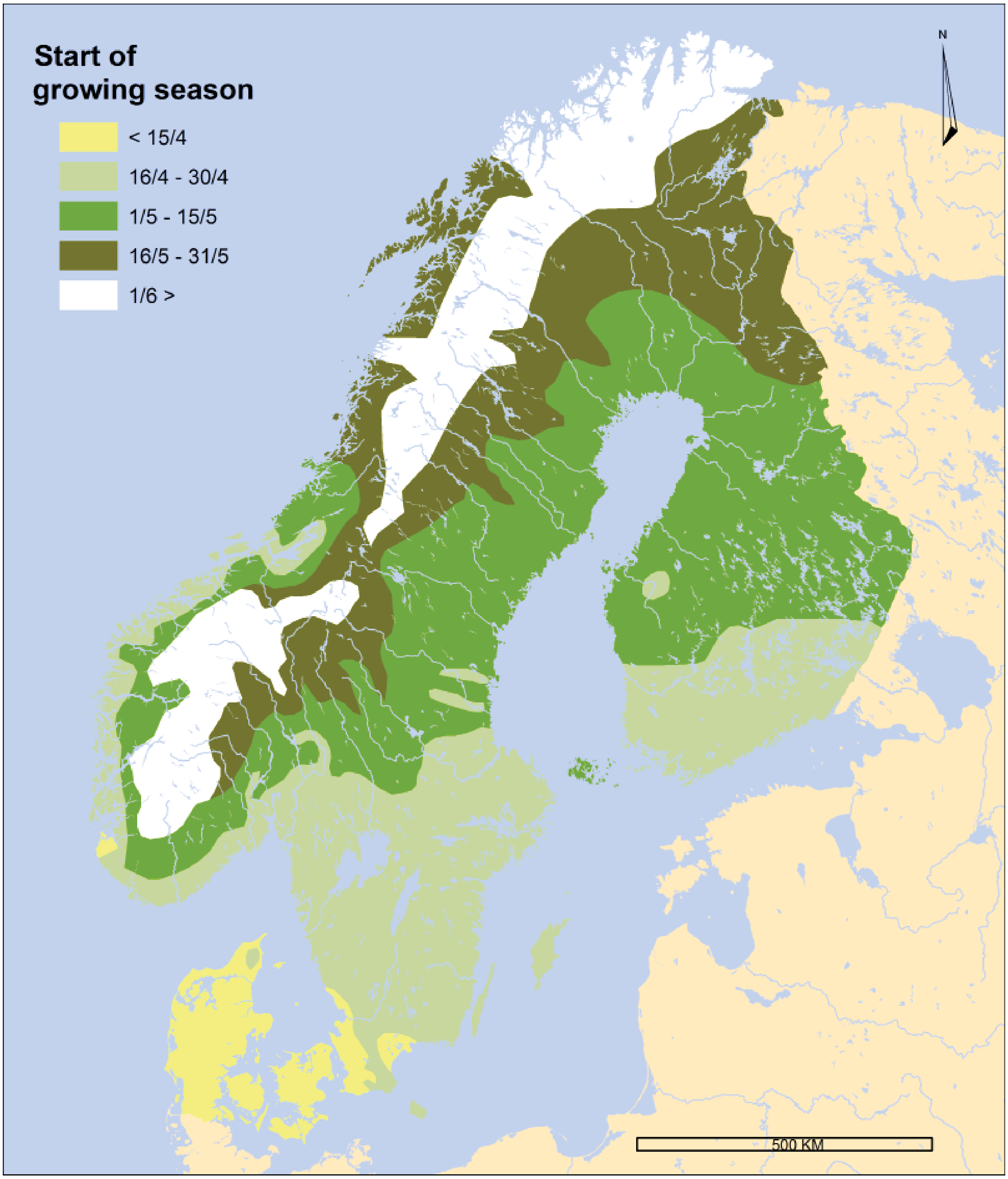


Fig. II. 6. Map showing the start of the growing season for crops in various regions of modern Scandinavia, based on the number of days above 5⁰C. After Tveito et al. 2001.

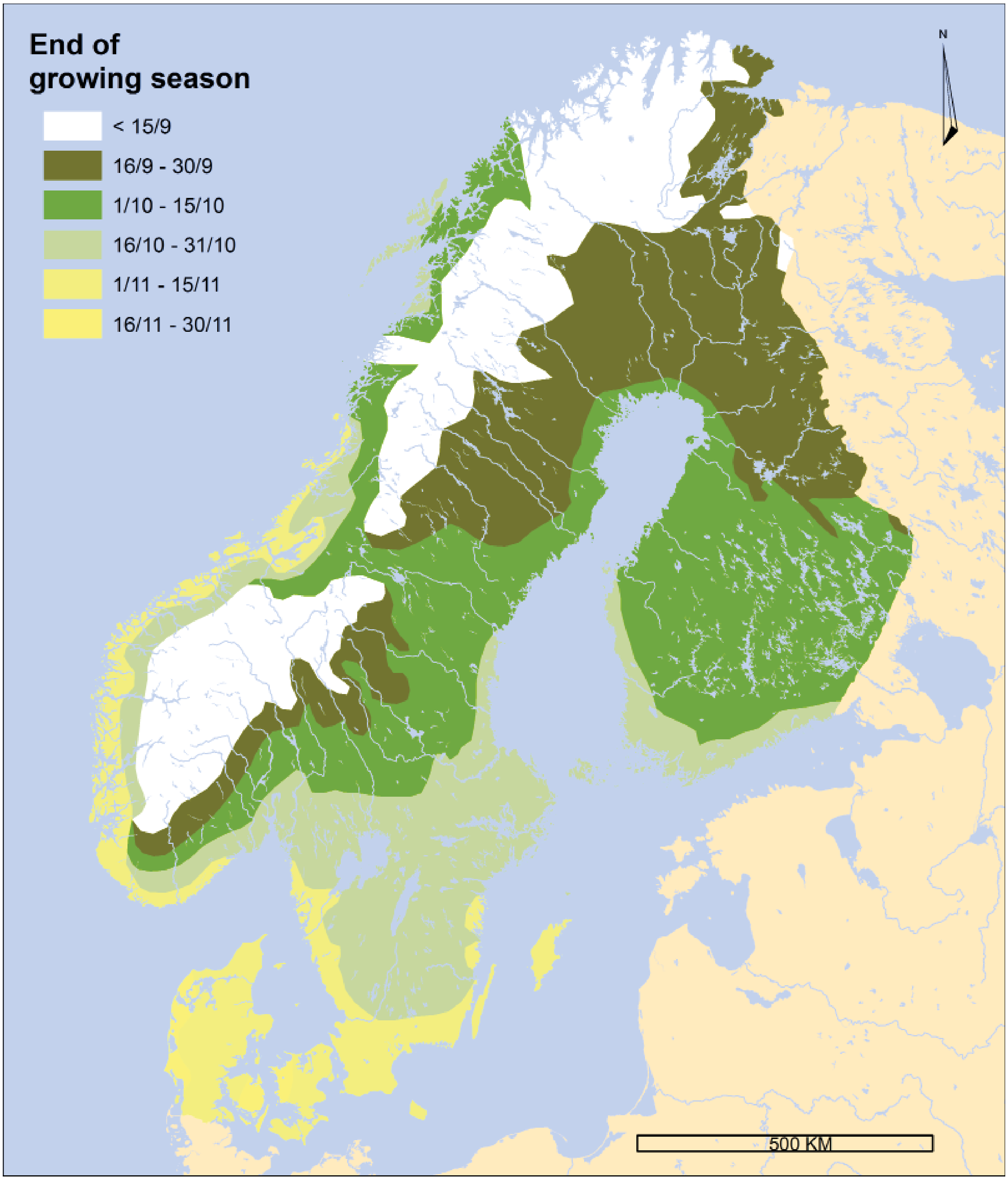


Fig. II. 7. Map showing the end of the growing season for crops in various regions of modern Scandinavia, based on the number of days above 5^{0}C. After Tveito et al. 2001.

circles should not contain foreign elements from another cultural circle (Kjærum 1959, 73ff; Kozłowski 1973, 334; Klejnstrup-Jensen 1978, 13). However, before the emergence of radiocarbon dates, the dating of the various cultures within cultural circles depended on the occurrence of imported artefacts, which made it possible to relate them to one another. Events like trade, exchange and war could explain the appearance of exotic artefacts inside the cultural circle. However, there is a clear weakness in using this theory, because the cultural circles are defined on deviations, thus making it possible to widen and stretch the chronological frame for each cultural circle. The risk of creating mixing of cultural circles is relatively high, making the theory of "Kulturkreis" highly problematic when used for defining archaeological cultures. The concept of cultural circles was adapted by Childe (1929; 1950), who argued that migrations and diffusions were the two most important factors in social relations. Childe based his hypothesis on Valilov's (1926) interpretation of the "centers of origin" of domesticated crops and animals in the Near East and argued that these represented a "Neolithic Revolution". From the center of origin Childe claimed that agriculture expanded and moved to Europe from the Near East via a series of migrations. According to Childe, the first livestock and crops did not reach Europe through trade or exchange, but through migrations or colonizations, as hunter-gatherers could not have taken up agrarian practices themselves. Childe was also one of the first to suggest a reason why the domestication of crops and animals occurred in the Near East, arguing that the harsh environments in this area forced humans to invent agrarian subsistence practices. According to Childe, population increase did not cause the transition to agrarian activity. However, Childe argued that one of the consequences of the invention of agrarian subsistence practices was increasing population pressure caused by the successful agrarian lifestyle. The spread of agriculture and agrarian societies would intensify through a process of migration and diffusion along the Danube and replace the indigenous hunter-gatherers because of the superior technology of agrarian practices (Childe 1925; Richards 2003; Jordan 2010).

3.4. Migrationism and pollen analysis in South Scandinavia

Danish researchers were some of the first to adopt the migration theories, and it was argued that the Funnel Beaker culture originally came to South Scandinavia through migrations of "new people in small groups" from Northern or Central Europe, as suggested by Johannes Brøndsted in the first edition of "Danmarks Oldtid" (Brøndsted 1938, 143). The migration of smaller groups of people was difficult to prove, but excavations of sites like Brabrand (Troels-Smith 1937), Klintesø (Jessen 1937), Ordrup Næs (Becker 1939), Siretorp (Bagge & Kjellmark 1939) and Dyrholm (Mathiassen et al. 1942) seemed to demonstrate stratigraphic overlaps between layers of the Ertebølle and the Megalithic cultures, thus pointing toward two contemporary groups of peoples. One group was the Ertebølle hunter-gatherers and the second group was the farmers who had immigrated from foreign regions. However, we now know that all the layers on the mentioned sites should be considered as mixed and that the argument of two contemporary groups of peoples cannot be supported by the data compiled from these sites. Nevertheless, during the 1940s and 1950s the Ertebølle hunter-gatherers and immigrant agrarian farmers were viewed as different ethnic groups. The hypothesis of two different ethnic groups of hunter-gatherers and farmers gained further weight when Th. Mathiassen (1940) was able to document marked differences in the flint technology between the Ertebølle culture and an immigrant agrarian people. He argued that the tools of the Ertebølle culture were produced by a finer blade knapping technique, while the tools of the immigrant agrarian people were based on a coarse flake-based technology. Mathiassen argued that the site of Strandegård was a typical example of a purely Ertebølle site, that contained items either borrowed or stolen from the agrarian people, which he identified in the material culture from the Havnelev site.

The impact these early agrarian farmers had on the landscape was documented in Johannes Iversen's important work about forest clearance or "landnam" (1941), in which a number of pollen analyses of bog deposits near Stone Age sites identified several forest clearance phases. In the pollen diagrams the first phase was characterized by few Cerealia pollen, high amounts of charcoal dust, a gradual decrease in *Tilia* sp., especially *Ulmus* sp., and an increase in pioneer species like *Betula* sp., *Populus* sp. and *Salix* sp. These changes could have been associated with the creation of fallow areas and the beginning of cultivation involving crop rotation. The second phase was interpreted as the actual agricultural phase, characterized by larger quantities of Cerealia, *Betula* sp., increasing amounts of *Corylus avellana* and lesser quantities of *Tilia* sp., *Ulmus* sp. and *Fraxinus* sp. The third phase was a stage of recovery of natural vegetation after the agrarian exploitation. This phase, according to Iversen, is characterised by less Cerealia, large amounts of *Corylus avellana*, *Tilia* sp. and *Ulmus* sp., and a decrease in *Betula* sp. Generally, the vegetation changes during the landnam phases would create small openings in the forest, which were well suited for pasture and arable fields. Iversen linked these forest clearance phases with the arrival of immigrant farmers from the Megalithic culture, thus maintaining the theory of migration as the driving force behind the expansion of agrarian practices (Iversen 1941, 18).

The migration theory was further supported in 1947 by Carl Johan Becker, with his study of 152 bog finds of ceramics from the Neolithic period. Becker placed the developments in South Scandinavia in a European context and argued that the term Funnel Beaker culture should be used instead of the previously used Megalithic culture. He divided the funnel beakers (funnel beakers, lugged beakers, funnel bowls, simple bowls, collared flasks, lugged flasks and lugged jars/vessels) into five groups, based on the shape of the base or neck and decoration. Types A, B and C characterized a division of the Early Neolithic, while types D and E were associated with the Middle Neolithic. The earliest types A were characteristically short-necked funnel beakers, which according to Becker could be associated with the latest part of the Band Ceramic Theiss-Jordansmühl group and the Michelsberg culture. Becker presented the A ceramics from Store Valby in a later paper and argued that the Michelsberg culture should be regarded as part of the Funnel Beaker culture (1954). He was therefore one of the first researchers to link the immigrating agrarian farmers in South Scandinavia to a culture of Western Europe.

By the beginning of the 1950s, the migration theories were already being challenged by Jørgen Troels-Smith, who argued that Ertebølle hunter-gatherers acquired agrarian practices as a supplement to hunting and fishing, influenced by Late Danubian cultures (Troels-Smith 1954). Based on the ceramics from the Muldbjerg site, he argued that the A ceramics were developed from Ertebølle pottery, because differences were only apparent in the shape of the base, and the thickness and construction of the vessels. However, detailed technological investigations of the pottery were still required, which were first undertaken some decades later (Hulthén 1977; Koch 1987; 1998). These studies concluded that the earliest of the type A vessels (type 0) are closely related to the Ertebølle vessels and could be a transitional type, but with respect to their technique and manufacture they are indeed funnel beakers (see ceramic discussion). Furthermore, the landnam model was revised by Troels-Smith (1954), who argued for an earlier appearance of cereals, which corresponded with a decline in *Ulmus*, thus claiming that agriculture began during the Late Ertebølle Culture. However, these pre-elm cereals are often associated with misinterpretation, as both *hordeum* and *triticum* pollen can be confused with grasses (see part IV).

3.5. Critiques of migrationism and the emergence of radiocarbon dates

Critiques of the migration theories generally gained further weight during the 1960s due to the emergence of processual archaeology, the proponents of which argued that the aims of archaeology corresponded to those of anthropology. All the previous cultural-historical theories were criticized and emphasis was placed upon a discussion of human behaviour within societies. The cultural history theories in particular were accused of merely cataloguing, describing and creating timelines based on artefacts, and not addressing the issue of how societies worked (Trigger 1989, 294ff). The theory of the cultural circle was especially criticized for creating long-term cultural borders and for being too static for understanding human behaviour (Kjærum 1959, 75ff). Processual archaeology perceived prehistoric societies as systems, which were exposed to similar influences, and environmental changes in particular were interpreted as the main reason for the adaption of agrarian practices. Changes in prehistoric cultures were therefore perceived as being associated with ecological adaptation, including some fixed processes and structures. Anthropology therefore played an important role, providing analogies in observations of how contemporary hunter-gatherer and agrarian societies interact with each other (Olsen 1997). However, using direct analogies and imposing observations onto prehistoric material have subsequently been criticized and can only function as inspiration (see part III).

The main reason why all the cultural-historical and migration theories were revised was because it was now possible to take radiocarbon dates of contexts containing material culture or from the objects themselves, thus making it possible to test the dates ranges of cultures and their typology. One of the first hypotheses to be tested was Gordon Childe's theory of the agrarian expansion from the Near East and into Europe, which was interpreted as a rather rapid process (Childe 1925; 1929; 1950). In 1965 Clarke published several radiocarbon dates from early agrarian sites in Europe, which confirmed an expansion from Eastern Europe towards Western Europe clustering in three stages from dates before 5200 BC, to dates between 5200 and 4000 BC and finally to dates between 4000 and 2800 BC. The radiocarbon dates therefore documented that the expansion of agrarian practices and societies was not rapid, but instead was a long and slow process lasting several thousands of years, before reaching Britain and southern Scandinavia between 4000 to 2800 BC (Clark 1965). However, when Clark presented his results he was unaware of the fact that the content of ^{14}C in the atmosphere had varied over time and that his radiocarbon dates were incorrect, as they had not been calibrated. The calibrations led to correction of the dates associated with the introduction of agriculture, which were now significantly earlier than those originally presented by Clarke (1965). The introduction of agriculture in South Scandinavia and the British Isles was now 800 to 1000 years earlier than was previously assumed, corresponding to a date of around 4000 cal BC (C. Renfrew 1973).

3.6. The rise of indigenism

Indigenism or diffusionism regards the adoption of agrarian practices as an internal or autonomous development in different regions (Ammerman 2003). Researchers arguing in support of indigenism claim that agrarian practices may have spread from farmers to hunter-gatherers as an idea, thus making it possible for an indigenous population to adopt agriculture without the interference of farmers from elsewhere (Troels-Smith 1954; Schwabedissen 1967; Jennbert 1984; Madsen 1987; Olsen 1992; Price 2000; Bergsvik 2002; Fischer 2002; Sørensen 2005; Hjelle et al. 2006; Andersen 2008a; Thomas 2008; Glørstad 2010). Agrarian ideas were adopted by local hunter-gatherers, showing a high degree of continuity in an often gradual transitional process (Troels-Smith 1954; Bolin 1999; Fischer 2002; Glørstad 2006; 2010; Louwe Kooijmans 2007; Valen 2007; Andersen 2008a; Thomas 2013). The concept of indigenism emerged along with processual archaeology and a renewed interest in the study of the hunter-gatherers of Mesolithic societies, with many investigations supporting the argument for local experimentation and domestication of animals and crops. The adoption of agriculture was considered primarily a process of diffusion of ideas, technology and resources, and the migration theories were largely out of fashion (Ammerman 2003).

The two competing hypotheses of migrationism (introduction of agriculture attributed to immigrating groups) and indigenism (agriculture adopted by local hunter-gatherers) have led to ongoing discussions between researchers in several regions of Scandinavia regarding the adoption of agrarian practices. One of the more significant discussions, as previously mentioned, involved Carl Johan Becker and Jørgen Troels-Smith in the 1940s and 1950s. Similar discussions, regarding the adoption of agrarian practices in Norway, have even resulted in the creation of two main theoretical approaches or schools, named after their chief proponents of A. W. Brøgger (1925) and H. Shetelig (1925) (Glørstad 2006, 214). The main disagreement surrounds the question of how the agrarian practices were introduced.

The "Shetelig-school" argued that agriculture was adopted due to external influences via migrations, whereas the "Brøgger-school" claimed that internal processes through diffusion were the decisive factor. The opposing theories continued to be supported by different researchers throughout several decades and these include currently active scholars (Fig. II.8). Adherents of the indeginist "Brøgger-school" interpret agrarian practices, together with imported material culture, as the result of trade and exchanges, whereas the followers of the migrationist "Shetelig-school" see the exotic objects as the result of a large migration of immigrating farmers. Many of the same researchers from both groups have also discussed whether agriculture was introduced to central and northern parts of Norway during the Neolithic, Bronze Age and Iron Age by an immigrant or indigenous population championed by Brøgger (1925) and Gjessing (1942). The two competing hypotheses of migrationism and indigenism have therefore been used to discuss how agrarian practices were introduced into certain regions at different times in Scandinavia.

3.7. Challenging the theory of indigenism

Generally, the research focus shifted away from migrationism during the 1970s. But there were still models proposed, such as the wave of advance, which challenged the theory of indigenism in archaeology (Ammerman & Cavalli-Sforza 1971) (Fig. II.9). The wave of advance model was based on the processual archaeological approach and used demographic data, population genetics, radiocarbon dates and archaeological evidence to show the spread of various agrarian expansions. The model therefore focuses on the consequences of the agrarian food production after it was adopted (Ammerman & Cavalli-Sforza 1973; 1984; Ammerman 2003; Cavalli-Sforza 2003). Based on radiocarbon dates from sites that produced evidence of agrarian practices, they calculated that the average movement of people would be around 1 km per year or 25 km per generation. These calculations supported a scenario of constant movement of migrating farmers (demic diffusion), that over 2500 years would cover the distance from the Aegean to the British Isles. Furthermore, they argued that cultural diffusion, which included exchange of knowledge without actual movement of farmers, also played a decisive role in making the indigenous population become farmers. This model can be used to produce a large-scale picture of the agrarian expansion in Europe. Other researchers, such as Renfrew (1987), have also used the wave of advance theories to propose a close relationship between the agrarian expansion from Anatolia and the introduction of the Indo-European language to Europe. However, such linguistic and cultural expansions are difficult to prove and the two are not necessarily connected. Generally, the wave of advance model has been criticized for being too static, and thus failing to acknowledge the dynamics behind migrations, as populations would have expanded in very different environments during prehistory. Evidence from several regions, where data are abundant, has shown that agrarian expansion is often very rapid, followed by short or long periods of static boundaries or even regression (Strinnholm 2001; Zilhão 2001; Sheridan 2010; Rowley-Conwy 2011; Sørensen & Karg 2012). Moreover, Ammerman and Cavalli-Sforza have argued that it is sufficient to characterize a society as agrarian when finds of ceramics are recovered from sites, regardless of the subsistence strategy. Such a definition, however, is highly problematic, as there are many hunter-gatherer societies that are known to have produced ceramics (Deichmüller 1969; Schindler 1962; Hulthén 1977; Koch 1987; van Berg 1990; Timofeev 1998; Raemaekers 1999; de Roever 2004; Louwe Kooijmans 2007; Gronenborn 2009; Hartz 2011). The wave of advance model is therefore biased, as it is based on some rather broad definitions of what material culture is required in order to interpret different prehistoric societies as being agrarian. Now waves of advance show swift expansions of agrarian societies during the Linearbandkeramik (LBK) culture followed by a longer period of a static border in North Germany, which is succeeded by yet another swift expansion to South Scandinavia during the Michelsberg and Funnel Beaker cultures (Vanmontfort et al. 2008; Sørensen & Karg 2012).

3.8. Migrationism and indigenism in southern Scandinavia

Despite the critiques of the migration theories during the 1970s, they were still upheld by many researchers in South Scandinavia. Jørgen Skaarup (1973) argued in his review of Early Neolithic hunting stations, that the Funnel Beaker culture was the result of immigration, thus supporting theories proposed by Becker (1948). Skaarup also emphasized that the Funnel Beaker culture quickly replaced the Ertebølle culture and that Neolithic coastal sites were seasonal camps used by farmers, who commuted between the inland and coastal areas. Bengt Salomonson (1973) also supported the theory of immigration as the main cause behind the emergence of the Funnel Beaker culture, based on differences in the flint technology. He compared the material from the Late Ertebølle site of Elinelund, which produced core axes and blades, with the Funnel Beaker assemblages from the site of Värby, which included pointed-butted axes. He also observed that both sites had produced an assemblage of flake axes, scrapers and transverse arrowheads, thus indicating a possible period of cultural continuity between the Late Ertebølle and the Early Funnel Beaker culture. Søren H. Andersen was more cautious and argued for larger settlements inhabited all year round, which could have resulted in an increased population, thus leading to the introduction of farming (Andersen 1973).

The scholars maintaining migrationism as the main reason behind the adoption of agriculture were first challenged in 1974, when Anders Fischer argued in support of indigenism as the main process behind the adoption of agrarian practices. He was clearly inspired by the earlier ideas of Schwabedissen (1967), who argued that the

Shetelig school	Brøgger school
Argueing primarily for migrationism	Argueing primarily for indeginism
H. Shetelig (1925)	A. W. Brøgger (1925)
A. Bjørn (1927)	G. Gustafson (1906)
A. Nummedal (1929)	H. Gjessing (1920)
G. Gjessing (1945)	E. Bakka & P. E. Kaland (1971)
E. Hinsch (1955; 1956)	B. Magnus & B. Myhre (1976)
A. Hagen (1967)	E. Mikkelsen (1984)
E. Østmo (1988)	L. G. B. Bjerck (1988)
B. Solberg (1989)	K. L. Hjelle, A. K. Hufthammer & K. A. Bergsvik (2006)
C. Prescott & E. Walderhaug (1995)	H. Glørstad (2010)

Fig. II. 8. Researchers belonging to the Shetelig school (migrationism) and the Brøgger school (indigenism). After Gustafson 1906; Gjessing 1920; Shetelig 1925; Brøgger 1925; Bjørn 1927; Nummedal 1929; Gjessing 1945; Hinsch 1955; 1956; Hagen 1967; Bakka & Kaland 1971; Magnus & Myhre 1976; Mikkelsen 1984; Bjerck 1988; Østmo 1988; Solberg 1994; Prescott & Walderhaug 1995; Glørstad 2006; 2010; Hjelle et al. 2006; Solheim 2012.

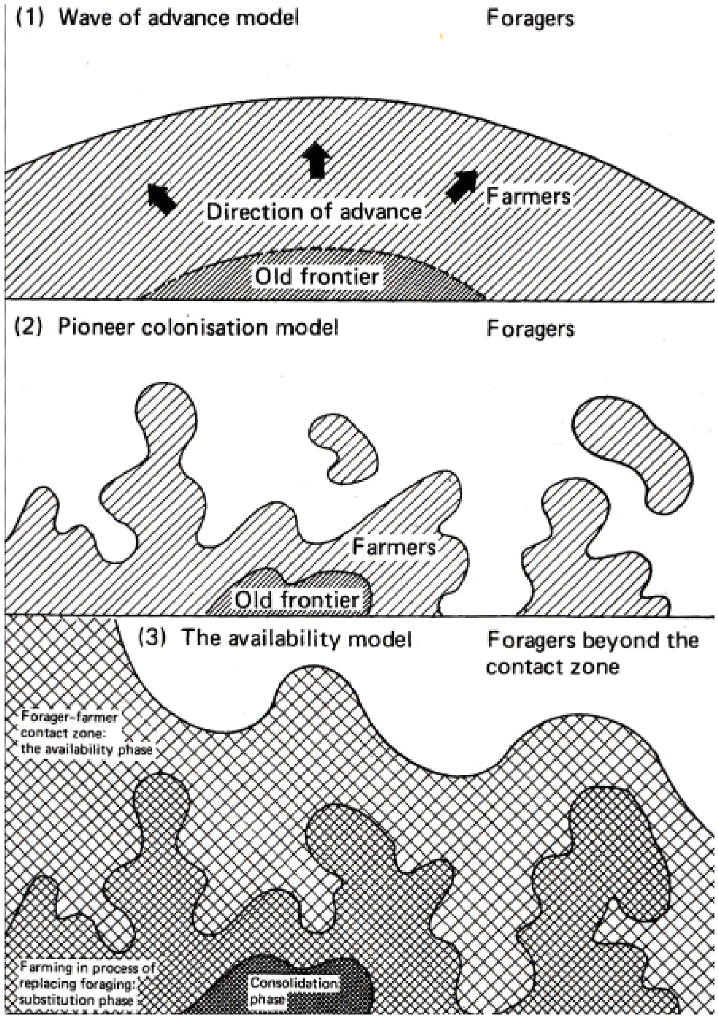


Fig. II. 9. Three spatial models for agricultural frontiers. 1. Wave of advance model. A frontier that is constantly advancing as a result of population growth and migration of the farming communities (Ammerman & Cavalli-Sforza 1971). 2. Pioneering colonization model. New settlements as centres of development beyond the boundary of farming (Arnaud 1982). 3. The availability model. Exchange of knowledge between hunter-gatherers and farmers on either side of a boundary (Zvelebil & Rowley-Conwy 1984). After Zvelebil 1986; 1996.

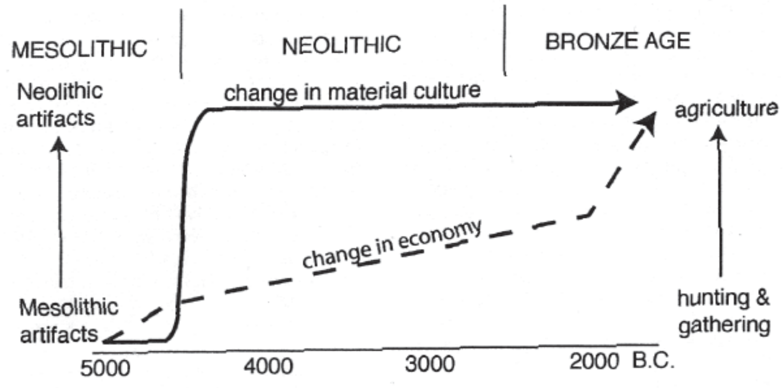


Fig. II. 10. The availability model showing the change in economy and material culture at the Mesolithic and Neolithic transition in north-western Europe. After Rowley-Conwy 2004.

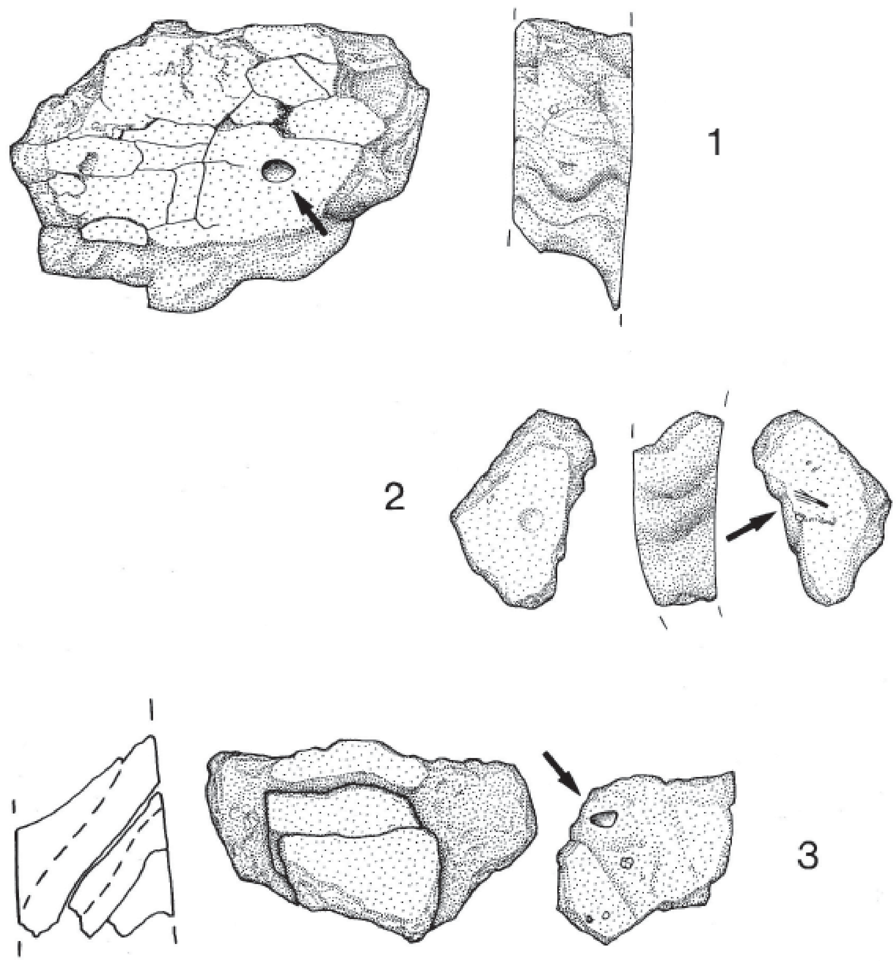


Fig. II. 11. Drawings of Ertebølle sherds with grain impressions from the settlements of Vik and Löddesborg in Scania. 1. Sherd with impressions of wheat (*Triticum compactum*). 2. Sherds with impressions of a grain of barley (*Hordeum*). 3. Sherd with impression of einkorn wheat (*Triticum monococcum*). After Jennbert 1984; Koch 1998, 49.

appearance of shoe-last axes showed influences dating back to the Rössen culture. Anders Fischer interpreted the appearance of shoe-last-axes from Ertebølle contexts as proof of contacts and exchange of prestigious artefacts between Ertebølle hunter-gatherers and agrarian societies of the Rössen culture. These contacts indicate that the Ertebølle hunter-gatherers had known the principles behind the cultivation of crops and animal husbandry, but had chosen not to exploit these resources. Fischer found further inspiration from Boserup (1965), who argued that the implementation of agrarian practices would require a greater investment in labour than foraging activities. Fischer therefore claimed that rising population growth would bring about a change in the subsistence strategy. The adoption of agriculture due to internal changes was also supported in the two following articles by Paludan-Müller (1978) and Mahler (1981), who argued that an increasingly sedentary lifestyle during the Late Ertebølle culture led to increased population pressure and exploitation of natural resources, thus resulting in the adoption of agrarian practices. Generally, many of these theories were inspired by processual archaeology finding the explanation in peoples' reaction to environmental stress, which resulted in the adoption of agrarian practices.

A counter reaction emerged with the arrival of post-processual archaeology, in which it was argued that human free will or various random coincidences could play a primary role in the change that occurred in prehistoric societies (Hodder 1982; Miller & Tilley 1984). Post-processual archaeologists criticized processual theories for being so focused on calculations that the people themselves had been forgotten. According to post-processualists the adoption of agrarian practices was due to ideological and socio-economic reasons. The process of becoming a farmer was interpreted as a cognitive or ideological change, this relying on anthropological theories focusing on adaptation, social forms of organization, relationships, identity, power and ethnicity. Kristina Jennbert, with her theory of "the productive gift", was one of the first researchers to argue that the adoption of agrarian practices was primarily a social process, thus showing the impact of post-processual ideas in the Neolithisation debate (Jennbert 1984).

According to Jennbert, the introduction of agriculture was the result of prestigious gifts from agrarian societies to the Ertebølle hunter-gatherers, thus supporting indigenism. Furthermore, she argued for a transitional phase and cultural dualism between Ertebølle hunter-gatherers and Funnel Beaker farmers, based on a series of sites containing layers with materials from both the Ertebølle and Funnel Beaker cultures. Her main argument is that archaeologists create artificial phases when focusing purely upon finds, thus producing hiatuses between prehistoric periods. The site of Löddesborg is, according to Jennbert, a prime example of sites where both Ertebølle and Funnel Beaker tools were in use in a transitional phase. However, the definition of the Löddesborg phase is problematic, and has been criticized for consisting of intermixed layers created by various Atlantic and Subboreal transgressions (Larsson 1987; Madsen 1987; Nielsen 1987). The layers at Löddesborg therefore resemble the mixed layers at sites that were published during the 1930s and 1940s in southern Scandinavia (Jessen 1937; Troels-Smith 1937; Bagge & Kjellmark 1939; Becker 1939; Mathiassen et al. 1942). Moreover, detailed excavations of the kitchen middens in northern Jutland from the 1980s to the present have not revealed any such transitional layers, but instead a clear division between layers from the Late Ertebølle and the Funnel Beaker cultures (Andersen 2008a).

3.9. The emergence of the availability model and isotope analysis

The enduring models of migration were increasingly challenged during the 1980s, because many scholars now favoured varying degrees of indigenous participation in the spread of agrarian practices. One of the results of this, explaining how Mesolithic hunter-gatherers and Neolithic farmers had interacted, was the availability model proposed by Marek Zvelebil and Peter Rowley-Conwy (1984; 1986) (Fig. II.9). They argued that the agricultural frontier zones contributed to the origins of agriculture through an increased pattern of mobility and contacts rather than migration. The border zone was characterized by an exchange of objects and knowledge between farmers and hunter-gatherers, where new cultural traditions arose. The model predicts a biological and cultural continuity from the hunter-gatherers to agrarian societies. The transition to agriculture consists of processes in different stages, in which local and regional adoption would be of shorter or longer duration. During the initial availability phase, subsistence farming makes up less than 5%; farming is known to the foraging groups and there is an exchange of materials and information between foragers and farmers, but without the adoption of farming, as we are still dealing with two independent groups. During the following substitution phase, agrarian activities replace foraging and agrarian food production increases so it makes up 5-50% of the subsistence economy. The final stage is the consolidation stage, which marks the shift to a fully agrarian subsistence strategy covering between 50 to 100% of the food production (Fig. II.10). The model serves as an alternative to the theories of more rapid transition to farming, such as the wave of advance model (see section 3.7), which has often been associated with migration (Ammerman & Cavalli-Sforza 1984). Therefore, the model does not explain why agriculture expanded, but describes the circumstances in which it happened (Zvelebil 2004, 187).

The rather gradual transition towards agrarian practices was, however, challenged by a new method that measured the stable isotopes in human bones and thus provided information about the prehistoric diet associated with an agrarian transition (Tauber 1981). Tauber measured the ^{13}C values of human bones from the Ertebølle and Funnel Beaker cultures, which revealed a very clear change from a marine diet during the Mesolithic period to a terrestrially dominated diet in the Early Neolithic in southern Scandinavia. However, the sampled material collected in these studies is biased, because human remains from Early Neolithic coastal sites in South Scandinavia were not analysed. The somewhat rapid change of diet between the Ertebølle and the Early Neolithic period, together with the excavation of kitchen middens during the 1970s and 1980s, inspired a new hypothesis. Peter Rowley-Conwy suggested that agrarian economies were adapted in order to compensate for a sudden decline in marine resources, namely oysters. Rowley-Conwy (1983) also argued, along with other researchers (Price & Brown 1985), in favour of a more complex picture, in which the Late Mesolithic hunter-gatherers were more sedentary and this led to the adoption of agrarian practices, with indigenism playing a decisive role.

3.10. The emergence of complex hunter-gatherers?

The term complexity was defined as the product of an evolutionary process in prehistoric societies, in which hunter-gatherer groups went from small- to large-scale societies, thus making it more likely they wished to and were capable of adopting agrarian practices (Price & Brown 1985; Rowley-Conwy 1983; 1985). The hypothesis was clearly inspired by the results of the "Man the Hunter" symposium, which suggested that hunter-gatherer societies gained special properties from the relationship between their environmental and social surroundings. The characteristic features of complex hunter-gatherers were intensification, elaboration, sedentism and inegalitarianism. However, many of these properties are elements of human behaviour that rarely can be associated with material culture, thus making it difficult to test in the archaeological record. However, some archaeological finds were used to argue that the Ertebølle hunters were becoming more complex than their predecessors during the Early and Middle Mesolithic. The cemeteries like Henriksholm-Bøgebakken and Skateholm from the Ertebølle culture were used to support the argument for greater complexity (Albrethsen & Petersen 1976; Larsson 1988). But these cemeteries are all dated to the Early Ertebølle culture, which is long before any evidence of agrarian activities have been found (Sørensen & Karg 2012). Furthermore, it has been questioned as to whether these cemeteries are in fact cemeteries, as clusters of burials are located near sites, which covered a longer chronological span (Meiklejohn et al. 1998; Brinch Petersen 2015). Recently excavated Late Kongemose and Early Ertebølle burials at Nivå on Zealand have also been associated with neighbouring huts rather than the establishment of cemeteries (Lass Jensen 2009). In addition, there are only a few graves from the Late Ertebølle culture and these often consist of bone scatters, suggesting "ad hoc" burials, thus pointing away from the idea of complex hunter-gatherers in the transition to the Neolithic. The larger size of kitchen middens from the Ertebølle culture has also been used in support of greater complexity, but detailed stratigraphic recording indicates that these sites consist of many palimpsests of shell heaps (Andersen & Johansen 1987; S. H. Andersen 1993; 2008a). The term "complexity" in an Ertebølle context seems rather to be related to an adaptation and specialization of hunter-gatherers living in a marine landscape. Furthermore, evidence for intensification during the Ertebølle period is limited amongst the archaeological data (Johansen 2006). Previous supporters of the notion of complex hunter-gatherers in the Late Ertebølle period now either argue against the term (Rowley-Conwy 2004, 87) or are very cautious when using this line of interpretation in discussions regarding the adoption of agriculture (Price 2000).

3.11. A rapid or slow adoption of agrarian practices in South Scandinavia

The rapid transition towards agrarian practices, as suggested by Tauber based upon his isotope analysis, also inspired other scholars during the 1980s in South Scandinavia. It was argued that the transition was a quick process lasting one or a few generations (Madsen 1987; Thomas 1988). The clear cultural break between the Late Ertebølle and the Funnel Beaker layers was also documented in several excavations of kitchen middens at Sølager (Skaarup 1973), Norsminde and Bjørnsholm (S. H. Andersen 1991; 1993). These studies led to the abandonment of Becker's (1948) hypothesis of a cultural dualism or coexistence of the Ertebølle and the Funnel Beaker cultures, as well as Troels-Smith (1960; 1967) and Jennbert's (1984) theories of agrarian practices during the Late Ertebølle period. Instead, an alternative model called "the catastrophic theory", explaining the sudden changes within one or two generations, was proposed by Torsten Madsen (1987). Normally rapid changes were interpreted as the result of immigration, but Madsen was one of the first to argue in favour of preliminary stages of transformation until a tipping point is reached, when huge changes occurs in prehistoric societies. The speed of these processes was determined by the level of the exchange of knowledge that occurred between hunter-gatherer and neighbouring agrarian societies. Thus, Madsen interprets the changes between the Ertebølle and the Funnel Beaker culture as a "black box" event, which happened so fast that transitional sites are difficult to find. However, the Ertebølle ceramics displaying cereal impressions from Löddesborg and Vik are problematical in relation to Madsen's theory (Jennbert 1984) (Fig. II.11). Nevertheless, he explains these sherds as an example of local development in Scania, thus acknowledging that the adoption of agrarian practices could occur at different speeds in various regions.

A similar model was proposed by Poul Otto Nielsen, who argued that the Ertebølle and Funnel Beaker cultures were two different social and cultural systems. The adoption of agrarian practices would lead to rapid changes for the hunter-gatherers in all aspects of society, including the material culture, social organization and religious practices. Nielsen argues that the Ertebølle hunter-gatherers moved around in the landscape according to seasonal changes, whereas the Funnel Beaker culture was characterized by permanent inland sites. From these inland sites these early farmers would commute between the inland and coastal zone to specialized hunting and fishing camps, in order to supplement their diet with foraging activities. Furthermore, Nielsen proposed that permanent sites would have emerged very quickly, if husbandry and cultivation practices were adopted, taking the classic line of argumentation that population pressure led to social stratification. Madsen (1987) and Nielsen (1987) thus argue that whole societies changed rapidly with the adoption of agrarian practices, although some foraging activities continued during the period of the Funnel Beaker culture, together with certain tendencies in terms of the lithic technology (Nielsen 1985; Stafford 1999). The models that emerged during the 1980s acknowledged that local hunter-gatherers played an active role in the adoption of agrarian practices, which could be initiated by processes of both migrationism and indigenism, thus paving the way for integrationism (Tauber 1981; Mahler 1981; Hodder 1982; Fischer 1982; 1983; Miller & Tilley 1984; Mahler 1981; Jennbert 1984; Larsson 1984; 1987; Price & Brown 1985; Rowley-Conwy 1983; 1985; Zvelebil & Rowley-Conwy 1986; Madsen 1987; Nielsen 1987; Thomas 1988).

3.12. The emergence of integrationism and new scientific methods

Integrationism combines the hypotheses of migrationism and indigenism, and is adhered to by most current researchers, although many tend to favour either immigrants or indigenes as the primary carriers of agrarian practices (Rowley-Conwy 2011). Integrationism argues that the primary carriers of agrarian practices and societies were small groups of pioneering farmers, who integrated with the indigenous hunter-gatherers, who then adopted agriculture. These hunter-gatherers could spread their newly acquired knowledge about agriculture, functioning as secondary carriers of agrarian practices to other hunter-gatherer societies (Zvelebil 1998; Bolin 1999; Hartz et al. 2002; 2007; Louwe Kooijmans 2007; Gronenborn 2007; 2010; Klassen 2004; 2005; Vandkilde 2005; Sarauw 2006; Andersen 2008a; Hallgren 2008; Brinch Petersen & Egeberg 2009; Nielsen 2009; Prescott 2009; Terberger et al. 2009; Sheridan 2010; Czekaj-Zastawny et al. 2011a; Hop 2011; Asprem 2012; Kaul & Sørensen 2012; Melheim 2012; Ravn 2012; Rowley-Conwy 2011; Rønne 2012a; Skandfer 2012a; 2012b; Solheim 2012; Sørensen & Karg 2012; Valen 2012; Vander Linden 2012; Arntzen 2013).

Therefore, in the past three decades the emergence of integrationism has refined the discussion of the adoption of agrarian practices, together with new scientific methods. One of the more important methods has been AMS dating, which has allowed researchers to undertake dating with much smaller sample sizes than conventional ^{14}C dating. However, using a very small sample always involves the risk of contamination from earlier material or influenced by the reservoir effect as discussed in section 6.2.

Another method showing primary evidence of agrarian practices is the presence of milk from cows, which has been identified in lipid analysis of food residues on Early Neolithic pottery from the Linearbandkeramik period onwards (Craig et al. 2005). However, isotopic values of milk fat seem to overlap with deer fatty acids, which make it hard to distinguish whether or not milk was actually being cooked in these vessels. Until researchers have solved this particular problem, all the identifications of milk lipids on vessels found at transitional agrarian sites remain questionable (Evershed et al. 2002; Craig et al. 2005).

Mitochondrial DNA (mtDNA) analysis is another method that has been used in the discussion regarding the adoption of agrarian practices (Bramanti et al. 2009, 139; Haak et al. 2010). However, unfortunately the statistical data used in these discussions is very limited in southern Scandinavia, as there are only nine human samples from the Mesolithic (hp-groups U2, 4 and 5), seven individuals found in passage graves from the Middle Neolithic (hp-groups H and K), 20 samples from burials dated to the Pitted Ware culture (hp-groups U4 and U5), two individuals from the Late Neolithic (hp-groups U4 and U5) and only one individual from a Bronze Age burial (hp-group U4) (Malmström et al. 2007; 2009; Melchior et al. 2010; Skoglund et al. 2012; 2014; Skoglund 2013; Lazaridis et al. 2013) (Fig. V.39, Tables 19 and 20). In general, many of the research results for mtDNA are biased, as mitochondria are inherited from the mother, which is why current DNA research is focused on extracting nuclear DNA.

In recent years strontium isotope analysis ($^{87}Sr/^{86}Sr$) has also played an important role in the discussion of human movement and is important in verifying theories of migration (Price et al. 2001, 594). Strontium analysis of prehistoric teeth and bones provides a geochemical signature of birth and death, the isotopes remaining constant as they pass from the local geology and up through the food chain. Using this method it is therefore possible to investigate whether humans or animals had moved to another region with a different strontium isotope value. The movements can be connected with the expansion of economic strategies, such as agriculture, or social strategies, including exogamy and marriage alliances, travel and individual life histories (Bickle & Hofmann 2007, 1029). Vital to the success of this method is the creation of a baseline in every region in order to explore overlaps in the strontium isotope values. However, up until now no strontium analyses have been undertaken upon Scandinavian human skeletal material from the Mesolithic or Neolithic periods. But other strontium analyses of human bones from the Bell Beaker culture have shown the potential of the method, as a greater degree of mobility has been documented, thus pointing toward immigration during this period (Price et al. 1994, 2004; Grupe et al. 2004; Evans et al 2006; Lee et al. 2012). However, it is somewhat questionable whether it is possible to observe any differences in the strontium isotope values of humans living on the Northern European Plain, thus making it difficult to detect any kind of mobility (Frei & Price 2012). Nevertheless, mobility studies can also utilise provenance analysis of flint.

Research into the provenance of flint started with the pioneering work of Carl Johan Becker, who made some visual classifications of various flint types in southern Scandinavia (Becker 1993) (Fig. II.12). His work upon provenance began when he excavated some flint mines in North Jutland, thus giving him access to the primary flint layers which had been used for mass production of Neolithic flint axes (Becker 1980). Later studies have been able to identify at least 17 characteristic types of flint from southern Scandinavia through visual classification (Högberg & Olausson 2007). The classification has been used to argue for a significant exchange and trade in mainly flint axes, daggers and sickles during the Neolithic and Bronze Age, between the flint-rich areas of southern Scandinavia and central and northern Scandinavia, where the material is scarce. Unfortunately there are some problems with this kind of classification, as there can be great visual differences within a flint nodule, thus making positive identification impossible. Recent non-destructive, pilot provenance studies have been carried out to measure the chemical fingerprints of various flint types, in an attempt to solve the problem of distinguishing between the different flint types. By using X-ray fluo-

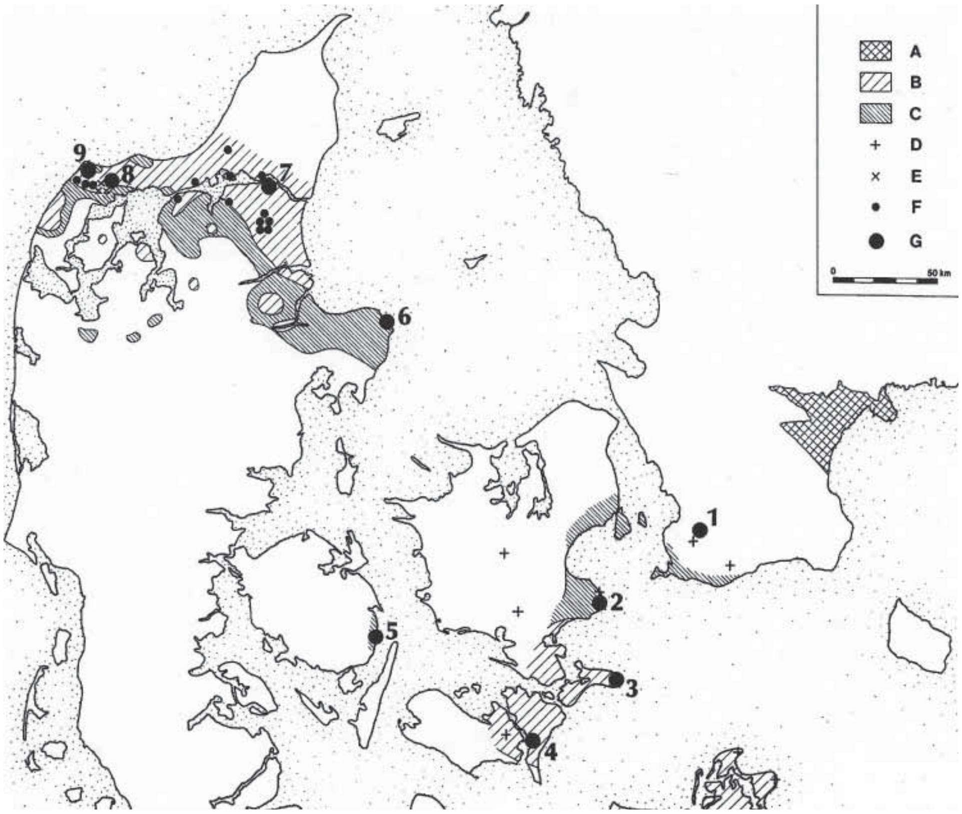


Fig. II. 12. Available flint sources in South Scandinavia. A: Kristianstad flint. B: Senonian flint. C: Danien flint. D: Senonian flint from Zealand. E: Senonian flint from Hov. F: Senonian spotted flint from Jutland. G: Senonian flint without spots from Jutland. Localities with important flint sources. 1. Sallerup, 2. Stevns Klint, 3. Hasselø, 4. Klintholm, 5. Fornæs, 6. Skovbakken, 7. Hov and 8. Bjerre. After Becker 1993; Vang Petersen 1993, 23.

rescence (EDXRF) analysis, certain trace elements (Al, Si, S, Cl, K, Ca, Ti, Mn & Fe) were found in the various samples from different primary flint sources in southern Scandinavia (Hughes et al. 2012). However, the measuring of flint surfaces can lead to contamination of the samples. Secondly, the primary flint sources contain several layers of flint, which were not included in the pilot study. There may be a difference in the chemical fingerprint of the different flint layers at one site. Furthermore, the non-destructive method used by Hughes et al. (2012) could be replaced by a destructive method, using samples of approximately 2x2 mm, in order to investigate many more trace elements in the various flint types and thus gain a more nuanced picture of their provenance.

The transitional process from hunter-gatherer to farmer was a complex process, which could involve actors and impulses from both neighbouring and more foreign regions. The scale of the investigations has influenced researchers to interpret the adoption of agriculture as either a long process, supporting an indigenous point of view, or a rapid process pointing toward migrationism. Researchers are therefore biased due to their focus on either small-scale investigations concentrating on one region, or large-scale work involving archaeological material from several countries. The critical point is reached when the adoption of agriculture, based on regional studies, is interpreted as including several regions or whole countries. This fails to acknowledge variations between different areas in the complexity of the transitional processes involved in the adoption of agrarian practices. The same tendency can be observed in the large-scale investigations of the adoption of agrarian practices, where it is often the rapid transitional trends that are highlighted at the expense of the slow processes documented in regional investigations (Fischer 2002; Klassen 2004; Andersen 2008a; Hallgren 2008; Nielsen 2009; Rowley-Conwy 2011).

3.13. Deadlock in the discussion

The questions of how agriculture was introduced and by whom in the various regions in Scandinavia are still associated with the three hypotheses of migrationism, indigenism and integrationism. The three hypotheses are being repeated and have, according to Kind (2010), created a deadlock in the general discussion of how agrarian practices and societies expanded. As a result the various arguments for and against migration and diffusion have been made, and the arguments have a general tendency to become circular (Robb & Miracle 2007). Proponents of each explanation accumulate further data to back up their own position. Researchers such as Neustupný (2004) have argued that some archaeologists seek a predetermined outcome, leading to a biased viewpoint in their conclusions. The same tendency has been observed by Bourdieu (1977), who has argued that it is normal for people in everyday life, as well as in science, to promote views or opinions which are in opposition to one another, or to create a clear division between modes of thought. The behaviour then simplifies the discourse and discussions of a given theme, which can be due to the fact that the theoretical directions have different starting points in relation to a given subject. Generally, the relationship between wild and domestic, as well as nature and culture, is of primary importance when researchers interpret the adoption of agrarian practices (Rudebeck 2000). In the case of the agrarian expansion, such different approaches create fewer consensuses with regard to when a hunter-gatherer becomes a farmer. There are also disagreements over who can be interpreted as a primary or secondary carrier of agrarian practices. Differences of opinion are also associated with the discussion of the terms of Mesolithic, Neolithic, Neolithisation and the Neolithic package. Researchers define key discourses differently according to what kinds of data the archaeologists are working with, the scale of their investigations and their theoretical position. The same tendency of repeating arguments has also affected the discussion of the reasons for the agrarian expansions. Generally, the reasons for the adoption of agrarian practices and their expansion can be narrowed down to three lines of argumentation, concentrating on population growth, resource availability and social changes within societies, or a combination of all three. However, researchers tend to prefer one explanation over another, emphasizing either the advantages of the agrarian subsistence strategy, or the social, ideological and power-related benefits of the adoption of agriculture.

3.14. Population growth

Population growth has almost by definition been associated with the emergence of agrarian societies, where increased sedentism, combined with a greater stability of food resources, leads to population growth. The wave of advance model is a product of this kind of argumentation (Ammerman & Cavalli-Sforza 1984). However, several Europe regional studies have shown that agrarian expansions occur very quickly, followed by longer static periods (Zilhão 2001; Rowley-Conwy 2011; Sørensen & Karg 2012). One of the reasons for this may be that the increase in prehistoric populations was a process that took several decades, which is why it is very difficult to document in the archaeological material (Sardó 2011). However, attempts have been made to calculate population increase or decrease by using the number of radiocarbon dates and pollen data from certain regions (Bocquet-Appel 2002, 2008, 2009; Eshed et al. 2004; Barnard 2007; Hinz et al. 2012). Recently, Shennan et al. (2013) have proposed a "boom and bust" hypothesis. Their results documented an increase in population a few centuries after the first agrarian practices were introduced in several regions across Europe. The increases in the populations were followed by a decrease some centuries later. But in the author's opinion and that of others (Crombé & Robinson 2014), these examples of "boom and bust" only represent what archaeologists have found interesting enough to date. In southern Scandinavia many researchers have concentrated on taking radiocarbon dates of the earliest evidence of agriculture, thus resulting in dates from these periods being overrepresented. The subsequent periods are typologically well established, therefore making radiocarbon dating unnecessary (Persson 1999).

Population studies would gain more weight, if actual archaeological material were to be used as evidence alongside radiocarbon dates and pollen data from a given region. In some parts of South Scandinavia we have some quite detailed data: from north-western Zealand (Mathiassen 1959), the Ystad project (Berglund 1991; Larsson et al. 1992) and northern parts of Schleswig-Holstein (Lüth 2011). These three surveys document a dense distribution of thin-butted axes in the inland zone. The results may indicate a more intensified usage of the landscape, which could be the result of a population increase shortly after the introduction of agriculture. However, the population "bust" at the beginning of the Middle Neolithic, as claimed by Shennan et al. (2013), is not supported by any of the three surveys with the construction of megalithic tombs or the distribution of later types of thin-butted and thick-butted axes. Arguably, there are fewer thin-butted axes of the Blandebjerg type in northern Schleswig-Holstein, but this type of axe was in use for a much shorter time than the early thin-butted axe types (Nielsen 1977; Lüth 2011; Sørensen 2012a). It is therefore important, when using the distribution of axes as evidence of activities in the region, to check how long the various types of axes were in use.

Another method of calculating the population sizes is to investigate the genetic variability in ancient mtDNA. Recently Skoglund et al. (2014) have argued that there was a relatively low genetic variability in Late Mesolithic hunter-gatherer populations compared to Early Neolithic farmers in Northern Europe. They conclude that the hunter-gatherer population was low and could easily have disappeared during an agrarian expansion of migrating pioneer farmers. The greater variability within the agrarian societies could have been the result of incorporating the hunter-gatherer populations into an incoming agrarian population during the Neolithic period in South Scandinavia. However, the data behind the statistical calculations supporting a lower genetic variability during the Late Mesolithic is based on a very limited amount of material (see section 3.12) (Fig. V.39).

It is generally extremely difficult to document the decrease or increase of population sizes from the archaeological record. But what we can document from the distribution of sites and stray finds is whether there was a more or less intensified use of the landscape, which could indicate changes in either population sizes or the social structure of prehistoric societies.

3.15. Availability of resources

The availability of resources has also been proposed as one of the main reasons for the adoption of agrarian practices and societies. Lack of resources resulting from climatic and environmental changes creating situations of stress has especially been used to explain the emergence of agrarian societies. Johannes Iversen (1941) was one of the first researchers to use this line of argumentation, when he attributed elm decline to a colder and wetter climate, which may have paved the way for the adoption of agrarian practices. However, later studies have clearly documented that the elm decline was associated with the spread of elm disease (Pelgar et al. 1993; Rasmussen 1995). Other researchers have also argued that the transition from the late 5th to early 4th millennium BC was a time of shortages in supply of certain marine food resources (Paludan-Müller 1978; Zvelebil & Rowley-Conwy 1984; Rowley-Conwy 1984; Andersen 2008a). The crisis was caused by changes in water levels, thus reducing the sizes of the inner fjords and hereby decreasing the amount of resources. A change in salinity during this period has also been proposed to explain the limited amounts of shellfish. But there are many problems associated with these interpretations of crisis, as we are not dealing with an abrupt change in the water levels, but rather a gradual one (Christensen 1995; Pedersen 1995; Hartz et al. 2007; Andersen 2008a). This is one of the reasons why kitchen middens are still in use during both the early and middle parts of the Funnel Beaker culture, thus showing that foraging strategies continued in the agrarian societies (Skaarup 1973; Andersen 2008a). Moreover, it can be argued how significant a shortage of shellfish may have been to the prehistoric diet, as a human needed to eat several oysters per day to obtain enough energy to survive (Møller 1983; Løje et al. 2002).

3.16. Social and economic change

Researchers arguing that social and economic changes are the driving forces behind the adoption of agriculture tend to focus on the appearance of inequality rather than external factors, such as population growth or environmental changes (Bender 1978; Hayden 1990). This point of view has been championed by Kristina Jennbert (1984) in her "fertile gift" model and in Anders Fischer's (2002) "food for feasting" hypothesis. Both argue that direct social connections between hunter-gatherers and farmers were of primary importance. The direct connections could result in the exchange of prestigious artefacts and ideas between farmers and hunter-gatherers, which could initiate a gradual process of inequality. It is also argued that a few individuals of higher status in the hunter-gatherers societies may have adopted agrarian practices in order to produce a surplus, thus increasing their wealth and power. The increased competition could escalate over time, thus resulting in whole societies in many regions adopting not only the agrarian subsistence strategies, but also the agrarian way of life. Most discussions regarding the reasons behind the adoption of agrarian practices and the spreading of agrarian societies involve population growth, resource availability and social changes, as all these explanations are to some extent interlinked with one another, thus increasing the complexity of the debate.

3.17. A new way forward

Despite the rather discouraging assessment made by some researchers, that the same hypotheses are being repeated, it is clear that the adoption of agrarian practices and expansion of agrarian societies was a highly complex process. Continuing discoveries from excavations and renewed documentation of artefacts can in the author's opinion still challenge the current perceptions of how, why and when the adoption of agrarian practices took place. The development of new hypotheses is therefore dependent on new theoretical discourses, as well as the analysis of new and previously unchartered material, in order to bring the discussions to a different level. In addition, one of the main questions that many researchers tend to forget about in connection with the adoption and spread of agrarian practices is just how complex agriculture really is, as a technology and strategy. The next chapter will focus on the complexity of agrarian subsistence practices compared to foraging strategies.

PART III. THE COMPLEXITY OF LEARNING AGRARIAN PRACTICES

4. THE COMPLEXITY OF HUNTER-GATHERING AND AGRARIAN SUBSISTENCE PRACTICES

It has been argued that agriculture could spread through social contact and exchange between hunter-gatherers and agrarian societies (Troels-smith 1954; Jennbert 1984; Fischer 1982; 2002; Hjelle et al. 2006). The prime movers of agrarian subsistence practices would therefore not necessarily be migrating farmers, but also hunter-gatherers, who had learned the skills of animal husbandry and cultivation of crops, thus supporting an adoption of farming by the indigenous population. However, farming is a complex technology to learn and associated with long-term planning processes. It is therefore necessary to investigate agrarian practices in much greater detail in order to understand the full scale of this technology. Only then is it possible to discuss whether indigenous populations were capable of adopting farming as an idea, without having any practical skills relating to agrarian practices.

4.1. Farming and foraging

Agrarian practices are often conceptualized as a rather simple task, which anyone can learn relatively quickly. But obtaining a positive yield continuously is a very difficult task. It has often been stated that agrarian subsistence produced more productive and reliable sources of food than foraging strategies (Fig. III.1). However, agrarian practices, like animal husbandry and crop cultivation, were not necessarily reliable resources in the Neolithic or later prehistoric context, because diseases could kill all the animals and a dry or wet summer could destroy the crops, which would then force the early farmers to engage in the foraging activities of hunting, fishing and gathering to supplement their diet (Gregg 1988). The transition from a hunter-gatherer to an agrarian society has often been associated with the assumption that the foraging and agrarian subsistence strategies are incompatible with one another (Cummings & Harris 2011, 361ff). Foraging and farming communities have therefore been investigated more or less isolated from one another, because anthropologists and archaeologists tend to divide subsistence strategies into certain categories (Binford 1977; Hodder 1982; Ingold 1984; Thomas 1999; 2004; 2013; Glørstad 2006, 204).

One of the reasons why modern researchers divide foraging and agrarian subsistence practices so distinctly could be associated with the results of the symposium "Man the Hunter" in 1966, which marked a dogmatic shift in the research of hunter-gatherer societies (Lee & DeVore 1968). Certain interpretations of behavioural patterns in these societies were proposed. It was thought that males resided in the same area for their whole lives and children learned how to exploit the natural food resources in the local territory. Women were, on the other hand, believed to have been exchanged, thus creating links and networks with other neighbouring groups. Furthermore, assumptions were also made regarding the size of the hunter-gatherer societies, which were interpreted as small groups that had a high degree of mobility (Lee & DeVore 1968, 11). Additionally, five characteristics were formulated. Huts were not established as the hunter-gatherers had a high degree of mobility. Living in smaller groups maintained a low population density, with which groups could occupy larger territories. Larger group territories with limited numbers of markers may indicate that no local groups had exclusive rights to resources and that food surpluses were neither collected nor maintained. Moreover, a high degree of mobility would prevent groups becoming too attached to one single area. Finally, it was argued that mobility as a strategy was an important form of behaviour in times of resource stress. These definitions of a hunter-gatherer society led to more evolutionary approaches to explain how agriculture was adopted by hunter-gatherer societies, which had an increasing complexity in their social organization, as well as in their choice of subsistence strategies (Zvelebil 1998; Barnard 2007).

An example of dividing subsistence strategies into categories with increasing complexity is the concepts of collectors and foragers (Binford 1977, 1978, 1979, 1980, 1991) (Fig. III.2). However, the variability between these two modes of subsistence strategies is based upon two environmental extremes, in the hot dessert and the cold tundra, which is related more to specialization in subsistence strategies than to increasing complexity. Perreault

Variation in food-getting and associated features	Hunter-gatherers	Horticulturalists	Pastoralists	Intensive agriculturalists
Population density	Low	Low to moderate	Low	High
Maximum community size	Small	Small to moderate	Small	Large
Nomadism/permanence of settlements	Generally nomadic or seminomadic	More sedentary. Move after several years	Nomadic or seminomadic	Permanent communities
Food shortages	Infrequent	Infrequent	Frequent	Frequent
Trade	Minimal	Minimal	Very important	Very important
Full-time craft specialists	None	None or few	Few	Some
Individual differences in wealth	None	Minimal	Moderate	Considerable
Political leadership	Informal	Few part-time political officials	Some part- and full-time political officials	Many full-time political officials

Fig. III. 1. Variations in the organization of hunter-gatherer and agrarian societies based on ethnographic observations. After Lee & DeVore 1968.

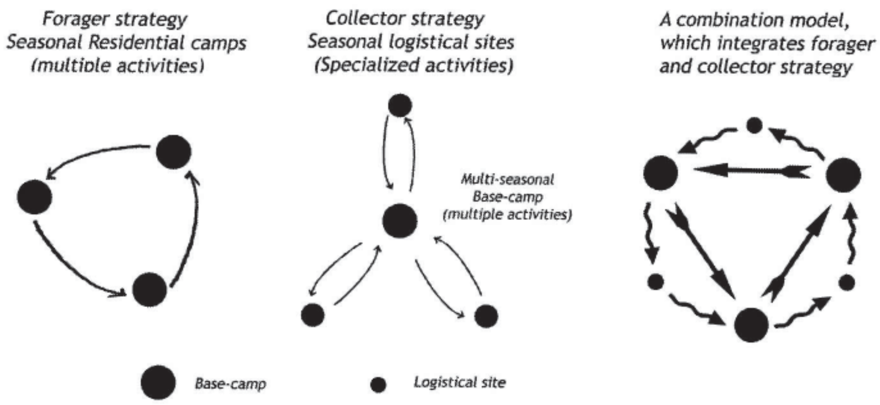


Fig. III. 2. Schematic diagram of a forager and collector strategy, together with a combination model which integrates both forager and collector strategies in the mobility pattern. After Binford 1977; 1978; 1979; 1980; 1991.

and Brantingham (2011) have recently argued that the transmission of new technologies and behaviour is optimized when the subsistence strategy is somewhere between foraging and collecting. It is therefore not surprising that ethnographic records, as well as archaeological evidence, indicate that mixed subsistence strategies can exist side by side, combining subsistence with foraging, collecting and agrarian strategies (Ingold 1984; Sørensen & Karg 2012). One argument in support of maintaining the division between foraging and agrarian practices has been that hunter-gatherer societies had to invest less work in order to obtain the daily amount of food compared to agrarian societies (Sahlins 1972, 14ff). However, the work load for a hunter-gatherer or a farmer differ from season to season, depending on different environmental and cultural conditions in a given region, which makes it difficult to calculate whether life was easier, harder or more time consuming in each of the subsistence strategies. Life was probably a struggle in both the Mesolithic and the Neolithic period. Periods of stress can be indicated by cases of enamel hypoplasia, which may have been attributed to seasonal crises of diet or diseases; this has been observed in both Late Mesolithic and Early Neolithic individuals (Bennike & Alexandersen 2007, 139).

4.2. Shifting subsistence strategies

The hypothesis that agrarian practices can spread as an idea is based on 20th century ethnographical studies, which documented that hunter-gatherers indeed took up agrarian practices, such as animal husbandry and sometimes even the cultivation of crops (Nicolaisen 1975; 1976; Gregg 1988, 53; Moore 1985; keeley 1995; Barnard 2004; Bellwood 2005, 37ff; Xavier et al. 2008, 1ff; Grøn in press). However, many of the ethnographical records are biased and cannot be used as direct analogies for the transitional processes in prehistoric times. But they can serve as an inspiration to gain a deeper understanding of the complex processes that lay behind the adoption of agrarian practices. Unfortunately, anthropologists have a tendency to remove people from the category of foragers if evidence of agriculture has been observed, thus neglecting the fact that farmers also conduct foraging/collecting activities (Ingold 1984, 5). However, ethnographic studies have revealed three categories of human subsistence. The first involves foragers or collectors, who subsist on uncultivated plants and wild fauna. The second category consists of people with a mixed subsistence, consisting of both domestic and wild resources, who can be sub-divided into foragers who farm (similar to the first category) or farmers who hunt, fish and exploit natural resources (similar to the third category). The third category consists of people who predominantly rely on subsistence from cultivated plants (horticulturalits) and domesticated animals (pastoralists) (Ingold 1984). However, it can be difficult, based upon faunal or cereal assemblages in archaeological contexts, to calculate how important agrarian subsistence was in comparison to foraging subsistence. Nonetheless, the availability model proposed by Marek Zvelebil and Peter Rowley-Conwy (1984) divided the transition to agrarian subsistence into three phases, therefore pointing to a gradual transition from foraging to farming.

The availability model therefore acknowledges that the transition towards an agrarian subsistence strategy was a complex process and not a sudden change, when societies stopped exploiting natural resources. Support can be found for the model in ethnographic and archaeological records. Ethnographic examples show that it is very common for farmers to supplement their food supply with foraging practices. The same practices have been indicated by archaeological faunal records, with hunting and fishing stations located near the coast during the Early Neolithic period, and this continuing on a smaller scale in the Bronze Age and Iron Age, and up to the 20th century AD in Scandinavia (Skaarup 1973; Andersen 1998b; Ringtved 1998; Hartz & Schmölcke 2013). Researchers have, however, argued that shifting between foraging and agrarian practices would be difficult, because farming would lead to rapid population growth, thus making humans more dependent upon agrarian subsistence (Bocquet-Appel 2002, 2008, 2009; Eshed et al. 2004; Barnard 2004; 2007; Shennan et al. 2013). But ethnographic studies have indicated that even in agrarian societies there are restraints on the population growth (Englebrecht 1987). Furthermore, population growth is a long process, which can take several hundred years (Fogel 1994). It has even been suggested that restraints upon and control of population growth may have been amongst the reasons why the agrarian expansion came to a halt during the Linearbandkeramik culture around 5000 cal BC, and it did not continue further north until 4000 cal BC (Sardó 2011). Ethnographic examples also show societies in which the subsistence strategy is very flexible. Agrarian practices can be adopted for a few years and foraging in other years, depending on the social relations between people, as well as the local environment (Nicolaisen 1975; Peterson 1978; Griffin 1984; Rambo 1985). Such a strategy can, however, only be successful when the skills associated with agrarian subsistence practices are remembered and solidly embedded in the minds of the people, or constant and close interaction with neighbouring agrarian societies is maintained.

It should be pointed out that many of these ethnographic examples of foragers, who take up agrarian practices, originate from regions characterized by a tropical or subtropical environment, where the average temperature rarely reaches below 0° C, thus prolonging the growing season for cultivating plants (Andersen & Vahl 1963). It is therefore possible to sow and harvest cultivated plants like rice between one and four times a year, therefore increasing the success rate in obtaining a surplus before the winter season (Chandler 1979; De Datta 1981). If the harvest fails, it does not necessarily have devastating consequences, as sowing and harvesting can take place again later in the year to achieve a surplus. Such a cultivation strategy, which allows for mistakes, may explain why foragers in such an environment have unique possibilities of shifting between agrarian and foraging subsistence. Other ethnographic evidence from more arid and temperate climate zones also demonstrates that hunter-gatherers have been involved in small-scale (garden) cultivation. In arid climates in particular, it is also possible to sow and harvest certain crops like millet (*Poaceae*) twice a year (Creswell & Martin 1998). Freeman (2012) defines these foraging cultivators as either ancillary cultivating societies, that practice the plant-and-leave method and store a few domesticated plants, or as minimum surplus cultivators, who plant and tend the fields at least once during the growing season. The cultivation method is adapted into a pattern of greater mobility, in which cultivation practices are regarded as a supplement to foraging activities. The yields would be highly variable as the fields were left unmanaged during large parts of the growing season. But the continued practice must have given some sort of yield to these hunter-gatherers. However, the lack of storage facilities would make these hunter-gatherers dependent on obtaining access to new crops every year, which requires close and consistent contact with farmers, who could produce a surplus. The regular contact may have resulted in exchanges of knowledge, thus making it possible for the hunter-gatherers to learn the cultivation practices (Freeman 2012, 3014). However, in Europe it is only possible to sow and harvest cultivated crops once a year, thus making the cultivation strategy much more fragile and vulnerable, as a failed harvest could have serious consequences for these agrarian societies during the winter months. In Central and North Scandinavia, the possibilities of obtaining a surplus from agrarian practices would be even more limited, as the growing season is much shorter compared to southern Scandinavia (Fjærvoll 1961). Failure was not a serious threat because people most likely supplemented their subsistence with foraging of natural resources. A sharp distinction between foragers and farmers during a transitional phase is thus associated with problems. However, success in the implementation of agrarian practices is closely linked to people possessing significant agricultural skills. But in order to understand these agrarian practices, it is necessary to understand the routinized processes that lay behind animal husbandry and cultivation activities.

4.3. Animal husbandry practices

The management of stockbreeding practices is probably the least difficult technology to be adopted by a hunter-gatherer society. Several ethnographical studies have documented that animal husbandry practices were integrated into the hunter-gatherer subsistence pattern (Nicolaisen 1975; Gregg 1988, 53; Xavier et al. 2008, 1ff). Hunter-gatherers from the Mesolithic did have some experience in breeding practices with the dog (*Canis familiaris*), which had been part of their society since the Palaeolithic (Vang Petersen 2013). In addition, hunter-gatherers would have an in-depth understanding of the behaviour of wild fauna, including its mating, birth and pasturing seasons, which could be useful if they bred animals themselves. It is therefore possible that animal husbandry practices could have spread, without any significant exchange of knowledge between hunter-gatherers and farmers in boundary areas, where domesticated animals could have been received in exchange, stolen or escaped from farmers. However, a close connection with domesticated animals would have exposed people to certain diseases, which could have had a serious effect on a hunter-gatherer population that wanted to adopt husbandry practices. Cows were carriers of measles, tuberculosis and smallpox, whereas pigs could transmit flu or whooping cough to humans (Diamond 1999, 207). Nevertheless, livestock would still have been an attractive resource for the hunter-gatherers, as the animals were not only a reserve of meat and thus protein, but also because cow, goat and sheep milk contains large amounts of fat (Fig. III.3). Food reserves could thus be improved during the critical winter months.

However, keeping domesticated animals all year round is not an easy task and requires planning, which might have been an obstacle, when compared to the traditional hunter-gatherer subsistence strategy. New skills had to be learned about domesticated animals and their behaviour, regarding their life cycles, breeding patterns, feeding and nutrition, in order to gain acceptable meat and milk yields. Furthermore, grazing, browsing and fodder requirements had to be calculated, with particular attention given to the storage of fodder during the winter. It would also be important to calculate the minimum number of animals required in a herd and to compare it with the feeding capacity of a given region. One method to control the size and composition of the herds would be to systemize the breeding patterns and thus regulate when a yield could be expected (Mackinzie 1980; Perry 1984; Gregg 1988).

4.4. Estimated fodder demands and yields

Skills also had to be acquired in order to process the milk into more storable products, such as cheese or butter, which could also be useful if a given population was suffering from lactose intolerance/lactase deficiency (Gouin 1997; Burger et al. 2007; Itan et al. 2009; Salque et al. 2013) (Fig. III.4). Furthermore, milk from domesticated animals is an effective replacement for human breast milk, and could be used as a supplementary resource during weaning, thus decreasing the weaning period, lowering infant mortality and provide enough nutrition to also increase the fertility rate (Howcroft et al. 2012) (Fig. III.5). Lipid analysis of Early Neolithic Funnel Beaker

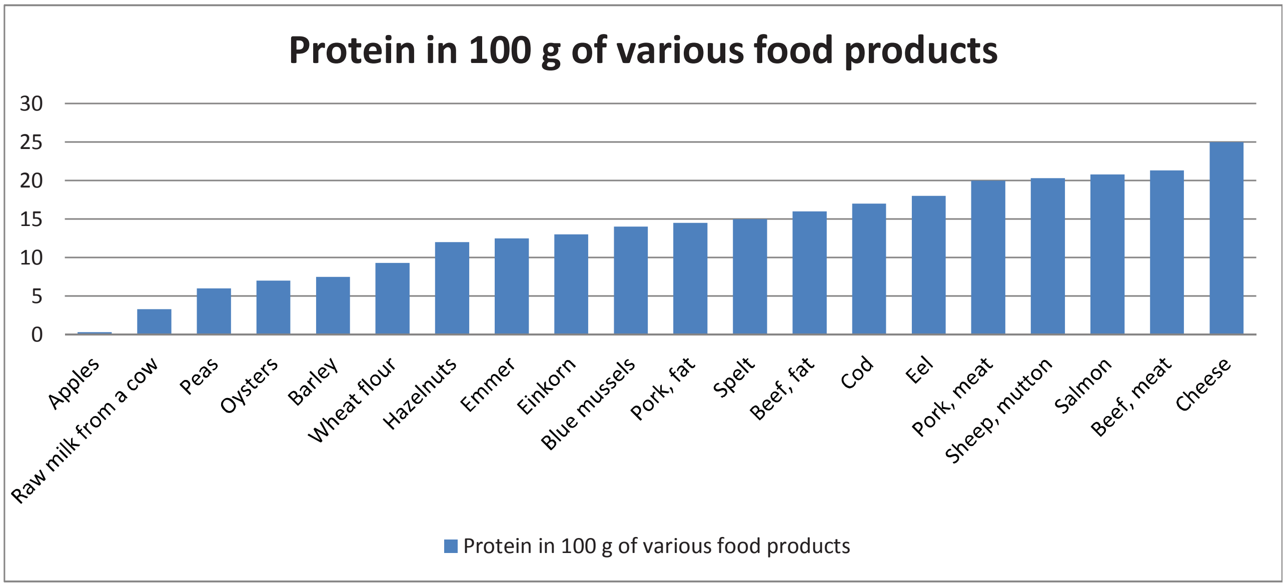


Fig. III. 3. Protein in 100 g of various produced (cereals, milk, cheese and meat from domesticated animals) and gathered/fished (apples, peas, hazelnuts, oysters, blue mussels, cod, eel and salmon) food products. Data after Møller 1983; Løje et al. 2002; Westphal 2005, 35; USDA nutrient database: http://ndb.nal.usda.gov/.

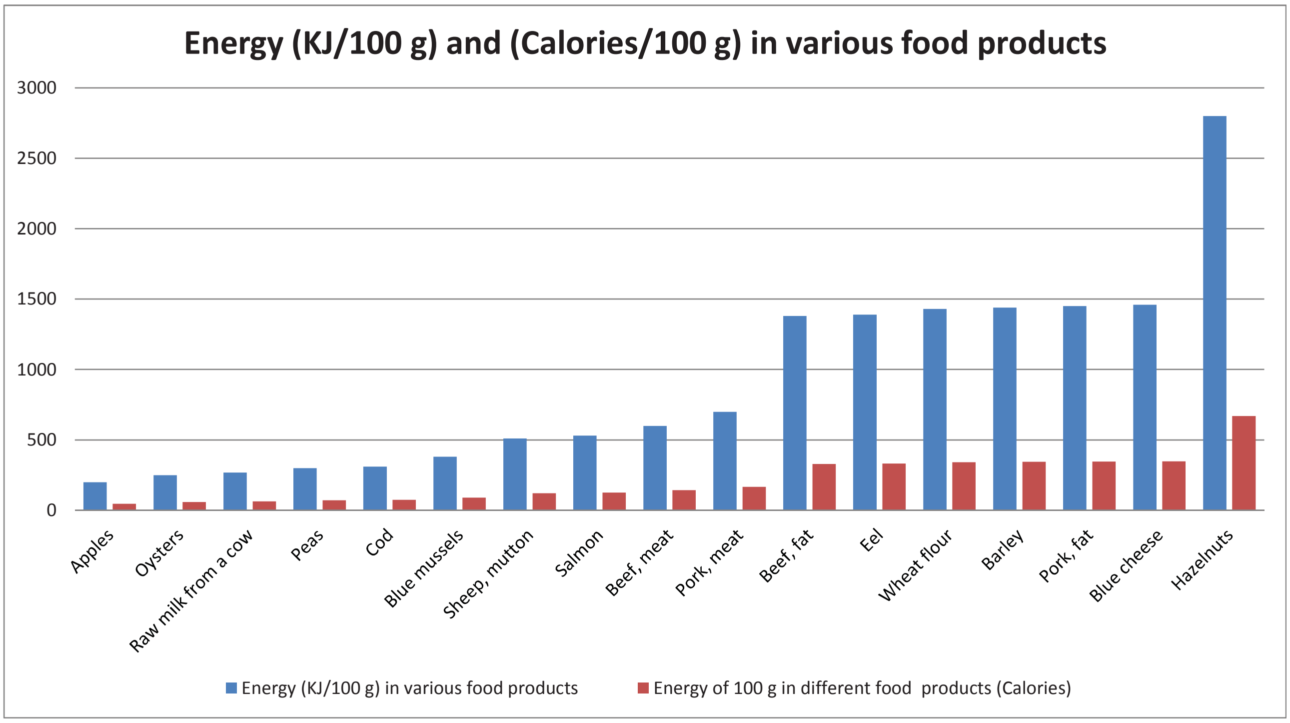


Fig. III. 4. Energy (KJ/100 g) in various produced (cereals, milk, cheese and meat from domesticated animals) and gathered/fished (apples, peas, hazelnuts, oysters, blue mussels, cod, eel and salmon) food products. Data after Møller 1983; Westphal 2005, 35; USDA nutrient database: http://ndb.nal.usda.gov/).

Species	Human	Cow	Goat	Sheep
Water (g)	87.5	87.69	87.03	80.7
Protein (g)	1.03	3.28	3.56	5.98
Carbohydrate (g)	6.89	4.65	4.45	5.36
Lipid (g)	4.38	3.66	4.14	7
Ash (g)	0.2	0.72	0.82	0.96
Energy (kcal)	291	268	288	451

Fig. III. 5. Milk fat values for humans, cows, goats and sheep. After: USDA nutrient database: http://ndb.nal.usda.gov/.

Herd size (Yearlings, heifers, steers, cows, bulls) per year	Usable meat (kg)	Milk supply (kg)	Forest browse (km²)	Pasture (ha)	Cereal straw/ Winter fodder (ha/kg)	Meadow hay/Winter fodder (ha)
30 (7 yearlings, 8 heifers, 2 steers, 11 cows, 2 bulls)	1140	1620	1.7	10.71	7,74 ha/17017 kg	13,92 ha/20464 kg
40 (10 yearlings, 8 heifers, 4 steers, 16 cows, 2 bulls)	1582	2378	2.29	16.57	10,4 ha/22892 kg	18,98 ha/27904 kg
50 (12 yearlings, 10 heifers, 7 steers, 19 cows, 2 bulls)	1927	2744	2.97	17.92	13,06 ha/28745 kg	23,97 ha/35240 kg
Herd size (Sheep: Yearlings, ewes, rams) per year	Usable meat (kg)	Milk supply (kg)	Forest browse (ha)	Pasture (ha)	Cereal straw/Winter fodder (ha/kg)	Meadow hay/Winter fodder (ha)
15 (3 yearlings, 10 ewes, 2 rams)	37.5	170.1	9.72	0.58	0,49 ha/1089,6 kg	0,26 ha
20 (4 yearlings, 14 ewes, 2 rams)	54	255.15	13.08	0.79	0,69 ha/1524 kg	0,34 ha
25 (5 yearlings, 18 ewes, 2 rams)	67.5	340.2	17.52	0.98	0,85 ha/1868,4 kg	0,43 ha
30 (6 yearlings, 22 ewes, 2 rams)	84	396.9	19.17	1.18	1,01 ha/2216,4 kg	0,52 ha
35 (7 yearlings, 26 ewes, 2 rams)	97.5	481.05	22.98	1.39	1,18 ha/2606,4 kg	0,61 ha
40 (8 yearlings, 30 ewes, 2 rams)	111	538.65	26.25	1.58	1,33 ha/2940 kg	0,69 ha
45 (9 yearlings, 34 ewes, 2 rams)	124.5	623.7	29.52	1.78	1,52 ha/3343,2 kg	0,77 ha
50 (10 yearlings, 38 ewes, 2 rams)	138	680.4	32.7	1.97	1,68 ha/3692,4 kg	0,86 ha
Herd size (Goats: Yearlings, does, rams) per year	Usable meat (kg)	Milk supply (kg)	Forest browse (ha)	Pasture (ha)	Cereal straw/Winter fodder (ha/kg)	Meadow hay/Winter fodder (ha)
15 (4 yearlings, 9 does, 2 rams)	54	340	10.08	0.61	0,49 ha/1080 kg	0,26 ha
20 (5 yearlings, 13 does, 2 rams)	79	510.3	13.44	0.82	0,69 ha/1470 kg	0,36 ha
25 (6 yearlings, 17 does, 2 rams)	93	680.4	16.98	1.03	0,84 ha/1858,8 kg	0,45 ha
30 (7 yearlings, 21 does, 2 rams)	112.5	850.5	20.34	1.23	1,02 ha/2248, 8 kg	0,53 ha
35 (8 yearlings, 25 does, 2 rams)	136.5	963.9	23.79	1.43	1,18 ha/2596,8 kg	0,62 ha
40 (10 yearlings, 28 does, 2 rams)	156	1134	27.24	1.57	1,35 ha/2977,2 kg	0,68 ha
45 (11 yearlings, 32 does, 2 rams)	172	1247.4	30.69	1.85	1,51 ha/3325,2 kg	0,80 ha
50 (12 yearlings, 36 does, 2 rams)	199.5	1417.5	34.14	2.05	1,69 ha/3715,2 kg	0,89 ha

Fig. III. 6. Estimated fodder demands and yields for cattle, sheep and goats. After Gregg 1988.

pottery has suggested that milk was used, although there are methodological problems associated with the identification of milk fat, as discussed in section 3.12 (Craig et al. 2005; 2011; Isaksson & Hallgren 2012).

Ethnographic data suggest that the size of the ruminant herds being raised for meat and milk production would be 30-50 animals (Bogucki 1982, 109). A cattle herd of 30 individuals would require annually 1.70 km^2 of forest browse and 10.7 ha of pasture, whereas a cattle herd of 50 would need forest browse of almost 3 km^2 and nearly 18 ha of pasture. Sheep and goat herds of 15-50 animals would need much less annual forest browse of between 9 and 35 ha, whereas the pasturing area would lie between 0.50 and 2 ha (Gregg 1988, 120f). Of particular interest are the quantities of winter fodder that have also been calculated for ruminants. It is unsurprising that the cattle herds require the most winter fodder. A cattle herd of 30 requires annually, but especially during the

Fig. III. 7. Storage of pollard hay used for fodder for livestock in Switzerland during the 1960s. Photo. Axel Steensberg, the National Museum of Denmark.

winter months, about 17,017 kg of straw and 20,464 kg of hay, whereas a herd of 50 cattle requires a staggering 28,745 kg of straw and 35,240 kg of hay. The amount of straw and hay needed for the winter fodder would come from 7-13 ha or up to 14-24 ha. A sheep or goat herd of between 15 and 50 animals requires an annual amount of winter straw of between 1100 and 3700 kg, which covers an area of between 0.50 to 2 ha, and is thus a considerably lower amount than the winter fodder required for cattle (Gregg 1988) (Fig. III.6). The pollarding of trees could also have provided an important supplement to the winter fodder, which may have been practiced during the Early Neolithic based upon finds from Switzerland. Experiments have indicated that the optimal time of year for pollarding trees would be during the late spring or early summer months (Christensen & Rasmussen 1991) (Fig. III.7).

These examples illustrate how much winter fodder is required when animals are kept inside during the winter months. The amount of storage capacity would have represented a challenge to the hunter-gatherers in the process of becoming more sedentary. However, there are currently no examples of animal pens or stalls from any of the two-aisled houses of the Early Neolithic period, indicating that keeping animals inside houses was not common at the beginning of the Neolithic in Northern Europe (Schirnig 1979; Rost & Wilberg-Rost 1992; Raemaekers et al. 1997; Nielsen 1999; Artursson et al. 2003). It is not before the Late Neolithic that some two-aisled houses with sunken floors could be interpreted as possible stables (Jensen 1973). But phosphate analyses of houses with sunken floors at Bejsebakken have rejected them as being stables, because fireplaces and cooking pits were found in these sunken floors (Sarauw 2006, 57). Generally, the earliest evidence of animal pens or stalls is observed in three-aisled houses from Gram, Bjerre and Spjald dated to the Early Bronze Age, but it is not until the Iron Age that animal pens or stalls become an ordinary feature of houses (Nielsen 1999; Pihl 2013). It is therefore likely that the domesticated animals lived outside during the Neolithic period, including during the winter months, where it was sufficient to erect a fence to prevent the animals from running away and a small shed in which they could shelter from the weather. Keeping domesticated animals outside all year round is much easier than keeping them inside in stalls and pens, as long as the winter fodder and sources of water were located close to the animals (Gregg 1988). Fodder would normally be collected during the summer months and then stored for the winter, which could change the timing of foraging strategies and gender-related work patterns, and thus the overall subsistence strategy of hunter-gatherers if they wanted to keep domesticated animals all year round.

4.5. Advantages of keeping domesticated animals

The advantages of keeping domesticated animals are the yields of usable meat and milk supply. A cattle herd of between 30 and 50 could provide 1140-1927 kg of usable meat annually and a milk supply of 1620-2744 kg, thus guaranteeing an all year round resource for several families (Fig. III.8). Domesticated pigs could also provide fairly high meat yields as they can be frequently culled, although most body weight is gained after the second summer. The probable weight of Neolithic pigs was around 30 kg and if 70% of the litter survived weaning it would annually provide around 30-40 kg of meat per litter. The prolific nature of pigs makes them a flexible resource, which means that they could have been slaughtered if there was a shortage of fodder, or fattened if there was an abundance of fodder during the winter months (Grigson 1982; Magnell 2005; 2007). A flock of sheep of 15 to 50 animals would produce 37.5-138 kg of usable meat and a milk supply of 170-680 kg, whereas a similar sized flock of goats would produce 54-200 kg of usable meat and a milk supply of 340-1417 kg (Gregg 1988). All these calculations clearly show that managing domesticated animals involved a huge potential for the building up of food reserves, although it would be necessary to build storage facilities. The potential yields from domesticated animals presented above could easily supply the daily caloric requirements of several families (Møller 1983; Gregg 1988, 143; Løje et al. 2002). Even a small herd of less than 10 animals would be sufficient to support the daily food intake of a whole family during prehistoric times. Animal husbandry practices and the keeping of livestock would therefore have been attractive activities, and may have been amongst the first agrarian practices adopted by hunter-gatherer societies.

4.6. Cultivation practices

Crop cultivation is an even more difficult agrarian activity to master than animal husbandry. The cultivation of crops has limited room for trial and error, as it is only possible to sow and harvest crops once a year in Europe (Fig. III.9). In order to have initiated cultivation practices it would have been necessary to obtain domesticated crops and obtaining skills and knowledge relating to the properties of the crops, thus minimizing mistakes. The two common types of cereals during the Neolithic in Scandinavia were barley (*Hordeum*) and wheat (*Triticum*). Barley requires less nutrients in the soil, and is thus more resistant to cold weather, which may be one of the main reasons why it is amongst the preferred crops in North Scandinavia. The yield from barley is often higher than from wheat and it can grow in alkaline soils, but not in acidic soils. A lower yield can be anticipated from both barley and wheat when grown on sandy soils (J. M. Renfrew 1973, 80ff). Nevertheless, it is very clear that sandy to clayey sandy soils were preferred in Neolithic crop cultivation. The Linearbandkeramik and Michelsberg sites were located on sandy loess soil in Central Europe, whilst the Funnel Beaker inland sites were located on the sandy areas of moraines in Northern Europe (Lüning 1968; 2000; Larsson 1984; Nielsen 1985; Vermeersch 1988; Zvelebil 1998; 2008; Vanmontfort et al. 2008; Rowley-Conwy 2011; Sørensen & Karg 2012). Sandy soil was probably preferred because it did not become too saturated. In particular, types of wheat like einkorn (*Triticum monococcum*) and spelt (*Triticum spelta L.)* are fairly resistant to a changeable weather and can still grow well on poor sandy soils. However, they ripen later and have a lower yield than emmer and naked barley. Emmer (*Triticum dicoccum*) is also one of the more fragile crop types and cannot withstand frosts (Gregg 1988, 67). Bread wheat (*Triticum aestivum/compactum*) on the other hand exhibits a higher level of resistance to frost and can be grown up to a latitude of 68^{o} N; it requires a high-quality soil, but can give some of the highest yields of all cereal crops (Brouwer 1972). Later crop species like Oats (*Avena sativa*) and rye (*Secale cereale*) are cereals that can be grown on light soils, which were introduced during the Late Bronze Age and Iron Age. In addition, they thrive best in a cooler climate and can manage with less sunlight than other types of crops, such as wheat (*Triticum*) and barley (*Hordeum*) (J. M. Renfrew 1973, 98).

4.7. Making the right decisions

Before sowing the crops, it would be necessary to lay out a field, which has the optimal subsoil for the crop being grown. Soil moisture in particular is of primary importance, as plants draw their water and nutrients from the soil. Using either a stick or a plough in sowing is also important, thus making it possible to sow the crops at the correct depth, which could vary from 30 to 50 mm, according to the type of subsoil. Around 200 to 300 cereal grains should normally be sowed per square metre (Gill & Vear 1980). The timing of the sowing process has to be

Age	Daily caloric requirements (active hunter-gatherers)	Number of individuals	Total
Infants	550	1	550
1-4 years	1360	4	5440
5-9 years	2010	4	8040
10-14 girls	2420	2	4840
10-14 boys	2750	2	5500
Woman	2200	6	13200
Men	3000	6	18000
Total	14290	25	55570
Year 360 days			20005200

Fig. III. 8. Daily caloric requirements for a group of hunter-gatherers. After Gregg 1988, 143.

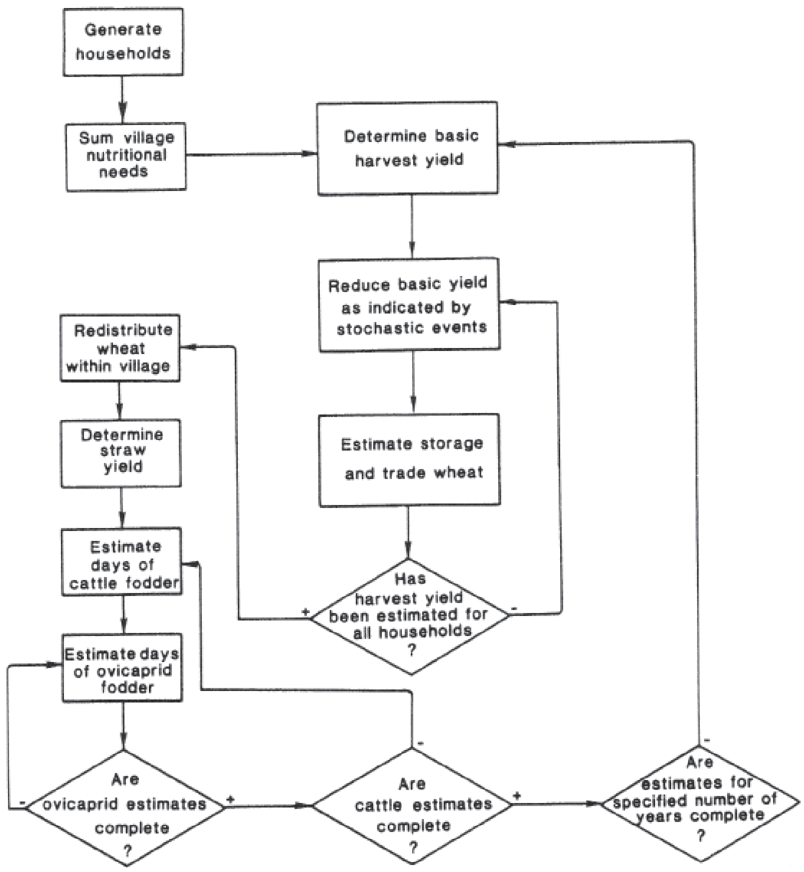


Fig. III. 9. Simulation flow diagram showing the complexity of and relations between practices of animal husbandry and crop cultivation. After Gregg 1988, 127.

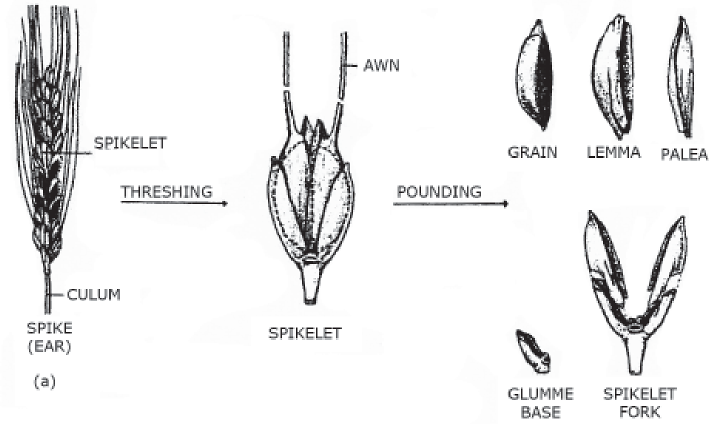


Fig. III. 10. Crop cleaning process. After Hillman et al. 1996.

Fig. III. 11. The sowing process at the Draved experiment, in which the cereals were placed directly in the ash. Photo. Axel Steensberg, the National Museum of Denmark.

planned carefully, thus giving the optimal growing conditions for the crops. However, periods of waterlogging or drought could have a devastating effect, depending on the growth stage of the plants and the soil moisture. The actual sowing process would usually be undertaken during the early spring and harvested would occur in the late summer. When cereals have been sown they go through certain stages of germination, tillering, elongation, shooting, flowering, grain maturation and ripening. Cereal crops are generally very vulnerable during the whole growing season. The weather is one of the more important unpredictable factors, together with animal intrusion and infestations of rusts, smuts or blights, which can destroy the crops. When the crops reach the dead ripe stage there is only 14 days to complete the harvest before the ears become so brittle that they can shatter (Rohmann 1964). Such a limited harvest period also limits the size of the fields. Calculations of the harvest period can therefore give an indication of the maximum size of crop fields during prehistory. Based upon historical records, a person could harvest 50-300 m^2 per hour, but the area could be considerably lower when using a flint sickle (Juel Jensen 1994). Plucking of individual ears could also be used as a harvesting method, but this is even more time consuming than the use of sickles (Gregg 1988). Pihl (2013) has, after some modelling of data, suggested that the number is closer to 50 m^2. Two persons could then harvest 1.4 ha in two weeks. When the harvest ended, the crop cleaning process could begin. Firstly, threshing separates the ears from the straw. Threshing can easily free the kernels and chaff from the rachis on cereal types like barley and naked wheat. However, emmer and einkorn require additional pounding or grinding before the grain is released from the spikelets (Hillman 1984). Sieving is then required in order to separate plant parts by size, thus removing the kernels from larger pieces of chaff and straw (Fig. III.10). Afterwards, the cleaned crop must be winnowed in order to separate the lighter chaff and other plant debris from the heavier kernels and plant remains. Finally, the cereal can is dried and stored. Cereals can be stored for several years with only limited loss of nutrients, thus providing the possibility of having resources in reserve if the harvest should fail the following year. Furthermore, a selection of cereal grains for seeds had to be undertaken, with larger grains preferred. Westphal (2005, 98) has measured the sizes of the cereal grains from several Neolithic sites belonging to the EN II and the MN II phases in Denmark. He documented that the average size of the kernels of emmer increased by 59% over a time span of only 400 years between 3500 and 3100 cal BC, thus indicating that this process was indeed practised in the Neolithic period.

4.8. The difficulties of learning cultivation practices

Cultivation of cereals is associated with a long knowledge-based process, involving accumulated experience of understanding the landscape, soil, climate, seasonal changes and plant properties, thus creating a different perception of nature compared to a hunter-gatherer lifestyle. An example of this has been documented in ethnographic studies of the last remaining hunter-gatherers (Nigritos and Penan), who regarded the forest as a place of opportunities for foraging practices and sacred places, as it was forbidden to cut down larger trees, whereas their neighbouring farmers saw the dense forest as an obstacle (Nicolaisen 1975; 1976). Johannes Nicolaisen documented the interaction between the two populations in this particular region, which was characterized by the farmers trying to persuade the hunter-gatherers to become farmers. The farmers were eager to show the hunter-gatherers how to build longhouses and to grow crops. Intermarriage took place, with hunter-gatherer women marrying agrarian men, whilst marriages between hunter-gatherer men and agrarian women did not occur. Small-scale growing of bananas, tubers and roots was adopted by the hunter-gatherers, but they did not want to learn how to cultivate rice, because it would involve storage and a more sedentary pattern of settlement, which would result in a break with the traditional mode of subsistence and way of life. Some Penan hunter-gatherers tried to grow rice for one or two years but gave up again, sometimes even abandoning their rice fields near maturing time and going pig hunting instead. They did not return to harvest the rice afterwards, thus showing that these hunter-gatherers lacked the knowledge of the proper techniques of food production, therefore resulting in limited yields (Fox 1952; Nicolaisen 1975).

4.9. The Draved and other cultivation experiments

The Draved experiments into growing crops of 1953-1955 also show how difficult it is to gain a good yield when trying to grow crops (Steensberg 1979). Axel Steensberg, who conducted the experiments, gathered a team around him, who had all the necessary theoretical knowledge and experience to clear the forest using the slash-and burn technique and to grow cultivated crops like barley (*Hordeum vulgare*) and wheat (*Triticum dicoccum*). The clearance of the forest went well, as Kustaa Vilkuna, who participated in the experiment, was an expert in slashing and burning. Fields were established so that swidden and non-swidden fields could be compared with one another. Here they made their first of many mistakes, as they chose an area with a clayey subsoil, which could become too wet and moist after heavy rainfall and kill off the crops, as occurred during the summer of 1954. The participants in the experiment blamed the wet summer of 1954 for the low yields, thus failing to understand all the mistakes they had made. An experienced farmer would never have created a field, which could potentially become waterlogged. Furthermore, clayey soil can be a problem in primitive farming during sowing, as this soil type tends to become very hard, making it difficult to sow crops, or else becomes too moist if it rains. Secondly, they chose to sow the crops immediately after they had burned down the forest, because the ash could be utilised as a fertilizer for the crops (Fig. III.11). In theory this assumption is correct, but they used a small stick to sow the crops, which did not place the cereals deep enough in the ground. Instead, the crop was sowed directly in the ash, therefore making it easy for birds, mice and other rodents to eat the crops. In addition, the pH value is so high in ash layers that this would have badly affected the crops.

The Draved experiments have often been described as successful, but it is evidently clear that participants had very limited knowledge of crop cultivation processes. However, modern experiments in crop cultivation have produced valuable information about the advantages and disadvantages of using the slash-and-burn method. The burning of the surface destroys weeds in the topsoil. Therefore, time does not have to be spent on the removal of weeds in the first season. The ash also contains many nutrients and works indirectly as a fertilizer. Furthermore, the burning of the forest produces a lot of charcoal in the fields, therefore creating a milder microclimate in the topsoil. This provides better growth conditions for the seeds. This type of soil does not require any kind of ploughing and a simple digging stick can theoretically be used in the sowing process if it is dug deep enough. An experiment into the slash-and-burn technique using simple digging sticks has been conducted in Germany. The results indicate that within the first three years it is possible to get a reasonably high yield in fields, of between three to five tons of wheat per. acre, depending on how fertile the soil is and the weather of the season (Ehrmann et al. 2009; 2014; Schier 2009). Other experiments using the slash-and-burn method, however, showed a much lower yield of 1.6 tons per acre (Reynolds 1977; Lünning 2000, 174). All the experiments showed that after two or three years of cultivation the nutrients in the soil were used up, resulting in a drastic decline in the yield. Similar experiments conducted in Britain and Estonia confirm that the yield decreases within two to three years (Reynolds 1977; Kihno et al. 2008). The field could thereafter be fallowed or used as a grazing area for domesticated animals. But in order to continue the cultivation using the slash-and burn method, it was necessary to start all over again in another area, thus proving that this method of cultivation requires access to relatively large areas. Use of the slash-and burn method should over time leave a trace in the pollen data from the various prehistoric periods. Some researchers argue that pollen diagrams do show signs of systematic rotation using slash-and burn methods (Iversen 1941; Kristiansen 1988). Meanwhile, other researchers suggest that if burning had been practised, then the primary reason for this would have been to clear the forest in order to create more permanent fields (Rowley-Conwy 1981; Engelmark 1992). However, both slash-and burn and especially the establishment of permanent fields require a detailed set of knowledge, as well as the ability to plan several years ahead in order to avoid a loss of soil fertility.

4.10. How to deal with lack of fertility in the soil

The fertility of the soil has an effect on yields, especially in a negative way when cereals are grown repeatedly in the same place, therefore exhausting the soil of nutrients. Shifting cultivation may be one of the strategies that Neolithic farmers practised in order to regenerate the land, if a field gave lower yields. Such a method would also have required the ability to plan several years ahead. Cultivation experiments have shown that yields would be relatively high during the first two to three years after a forest clearance using the slash-and burn strategy (Lüning & Meurers-Balke 1980; Schier 2009). If the soil in a field was of low fertility, it could become a fallow field, allowing the soil to restore its fertility through natural regeneration, thus enriching its organic content, microfauna and mineral nutrients (Gregg 1988). Many types of fallows have been identified during the historical period. The forest fallow allows the forest to regenerate, which thus is a long process lasting several decades. A bush fallow, on the other hand, lasts less than a decade, with shrubby vegetation developing. A fallow of shorter duration is the grass fallow, involving the regeneration of grasses and lasting only a few years. Each type of fallow results in different levels of fertility. The forest fallows produce the best restoration of the soil. When fields became fallow, they may have been marginal and more or less open areas, which might have resulted in increased hunting and gathering activities in these areas.

The shifting cultivation strategy could result in different patterns of mobility for prehistoric farmers. The colonizing mobility pattern is characterized by settlements that do not remain in the same location. A cyclical strategy is where several sites rotate within a region, returning to specific areas when regeneration of the fields has been completed. The periodical strategy is when a site is occupied and then abandoned, with no intention of reoccupying the area. A permanent strategy is involved when an area is occupied for several centuries, with the area surrounding the site systematically cultivated and fallowed (Gregg 1988). Therefore, the practice of shifting cultivation does not necessarily result in the relocation of settlements, as it is only the cultivated areas that change every few years.

Specific agrarian inventions like the ard/plough could also have triggered a more permanent cultivation strategy, involving either permanent fields or short-term fallows, as long-term fallows allow trees to reappear making ploughing more difficult due to the presence of roots (Carlstein 1982). Permanent fields would, however, have required increased manuring in order to avoid soil exhaustion (Rowley-Conwy 1981; Kanstrup et al. 2013). In such a system of permanent fields, the emergence of the ard would have played a key role, as it could have enabled more effective tillage of the soil, thus implying a change to sowing seeds in drills, which made watering and harvesting easier (Steensberg 1979). The invention of the plough would also have been contemporary with the introduction of draught animals, which meant that cattle had to be kept all year round (Sherratt 1981). Generally, all these agricultural practices may also have created more pronounced distinctions in agrarian societies in the form of specific gender-related work divisions.

4.11. Work division

Agrarian subsistence strategies may be related to a gender-specific division of labour, which based on ethnographic studies indicates that women do not play as significant a role in agrarian practices as men, although many of these hypotheses are difficult to document in our archaeological material (Miller 2007, 77). The men and ploughing hypothesis argues that men plough because they are stronger than women and have the advantage of greater aerobic capacity. Using a plough would not only have required strength to handle the plough, but also detailed knowledge and control of the animals used for pulling. Furthermore, the weather could have meant that ploughing had to be undertaken in a narrow time frame, so that in order to ensure that the work was done more quickly it was assigned to the stronger gender (Miller 2007, 77). The men and ploughing hypothesis is therefore related to a cultural strategy which increases the chances of gaining higher yields. Rock carvings from the Nordic Bronze Age also support the argument that men were involved in this process (Glob 1951; Pihl 2013). A second hypothesis argues that women were not involved in ploughing and other types of agricultural field labour as much as men, because such tasks were incompatible with childcare (Miller 2007, 77). The third hypothesis claims that agriculture increases the demand for labour near households, as winnowing, husking, grinding and cooking of agrarian food products are labour-intensive processes. These processes, together with women's role in childcare and the increased fertility in agrarian societies, restrict women to the households. Cross-cultural analysis of the gender division of labour in 46 cultures from ethnographic records reveals that men perform the main part of the work associated with agrarian processes, but again it is difficult to confirm these trends in the archaeological material (Miller 2007, 77; Michaelson & Goldschmidt 1971) (Fig. III.12). But from the author's own fieldwork in West Africa, a very different picture emerged. Here it was clear that women were just as involved as the men in cultivation practices, such as sowing, harvesting and processing of crops. Women carried their children on their backs while working, although they used sticks and not a plough to plant crops. It is therefore clear that both genders probably played a vital role in trying to establish a pioneering agrarian society in foreign lands. If an immigrating group of people were to colonize a new territory, they would probably have had a better chance of success if they included both men and women.

4.12. New foods and consumption habits associated with the adoption of agrarian practices

The new categories of food resources from the agrarian products would have led to new cooking practices. This change can be seen in the emergence or introduction of new types of pottery suited to new food sources, and more complex usage of foodstuff storage and food production, including slow heating of stews, porridge, broth and weaning foods. In connection with milk and the ability to store this type of food, it would have been necessary to incorporate bacteria into the production to make cheese, curd, whey and yoghurt. The handling of new ceramic foodways would have involved new practices of cooking, storage and consumption, which could have transformed the rhythms of social life (Parker-Pearson 2003, 11).

Such social transformation and the consumption of foodstuffs could have occurred during the building of larger structures, which may have gathered many people

Ethnographic patterns in the divison of labor by gender	Males almost always	Males usually	Either gender or both	Female usually
Primary subsistence activities	Hunt	Fish	Collect shellfish	Gather wild plants
	Trap animals	Herd large animals	Care for small animals	
		Collect wild honey	Plant crops	
		Clear land	Tend crops	
		Prepare soil for planting	Harvest crops	
			Milk animals	
Secondary subsistence, household activities		Butcher animals	Preserve meat or fish	Care for children
				Cook
				Prepare vegetable food
				Prepare drinks
				Prepare dairy products
				Launder
				Fetch water
				Collect fuel
Other	Lumber	Build houses	Prepare skins	Spin yarn
	Mine	Make nets and rope	Make leather products	
	Quarry		Make baskets	
	Make boats		Make mats	
	Make musical instruments		Make clothing	
	Make bone, horn and shell objects		Make pottery	

Fig. III. 12. Work divisions between men and women based on ethnographic records. After Ember & Ember 1993.

at large social events and feasts. Hedges (1984, 216) has argued that the slaughtering of larger animals like cattle was especially connected with special occasions or gatherings. Such an interpretation is interesting when it comes to interpreting the animal bone assemblages from various prehistoric sites. The emergence of feasts could have generated the need to produce special beverages and alcoholic drinks. Cereal grains may have served as a source of malt and malt sugars that could be fermented into beer or ale, with simple equipment involving containers, water and heating (Dineley 2004). However, there is no evidence of brewing beer in South Scandinavia before the Single Grave culture, where starch grains interpreted as being resulting from amylaceous pitting (the malting process) were found in the residue on a beaker at Refshøjgård, Jutland (Klassen 2005, 40). The earliest chemical evidence of the manufacturing of ale has been dated to the late 4th millennium and originates from the site of Godin Tepe in Iran, so it may be that the brewing of beer followed the expansion of agrarian societies (Dineley 2004, 25ff). Making alcoholic drinks or bread yeasts would have had to have been incorporated into the production of food. Generally, all these new ways of cooking foodstuffs associated with the transition towards an agrarian way of life would have resulted in a new material culture, which we should be able to investigate in our archaeological material.

4.13. Could indigenous hunter-gathers have adopted agrarian practices as an idea?

The adoption of farming as an idea would have been very difficult for the indigenous hunter-gatherers. The long-term processes needed for implementing and learning the agrarian practices would have required long visits to agrarian societies. Agrarian practices may also have been adopted if farmers were integrated into hunter-gatherer societies by marriage. Migrating farmers coming to live as neighbours of hunter-gatherer communities could have set these processes of learning and implementing agrarian practices in motion by increasing exchange of knowledge. Such situations have been shown by ethnographic examples of hunter-gatherers, who were able to

Routinized practices: Husbandry, cultivation, hunting, fishing, gathering	Jan.	Feb.	Mar.	Apr.	Mai.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Cattle breeding season						X	X	X				
Calving season			X	X	X							
Goat and sheep breeding season									X	X		
Lambing season		X	X									
Pigs mating season										X	X	
Pigs birth season		X	X									
Sowing season			X	X	X							
Harvest season and processing crops							X	X	X			
Harvest hay for winter fodder						X	X	X				
Pollarding trees					X	X						
Ruminants on pasture				X	X	X	X	X	X	X		
Gathering berries, plants and seeds from wild grasses						X	X	X	X			
Gathering nuts hazelnuts, acorns etc.									X	X	X	
Hunting red and roe deer					X	X	X	X	X			
Hunting wild boar					X	X	X	X	X	X		
Hunting migrating birds									X	X	X	X
Spring, summer, fall fishing (Salmon, turbot, pike, eel, mackerel, flatfish)				X	X	X	X	X	X	X		
Winter fishing (cod, herring, trout)	X	X	X								X	X

Fig. III. 13. Routinized practices of both agrarian and foraging activities during the different months of a year. After Biswell & Hoover 1945; J. M. Renfrew 1973; Mackenzie 1980; Grigson 1982; Perry 1984; Gregg 1988; Christensen & Rasmussen 1991; Enghoff 2011.

adopt cultivation processes because they had very close and continuous contact with neighbouring farmers. Furthermore, the possibility of trial and error would not have been available for the prehistoric farmers in Europe, as it is only possible to sow and harvest once a year. The author would therefore argue that the prime mover of agriculture was not an idea, which could be implemented by anyone; it was rather associated with people with suitable competences and the ability to exchange their knowledge with people from a different area. Agrarian expansion is therefore closely connected with the movement of people with the right competences, and the desire and aim to teach others about the agrarian practices. My theoretical focus is therefore upon what humans have to do, if they want to learn about agrarian practices.

5. THEORETICAL FRAMEWORK FOCUSING ON COMPETENCES, LEARNING, NETWORKS AND MIGRATION

People with competences have the ability to disseminate information about the knowledge and skills that are required to learn different practices (Illeris 2011). People with competences can disseminate all information, including untold information about practices, to a person who wants to learn a certain technology. It was such individuals that the hunter-gatherers in Scandinavia had to have social relations with in order to lean agrarian practices. For the purposes of this thesis, I have deliberately used the term "competence" rather than "skill" in order to indicate the ability to pass on knowledge to other individuals.

5.1. Learning practices

Agrarian practices, when they have been incorporated and applied, more or less repeat themselves every year according to preferred strategic choices in the breeding of animals, cultivation of crops and securing winter fodder, or foraging activities (Fig. III.13). However, agrarian practices also have to be adaptable if unforeseen circumstances occur. In everyday life certain traditions can be associated with changing seasons, according to the breeding and cultivation methods that have been chosen. The repeated patterns of agrarian strategies can be interpreted as routinized practices (Giddens 1984). Routinization is, according to Giddens, fundamental to daily social activities from which learning processes could emerge. The

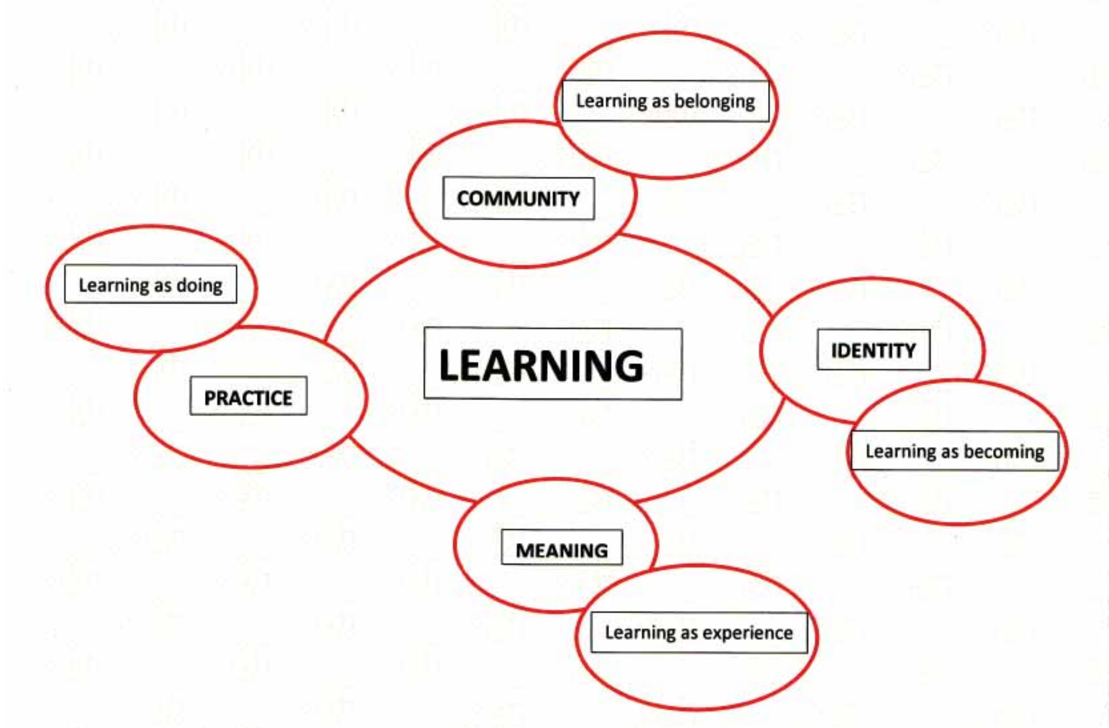


Fig. III. 14. Components of a social theory of learning. After Lave & Wenger 1991.

routines are repeated modes of activity by agents who do not need to consciously think or speak about them, thus being untold. The code of the untold actions makes it unnecessary for the agents to engage themselves in constant negotiations. This might be knowledge about combining certain cereal types with an individual soil type, thus optimizing the growth pattern, or laying out a field in accordance with the sun and wind directions, or controlling the breeding patterns of domesticated animals. It is precisely these untold routinized practices that make agrarian practices so difficult to learn, as there are over 30 processes associated with possible untold routinized information relating to cultivation or animal husbandry practices (Gregg 1988) (Fig. III.9). Furthermore, the time frame of when to initiate certain actions in agrarian practices is very long and could potentially last several years. Moreover, in critical situations the untold conventional and social codes would change and new ones would emerge. These new codes of action could also be untold and based on previous experiences. There could be several pieces of untold information amongst the transferred exchange of knowledge. Furthermore, the amount of information required to explain the different processes of agrarian activities could make it easy to forget certain important details. Information exchange through oral communication makes it even more difficult to grasp all of the details. Such untold or forgotten details are of vital importance in practice.

Timing and knowledge of the agrarian practices, combined with the ability to plan several years ahead, are of critical importance in the learning process of becoming a farmer. A strategy of learning by doing runs a high risk of failure, as there is no one with the competences to offer guidance in the right direction or help make the right decisions. However, learning agrarian practices on a small scale and obtaining only limited yields could, on the other hand, have been one of the strategies applied by the first farmers, as poor yields would not have had drastic consequences for the society. But this type of farming would have been associated with problems, because the ability to produce a decent surplus of sowing seed or an adequate reproduction of the livestock would have been very limited, thus risking long-term failure. The chances of a hunter-gatherer becoming a successful farmer were therefore closely linked to direct interaction with farmers.

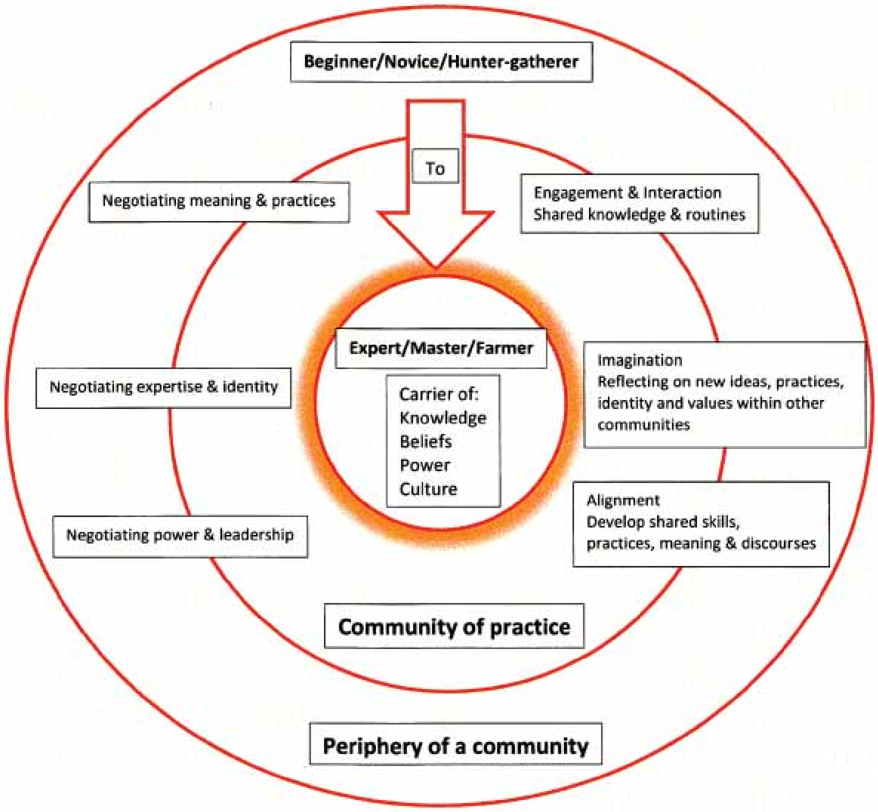


Fig. III. 15. Community of practice. A system of relationships between people, activities and the world. After Lave & Wenger 1991; Wenger 1998; 2000.

5.2. Communities of practice

The author suggests that the process of learning about agrarian practices is a social process of creating networks. People who wanted to learn about farming had to engage themselves in social relations with certain individuals or groups, who had the right competences to teach other individuals. Active participation by learners could increase the chances of obtaining the right competences (Vygotski 1934; 1978) (Fig. III.14). Such dynamic participation in exchanges of knowledge could have flourished in what Lave and Wenger (1991) have defined as a community of practice. The concept of communities of practice is, according to Lave and Wenger (1991, 98) a system of relationships between people, activities and the world, which develops over time and in relation to other overlapping communities of practice, in which exchange of knowledge and experiences can be developed. Within the communities of practice, knowledge is negotiated through a process of participation and reification, and thus they are important places of learning, meaning, identity and power (Wenger 1998, 58). Some characteristic features have been identified in connection with communities of practice. Firstly, members interact, thus establishing norms and relationships through mutual engagement. Secondly, members are bound to one another by an understanding of a common goal. In addition, members accumulate a shared knowledge of history and routines over time, which leads to increased competences in learning practices. Wenger (2000, 227) also distinguishes between three modes of belonging to a community of practice. Engagement is important and can be achieved by initiating activities with other members of the community. Imagination is creating an image of an individual and his or her community, in which they can become orientated and explore new possibilities. Alignment involves activities being aligned with other processes and thus becoming effective beyond their own engagement. Being part of a community of practice also involves the learner progressing from peripheral to more centrally-orientated learning practices, depending on the types of activities and the length of time spent in the community of practice (Fig. III.15).

The studies of communities of practice have shown that learning does not occur through isolated processes, but instead by active participation and interaction (Lave & Wenger 1991). Hunter-gatherers could have engaged themselves in such communities by moving to agrarian societies or by visiting for long periods. If farmers and hunter-gatherers had direct social relations, perhaps as neighbours, then such communities of practice could have emerged. However, this would have been dependent upon the farmers' and the hunter-gatherers' desire to teach and learn the knowledge of agrarian practices. In addition, it also depended on how to produce material culture associated with agrarian practices, such as axes, pottery and houses. If a large part of an indigenous population decided to participate in such communities of practice with farmers in order learn agrarian practices, then this would be shown by a rapid change in material culture, as well as social and ideological behaviour. The archaeological evidence of such communities of practice could be associated with a rapid change in material culture and subsistence practices.

There are also different kinds of communication strategies within a community of practice, which produce different amounts of knowledge. Communication producing lesser amounts of knowledge can include small-talk, ritualized language or cacophony, which contain a low degree of information compared to the work task. Problem solving, negotiation, instruction and storytelling can, with legitimate peripheral participation in a community of practice, give a higher level of knowledge and to a greater extent reveal the social identity of the participants (Fishman 1972; Goffman 1981; Sørensen & Holmen 2004) (Fig. III.16). Such strategies of communication could have been affected if the teachers and learners, in this case farmers and hunter-gatherers, did not speak the same language. Language acquisition and learning using a foreign language makes knowledge exchange an even harder task for both the teacher and learner (Vilien 2009). Renfrew (1987) and Bellwood (2005) have argued that the expansion of agrarian societies around 7500 cal BC also involved the spreading of the Indo-European language into Europe during the Neolithic period. Words like wheel, cart and traction have been associated with the Indo-European languages (Mallory 1989). However, these technologies did not exist before 4200-3700 cal BC, thus suggesting a later spread of the Indo-European languages into Europe (Rowley-Conwy 2011). The expansion of agrarian societies into South Scandinavia began around 4000 cal BC (Sørensen & Karg 2012), thus making it possible that exchange of knowledge could have taken place in two different languages spoken by the indigenous hunter-gatherers and farmers. Becoming part of a community of practice would also have had consequences for the power relations between the individuals possessing the competences and the learner (T. G. Roberts 2006). Hunter-gatherers who wanted to learn agrarian practices would to a certain degree have been under influence and authority of the people with the agrarian competences, thus supporting Foucault's (1979; 1980) argument for the close relationship between power and knowledge.

5.3. Becoming part of a network

Foucault interprets power as ubiquitous, whereas Bourdieu (1991) has argued in his practice theory that power is culturally and symbolically created, and is constantly renegotiated through an interaction between agency and structure. Such interplay occurs through his concept of habitus, which are socialized norms and tendencies guiding behaviour and thinking. Habitus becomes established in people in the form of tradition and learned competences, thus affecting how individuals think, feel and act in certain ways in a given situation. If we accept that hunter-gatherers had to have social relations with farmers on a regular basis in communities of practice, then it could have changed their habitus and identity towards an agrarian lifestyle and ideology. Cultural encounters in a community of practice could therefore have changed the identities of both the farmers and hunter-gatherers interacting with one another (Lave & Wenger 1991). The adoptation of agriculture is therefore closely connected to the emergence of an increased social and political hierarchy in these agrarian societies, which could have been initiated by the individuals having agrarian knowledge. The participation in these communities of practice, in connection with the establishing of new agrarian societies, could thus have created the foundation of a tribal society (Fig. III.17). Ethnographic studies have shown that societies having a tribal organization are food producers. The population density of tribal societies is higher and the way of life is more sedentary than in hunter-gatherer bands. Generally tribal societies have been interpreted

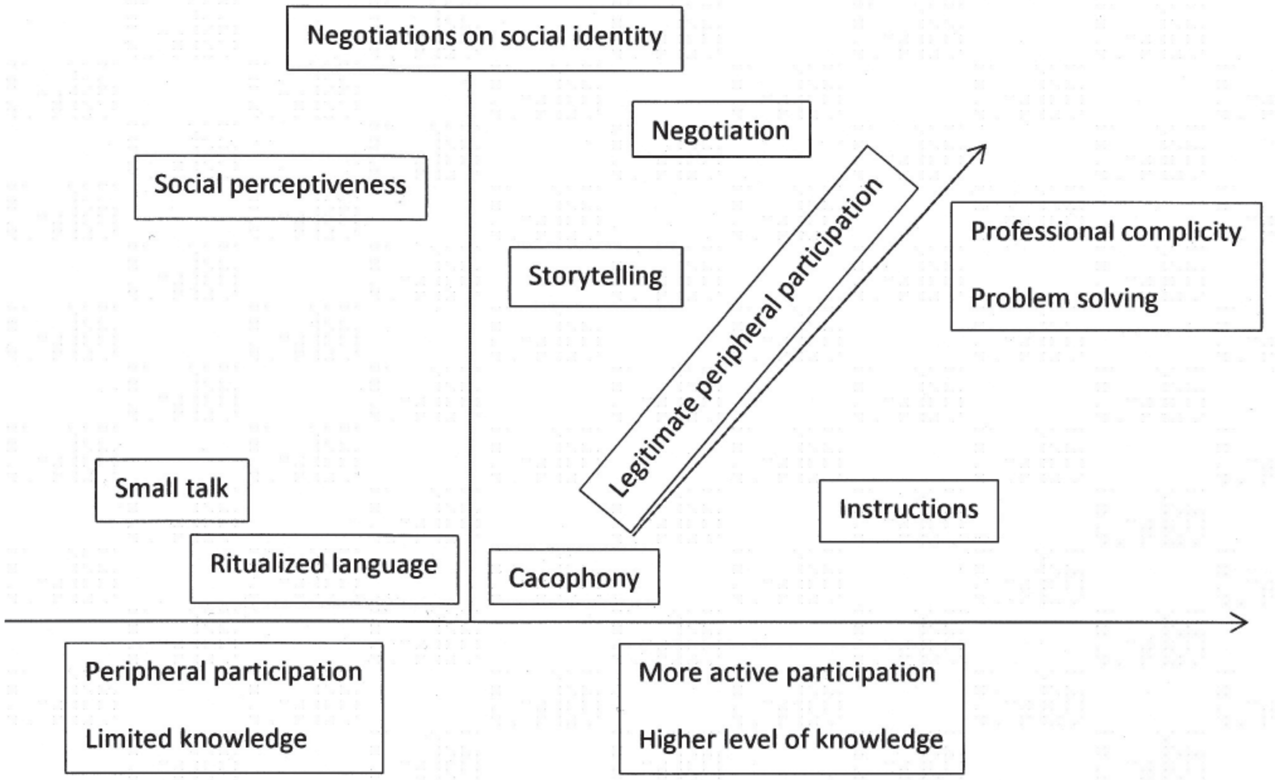


Fig. III. 16. Communication strategies within a community of practice producing different yields of knowledge. After Vygotski 1934; 1978; Fishman 1972; Lave & Wenger 1991; Sørensen & Holmen 2004; Vilien 2009.

Organization	Political integration	Subsistence	Community size	Population density	Social differentiation	Form of distribution	Social conflict
Band	Local group	Foraging	Very small	Very low	Egalitarian (Band leader)	Reciprocity	Small scale
Tribe	Multi local group	Agriculture	Small	Low	Increasing hierarchy (Big man/ Big woman)	Reciprocity and some redistribution	Raids/War
Chiefdom	Multi local group	Agriculture	Large	Medium	Rank	Reciprocity and redistribution	War
State	Entire language group	Intensive agriculture	Cities	High	Class and state	Market exchange	War

Fig. III. 17. Modes in political organization and other social characteristics based on ethnographic observations. After Ember & Ember 1993, 236; Miller 2007, 263.

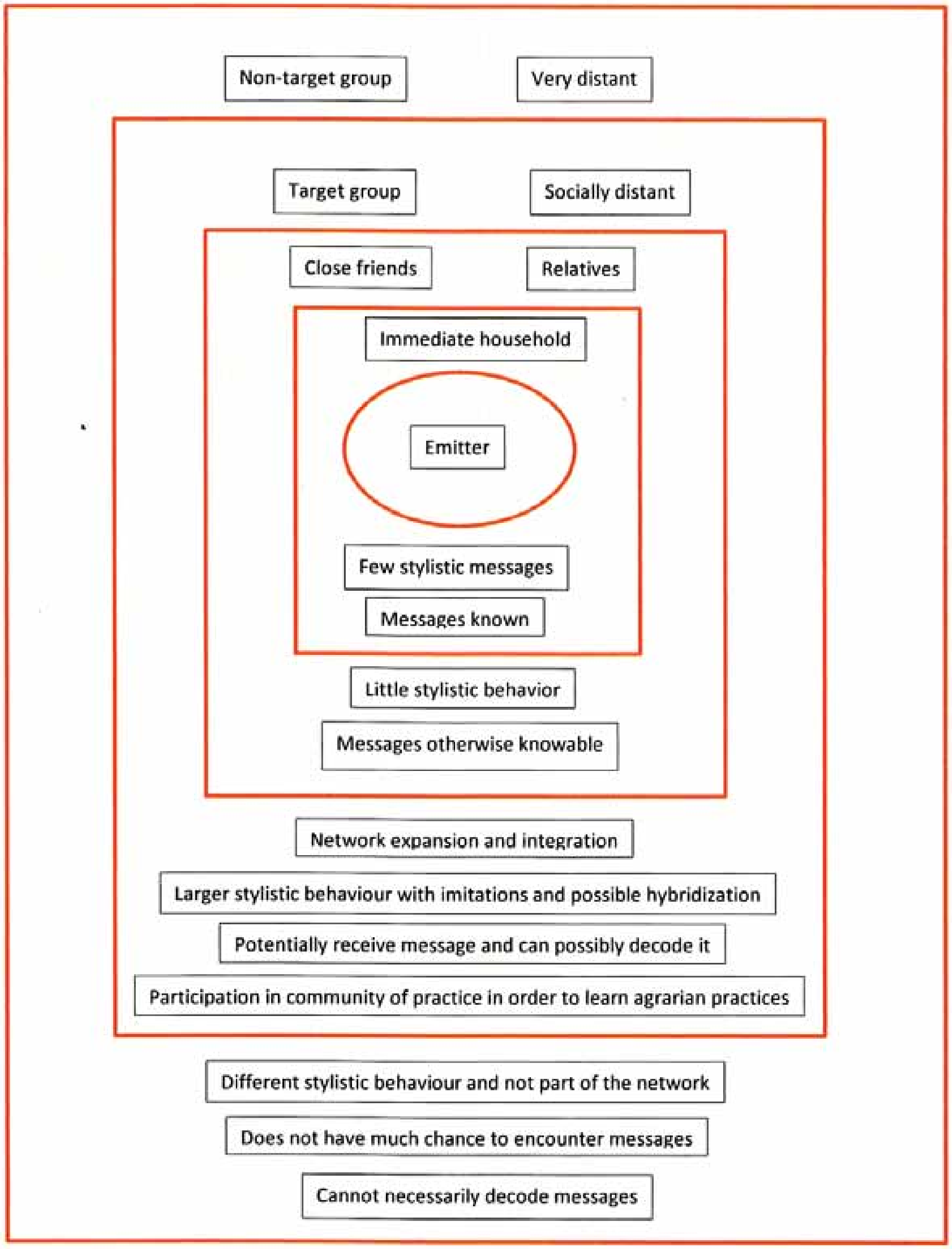


Fig. III. 18. The meaning behind an object or information within a network decreases from a target group to a non-target group. After Wobst 1977; Latour 1996a; 1996b.

as being egalitarian with no major social ranking or leadership (Ember & Ember 1993, 228ff). However, not all members of these tribal societies are equally important as observed by the emergence of "Big men", which has been documented in many ethnographic studies (Højlund 1979; Miller 2007, 262ff). These "Big men" could, within the pioneering agrarian societies, have been individuals having knowledge about agricultural practices.

If hunter-gatherers became part of a community practice in order to learn agrarian practices, then they would not only have gained social and cultural power in the form of knowledge, but also have become part of a much larger agrarian network. Such a network may have been associated with an extensive system of social relations, in which agrarian practices and other ideas could spread. Being part of such networks may explain sudden cultural developments or shifts, not only resulting from collapse or stress, but also from the ability to maintain connections. The expansion of agrarian societies could enable the formation of large-scale networks in Northern Europe, where people met more often and in a different way compared to hunter-gatherer societies. The changed behaviour would also be archaeologically visible in the tools exchanged between neighbouring societies. A theory explaining how material knowledge exchanges occur and act as a whole is the Actor Network Theory (Latour 1996a; 1996b). In this theory groups of actors participating in the network create knowledge of information, which can be transmitted as physical objects or as ideas. The networks are according to Latour (2005) constantly being made and remade. The groups of actors are, therefore, very similar to communities of practice (Lave & Wenger 1998). They can be connected to other groups of actors or communities of practice to create larger networks. However, whereas humans are the only actors in the communities of practice, it is argued in the Actor Network Theory that all activity takes place within the network of relations. Latour (1996a) thus places all entities, human and non-human, on the same level, which makes the Actor Network Theory different from all other classic sociological studies (Durkheim 2005). As a result, knowledge and ideas can be transmitted by both humans and, more importantly, non-human agents. However, as argued above, the exchange of knowledge of complex practices is only associated with humans, whereas the ideas behind a concept can be transmitted by a non-human agent.

5.4. The Actor Network theory

The Actor Network Theory also operates with two different types of concept regarding the exchange of information. Intermediaries are entities which transport information to another entity without any transformation. Mediators on the other hand are entities which multiply differences or imitations. Such mediators may be material objects, which can be investigated in the archaeological material. Behind the exchange of mediators may also lie a whole range of traditions or routinized practices or obligations connected with social interactions between human beings (Fig. III.18). Mediators can also be important gifts between people. However, if a mediator (in this case an object) changes hands several times ending up in more marginal areas of a network, then the original meaning and ideas that the object was carrying can change to something different or to a hybrid of information, depending on the context (Sørensen 2012a). The hybrids of objects, ideas and knowledge can in turn create new networks and result in the disappearance of other networks (Hallgren 2008). In ethnographic records there are several examples of networks that are often connected through marital alliances (Boas 1895; Nicolaisen 1975; Kirch 1988, 114; Miller 2007, 201ff). Another example of a network from ancient Greece involves guest-friendship and the concept of *xenia*, which dates a long way back into the Aegean prehistory (Herman 1987). It is a concept of mutual guest-friendship relations, involving rituals of gift exchange. The x*enia*-like bonds made it possible for people to exchange goods over long distances and to exchange gifts including prestigious items. Furthermore, close bonds between 'x*enoi*' living a long distance away from each other may provide an explanatory model of how ideas can spread over long distances. Using the Actor Network Theory in archaeological research makes sense as cultures, styles, depositional practices and technologies can be associated with networks of contact expressed through objects, burials and structures. The expansion of agrarian knowledge may have been one of the driving forces behind the creation of large-scale networks, which were also connected to the movement of people with agrarian competences.

5.5. The structure of migration

One of the most important articles on migration theories was published by Anthony (1990). Here it is argued that migrations and the processes behind them are associated with certain rules and structures (Anthony 1990, 895ff) (Fig. III.19). Migration is according to Anthony (1990, 905) a process not a singular event, as migrant societies generate people with a different sense of mobility, which disposes such individuals or groups to further migration depending on the age and gender structures of a community. Anthony claims that migration is a type of behaviour that is performed by a sub-group within a group. Such a sub-group has specific goals focusing on known destinations and following already routinized routes, thus laying the foundation for future networks for knowledge exchange. The process of migration develops in a predictable direction, depending on the social organization, transportation technology and the ability to maintain interaction with a larger network.

The trigger favouring a migration would be certain preconditions, which Anthony (1990, 899ff) has classified as push and pull factors. The push factors would occur if there was pressure-related evidence (climate instability, population growth, lower yields, scarcity of resources, malnutrition, rising death rates and conflicts) in a home region and pull factors would occur if there were favourable conditions (climate stability, higher yields and abundance of resources) in a distant or neighbouring region. The pull factors to distant regions in particular may also have resulted in more exploitative migration if the transportation to these areas was easy. The pull factors are therefore often associated with specific destinations, depending on the amount of information gathered from a specific region. Based upon historical records of migrations, Wiseman and Roseman (1979, 330f) have argued that migrants tend to search for a new place to live in only a few locations, connected mostly with relatives, friends or established kinship networks, and rarely in unknown territories. Expeditions may also have been undertaken in the search for certain resources and to create a network of alliances in unknown territories prior to, or during, times of stress, but then the aim was to return to the homeland with information from the unknown regions. In general, push factors relating to the economic benefits of migrating from a home region with low productivity to an area with higher productivity are often associated with migrations over long distances (Lewis 1982, 117; Anthony 1990, 900).

5.6. Short and long-distance migrations

Anthony (1990, 899ff) argues in favour of two kinds of migration, which he divides into short-distance and long-distance movements. The short-distance migration consists of less significant movements, often within a local region and related to residential traditions in connection with marriages. Such movements are difficult to detect in the archaeological material, due to the limited variations in the material within a local group. An example of a short-distance migration pattern is the wave of advance model, which argues in favour of the expansion of agrarian societies into Europe as involving a continuous population growth, which generates advances into less-settled regions with hunter-gatherer communities (Ammerman & Cavalli-Sforza 1973). But the model does not take into account previous movements of people, which are amongst the dynamics behind migration processes. Long-distance migration would have a higher probability of leaving traces in the archaeological material, as we are dealing with movements crossing both environmental and cultural boundaries, thus potentially bringing exotic materials to the immigrated area. Covering longer distances would require some planning, social organization and knowledge of the transportation routes, as well as information about potential destinations. Such knowledge may have been acquired by previous scouting expeditions. These expeditions may not have been a deliberately controlled process from the beginning, but instead connected to coincidences like individual explorations or curiosity towards unknown regions. However, if these scouting expeditions were repeated to the same regions and occurring contemporary with certain push factors, then one of the aims could be to establish a future foundation for networks in regions far way from the scouts' society and kin.

Anthony (1990, 902) has characterized such scouting expeditions as leapfrog movements, in which large areas may have been bypassed, which could cover much longer and sudden expansions than the wave of advance model (Ammerman & Cavalli-Sforza 1984). The leapfrogging movement is supported by parallels from ethnographic records of pioneering agrarian communities in South-East Asia and the expansion of farmers in the North American plains during the 19th century, who first sent out scouts or pioneers to a potential area, who after some time would be followed by whole families (Lefferts 1977, 44). A network between the old homeland and the area that was immigrated to was then established, which could result in future migrations in leapfrog movements.

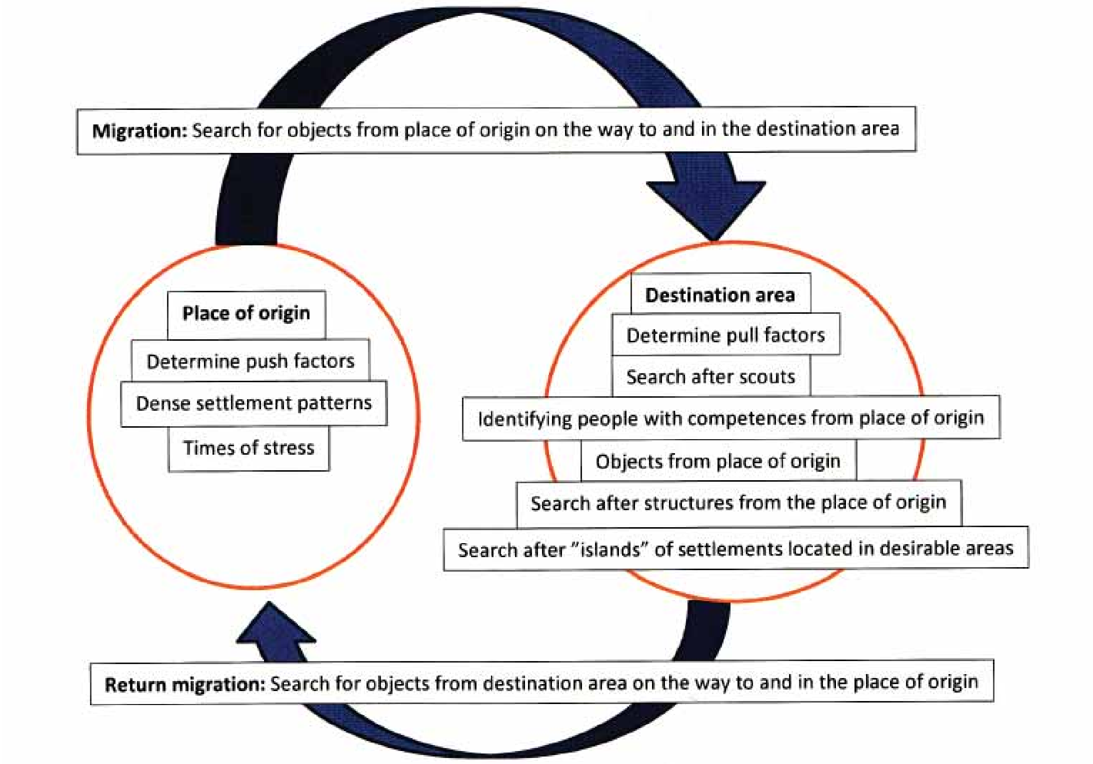


Fig. III. 19. The structure of migration in our archaeological material. After Anthony 1990; Burmeister 2000.

In general, these scouts or pioneers were of fundamental importance to the homeland societies, as their interpretation of a potential area and its resources (e.g. soil types, distance to water and communication possibilities) could result in the failure of future migrations if they did not make the right decisions about places to settle. This would be especially true in the case of agrarian societies penetrating into a hunter-gatherer region, as farmers would have to clear the forest and therefore destroy potential hunting grounds, which could cause conflicts. Choosing an area with a more widespread and limited indigenous population might have been advantageous. However, if the hunter-gatherer populations were interested in adopting farming, then it would make sense to place pioneering agrarian sites in an area with a dense indigenous population. Involving the indigenous population in agrarian activities may have been important when trying to establish the first agrarian societies, as a greater number of people could clear the forest much faster. If the indigenous population was not involved, then the clearances would of course be slower and the implementation of agrarian practices would take longer. The pioneers therefore had an important role to play in planning future migration, which implies that they may have been individuals with certain competences. Ethnographic studies have shown that expanding agrarian societies send out young adult males as scouts, and that the initial migration stream is dominated by young and mostly male individuals aged between 20 and 30 (Lefferts 1977; Simkins & Wernstedt 1971; Swierenga 1982; Burmeister 2000, 543). In many of these ethnographic examples, men are considered to be more mobile than women, thus making scouting expeditions a gender specific activity (Burmeister 2000, 543). If women had participated in such scouting activities, it should be possible to identify new trends within the ceramic assemblages at the time of such expeditions, if it is accepted that the women produced the pottery (Hodder 1982; Randsborg et al. 2009, 137ff). Nonetheless, in other ethnographic examples from the Lapita culture in the South Pacific it has been documented that the ceramic production of ceremonial vessels also was a male activity, thus making it

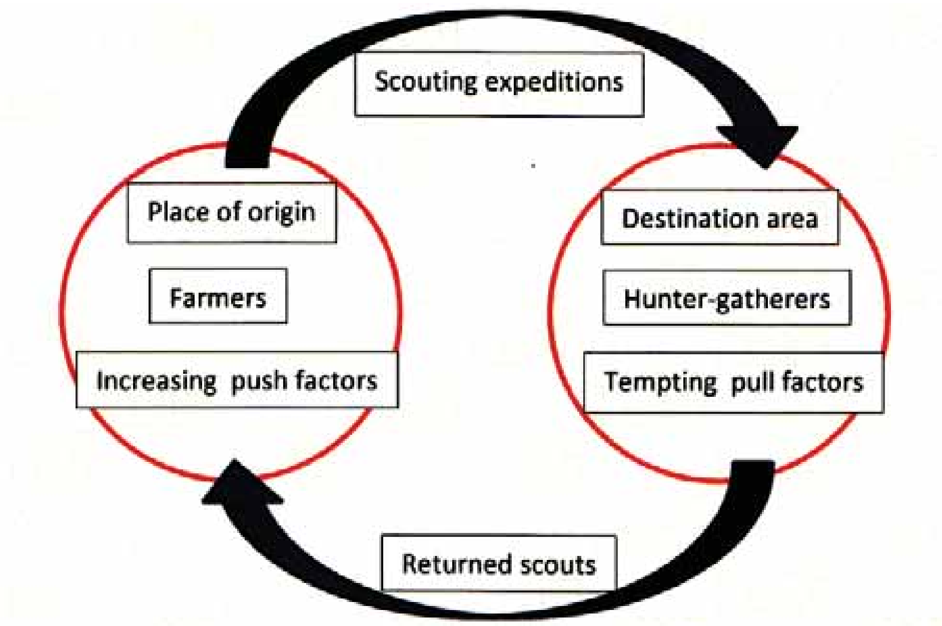


Fig. III. 20. The first phase of migrations would include several scouting expeditions to possible destination areas, which could be contemporary with the appearance of push factors at the place of origin.

rather difficult to identify the gender of these scouts in our archaeological records (Marshall 1985; Bolger 2013).

5.7. How do we identify leapfrogging movements in the archaeological record?

Archaeological evidence for a migration should therefore include evidence of scouting activities, in the form of exchange activities or specific crafts known from the homeland, which preceded and paved the way for later migrations and network alliances. Furthermore, leapfrogging movements of smaller groups of people would, according to Anthony (1990, 903), have the appearance of small "islands" or clusters of settlements in desirable or attractive locations, separated by significant expanses of unsettled and less desirable regions. An archaeological example of such leapfrogging movements is the sudden appearance of concentrations of Linearbandkeramik sites in Europe, which suggest a migration of an incoming agrarian society (Bogucki 1988). Moore (2001) has proposed five colonization pattern models, in order to categorise these "islands of settlements", when small groups of people migrate into a more or less unoccupied territory. The first one is the matrix model, in which networks of groups of people gradually migrate into a new territory, maintaining connections and increasing into new groups due to population growth, much like the wave of advance scenario. The second model is the beachhead model, which is used for migration from coastal areas, where the aim is to create a beachhead from which further expansion into the inland regions is possible. The third model is the string of pearls, in which expansion takes place along a coastline or along a river. In the next model, the outpost model, a group migrates away from other groups in a society. Lastly, in Moore's pulse model a colonization phase of several successive groups arrive in the same area (Moore 2001, 395f). However, it can be difficult to identify such colonization patterns amongst archaeological material, as the chronological period in which the patterns emerge can be very narrow and perhaps be only a couple of hundred years. Moore (2001) also argues that colonization into an unoccupied region is dependent upon certain demographic (sex ratio at birth, sibships, female mortality in childbirth and mortality) and cultural (marriage choice, polygyny and marriage pool) factors. However, according to Moore (2001, 397), there is no "magic number" for the initial group size of men and women, which can guarantee the reproductive success of an immigrating group of people. Even if a group of immigrating people consisted of 100 males and females of reproductive age, after a few hundred years it would be difficult to avoid possible cases of incest, which could result in more exogamous marriage systems (Moore 2001; Mahler 2013). Nonetheless, if the colonized region was inhabited by an indigenous population, the chances of survival would be higher, due to the potentially larger marriage pool. Detailed investigations of the destination area, including gathering information about which areas were densely populated by the indigenous peoples or uninhabited, would be of vital importance for the scouts or pioneers. The pioneers also play an important role in creating routes, which future migrations from a specific geographical area follow (Giddens 1984; Sindbæk 2005). Within the archaeological material, some objects should therefore follow a specific pattern of spreading correspondingly with the streams of migrations (Anthony 1990, 903). However, documenting such patterns of distribution can be very difficult, especially if the people migrated in boats (Rowley-Conwy 2011). The specific geographical area of origin of the migrants should also reveal itself in the archaeological material. However, searching for such places of origin may also be difficult if there are only minor differences in the material culture over a large geographical area. Furthermore, the rapid invention of new practices, styles and artefacts by the founders (Founders' effect) in a new area, may make it even more difficult to find the places of origin (Anthony 1990, 903). The founders of migrant societies would have had a key position in the societies, as they had in-depth knowledge of the new area and could pass on this knowledge to both newcomers and the indigenous population. These pioneering founders would also have a great impact on the material culture and upon what traditions, trends and ways of behaviour were passed on to the next generation, which could lead to a rapid hybridization of certain traits. Founders were people with competences that characterized them as integrators of new migrants and the indigenous population. They were creators of communities of practice, which could increase their capital, status and power in these newly-founded societies (Bourdieu 1977; Anthony 1990; Lave & Wenger 1991). The success of establishing such pioneering agrarian societies could therefore be dependent on an immigrating group consisting of both men and women, as both genders had important roles to play in trying to implement agriculture in a new region, as discussed in section 4.11. If such immigrating groups were limited in number, their chances of establishing an agrarian society would also depend on their ability to involve local hunter-gatherers in the adoption of farming. Such behaviour would have resulted in a complete and rapid change in the material culture, particularly if both the immigrating and local populations were engaged in communities of practice.

5.8. Return migrations

An important aspect of migrations is also the occurrence of return migrations, characterized as migrants or their dependants that move back to their homeland. Lee (1966) has argued that the amount of return is higher if the opportunities for survival in the homeland and the destination area are equal. However, if push factors were the reason for the migration, then there would be only very limited returns. These counter streams of migrating people returning to their place of origin should also be visible in the archaeological material, with artefacts from the destination area found in the homelands (Fulford 1985). The search for evidence of possible migration from archaeological material, therefore not only has to concentrate on identifying the place of origin through exotic objects in the destination area, but also upon investigating material which may have been returned from the destination area to the homeland. Burmeister (2000, 553) has stated that migratory movement was a multi-layered process, with the investigated patterns in the archaeological material creating the basis of a discussion that can support or reject the migration hypothesis in prehistoric contexts. The main problem concerning migrations in prehistoric contexts is that many of the patterns may also be the result of exchanges of objects between societies (Wobst 1977, 321; Burmeister 2000). It is therefore necessary to investigate how items changed hands, together with the amount of information that could have been attached to certain objects.

5.9. Exchange of objects, ideas and knowledge

Research into systems of economic exchange in small-scale societies is divided between two schools of thought: formalism and substantivism (Hylland Eriksen 1993, 216). Formalists associate the concepts of modern economics with small-scale societies, which has the consequence that the behaviour of people is determined by what they can gain or lose when engaging in a certain activity. However, the substantivists argue that the mindset of modern economics cannot be transferred to a small-scale society. Instead of attaching economic behaviour to an individual, they argue that humans are part of a larger

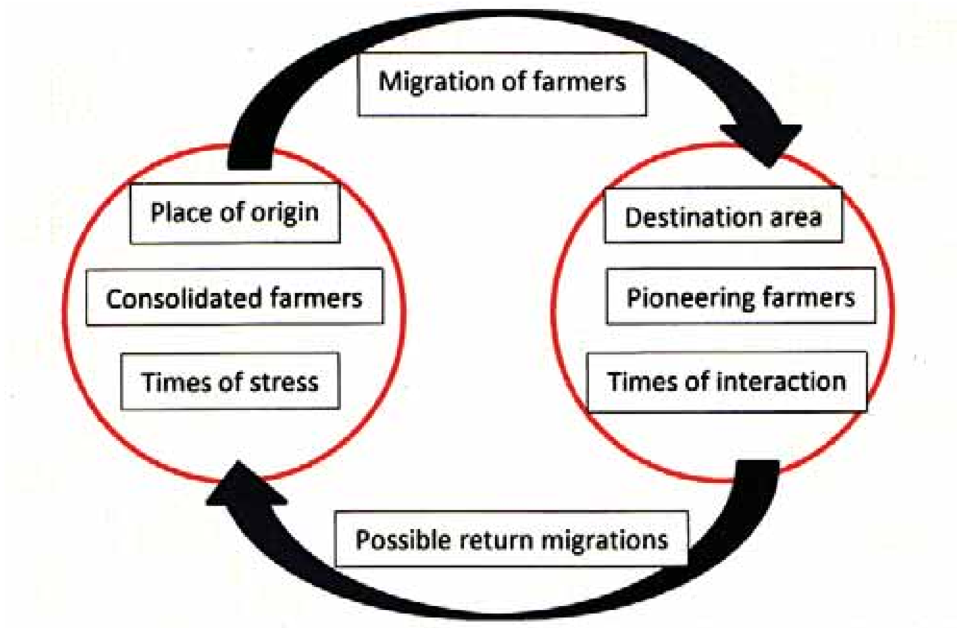


Fig. III. 21. The second phase of migrations would be an actual immigration of pioneering farmers of men, which could be followed by return migrations to the place of origin.

socio-economic system, consisting of a marked exchange of redistribution and reciprocity (Plattner 1989). The concept of reciprocity may have been especially important in a prehistoric society.

Reciprocity is gift exchanges between people, who exchange as equals, in which obligations are established between the receivers of gifts to repeat the gift exchange in the future. Positive reciprocity is when a person receives a gift with no demand from the sender to also receive a gift. Such a pattern of reciprocity normally occurs amongst close kin, family or friends. Balanced reciprocity is associated with trading equally between the giver and receiver. Negative reciprocity operates between strangers, in which the sender tries to exchange a better gift than that of the receiver. The concept of reciprocity is associated with the research of Mauss (1925) and his ethnographic studies. In his work relating to the "gift", he emphasizes that there are social and cultural aspects behind the exchange of services that have an economic value, and that implicit in receiving a gift is the obligation to return the gift. Furthermore, he argues that such a gift could be of a material or non-material character and that exchanges might occur through a system of rituals. The exchange of a gift not only involves individuals, but may have consequences for the social structures of a whole society. The exchange of gifts is, according to Mauss, not only related to individuals but to whole communities, in which social competences like kindness, politeness and sociability are important in creating new relations or maintaining social interaction between societies. In connection with social gatherings, the exchange of gifts or marriage partners can play a vital role in sealing a future bond between different societies. Some gifts can therefore serve as mediators of certain ideas or if people are involved, as in marriage alliances, then knowledge of certain technologies, such as agrarian practices, may expand into new regions.

If the exchange of objects was indirect, then the artefacts would lose their original meaning and status as they changed hands several times, thus minimizing the possibility of showing migration (Renfrew 1975; Wobst 1977, 321; Latour 1996a; 2005; Sørensen 2012a; 2013a). In contrast, if objects were directly exchanged, then the meaning and status behind them would be preserved, which could result in the production of imitations of the objects in local raw materials or continued depositional practices associated with the objects. Such a situation might indicate that both exotic objects and their imitations were the material result of a migration. All these patterns of exchange, along with the evidence of possible

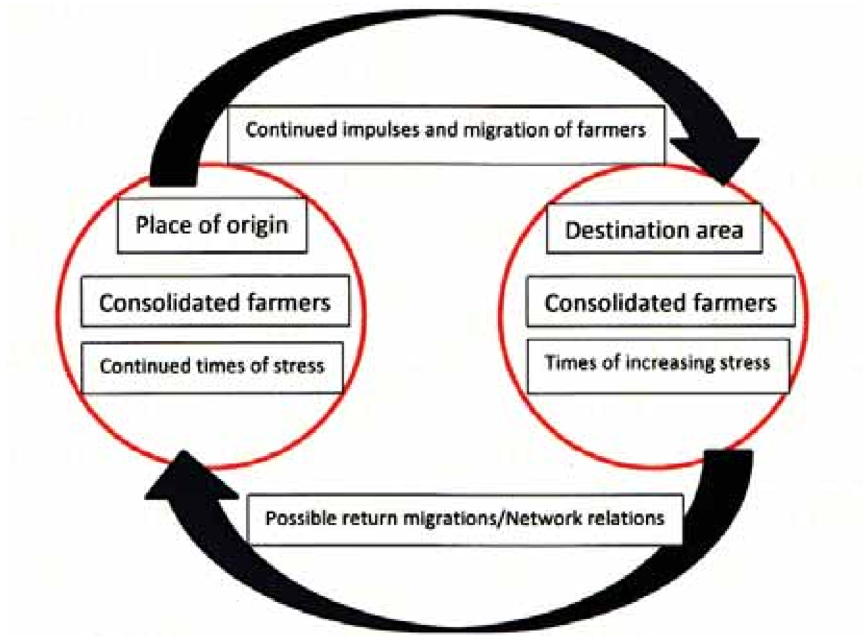


Fig. III. 22. The third phase of migrations can be characterized as a consolidation stage, in which the pioneering farmers expanded their territories and continued to receive impulses and possible immigration of farmers from the place of origin.

migration, will be discussed on the basis of an analysis of the material culture from the Scandinavian Mesolithic, Neolithic and Bronze Age.

5.10. Thoughts and tendencies relating to the adoption of agriculture

In the sections above, I have argued that agrarian practices expand together with people possessing the right competences and a willingness to teach others about agriculture. To learn these practices the learner (hunter-gatherer) had to involve themselves in a community of practice with farmers possessing agricultural competences. The result would be changed power relations between the learner (hunter-gatherer) and teacher (farmer), and this would lead to a change of identity for both groups, which would alter the material culture, social structure, behaviour and ideology of whole societies. Depending on the involvement in the community of practice, the adoption of agrarian practices could be a slow process, only integrating certain elements like animal husbandry, or a rapid process where the "whole package of agrarian practices" was implemented. The reasons behind a slow or rapid adoption of agrarian practices are therefore associated with a wide range of factors in a hunter-gatherer society. Such factors may have included an unwillingness to break from tradition, conservatism within a society, fear of new power structures and economic reasons, like having access to abundant resources, and therefore a lack of need to adopt agrarian practices or the social structures of an agrarian society.

The prime movers of agrarian practices are humans, who in a long-term learning process have acquired a detailed knowledge of and competences in agrarian practices. Agrarian expansion to different regions is most likely related to the migration of farmers and the willingness of indigenous hunter-gatherers to adopt agrarian practices, thus supporting both migrationism and integrationism.

Based on theoretical considerations, these agrarian expansions would probably be made up of certain phases, in which patterns of change occur.

The first phase would include several scouting expeditions to possible destination areas, which could be contemporary with the appearance of push factors at the place of origin. The scouting expeditions resulted in the exchange of certain prestigious objects, cereals or domesticated animals between agrarian scouts and local hunter-gatherers. The scouts would be searching for optimal arable locations and pull factors in connection with future migrations. Most ethnographic parallels indicate that the scouts would have been men, although it cannot be ruled out that women may also have been involved in these scouting expeditions. The strategy of initiating scouting expeditions may not have been a deliberately controlled process from the beginning. However, the aim was to return to the place of origin with valuable information about the potential destination area (Fig. III.20).

The second phase would be an actual immigration of pioneering farmers of men, women and children, carrying a complete knowledge of agrarian practices, who would settle in clusters located in optimal places for establishing an agrarian tribal society. One of the aims might be to engage and integrate the indigenous population into communities of practice, thus improving the possibilities of creating a more permanent agrarian society in foreign lands. Such a transition would be expected to have resulted in a swift change of the material culture and the emergence of new behavioural patterns together with an increased social and political hierarchy in these newly established agrarian societies. As early as the pioneering phase, there may have been attempts to initiate return migrations back to the place of origin, together with active engagement in larger networks by the pioneering farmers (Fig. III.21).

The third phase can be characterized as a consolidation stage, in which the pioneering farmers expanded their territories and settled in more marginal areas within the settled region. Such regional expansions may have resulted from population growth or other immigrations from neighbouring agrarian societies. Such behaviour may have created the need to construct territorial markers in the landscape, in order to maintain contemporary power structures and to prevent any major conflicts. But the intensified usage of the landscape may have resulted in yet another push effect, thus leading to new scouting expeditions and migrations (Fig. III.22).

The pioneering expansions probably consisted of small numbers of people moving in a leapfrogging movement to new areas, and becoming concentrated in small clusters of habitations in the pioneering phases. However, during all of stages in trying to establish an agrarian society in a new region, it was probably of vital importance to maintain regular contact with larger networks involving other agrarian societies, to gain access to the flow of new ideas and trends.

The testing of these behavioural patterns in connection with the adoption of agrarian practices in the various regions of Scandinavia will be done in the following sections. Particular emphasis will be placed on the agrarian expansion to South Scandinavia during the transition between the late 5th and early 4th millennium BC.

PART IV. CRITICAL REMARKS REGARDING MATERIALS AND METHODS

6. MATERIALS, METHODS AND CRITICAL REMARKS REGARDING THE SAMPLING OF THE ARCHAEOLOGICAL DATA

The materials and methods of this thesis are especially associated with the primary (cereal and faunal records) and secondary (material culture) evidence of agrarian activities and their representativeness in the research discussions. In connection with this thesis, a vast amount of data were obtained mainly about stray finds, together with new ^{14}C dates of domesticated animals from the Mesolithic and Early Neolithic transition in South Scandinavia. These data were then combined with gathered agrarian evidence, pollen diagrams, material culture, as well as information relating to burials and larger structures, in order to discuss how, when and why the agrarian expansions occurred in South Scandinavia around 4000 cal BC. The work on the later agrarian expansions during the Middle to Late Neolithic and the Late Bronze Age, was mostly based upon previously published data, which was compiled and processed in order to create an overview. In addition, there are some critical remarks regarding the usage of radiocarbon dates and pollen analyses. Other methodological problems relating to isotope, lipid, strontitum, mtDNA and provenance analysis of lithics and metals have already been reviewed and discussed in section 3.12.

6.1. The representativeness of agrarian sites in Scandinavia

Archaeological material from kitchen middens and sites located close to large lakes has so far formed the basic information for research into the Neolithisation process in South Scandinavia (Fischer 2002; Andersen 2008a). All these sites were easily detectable and were associated with excellent preservation conditions for organic material and artefacts, whereas the inland sites were more difficult to find and produced only poorly preserved organic finds. The empirical data from the inland sites, normally located on easily worked arable soils at least 1 km from the coast, is absent in discussions about the introduction of agriculture. However, over the last twenty years a series of rescue and research excavations at sites dated to the Late Ertebølle and Early Neolithic transition have produced new agrarian evidence from both coastal and especially a few important inland sites (Sørensen & Karg 2012). We therefore must focus on agrarian evidence from these sites, which includes plough marks, cereals, pollen evidence, bone from domesticated animals and archaeological finds, such as stone querns and pointed-butted flint axes, to acquire new knowledge about the Neolithisation process in southern Scandinavia.

In central and northern parts of Scandinavia, where the representativeness of sites with evidence of agrarian practices is low, information comes from direct ^{14}C dates of cereals and domesticated animals (Kaul & Sørensen 2012; Sørensen 2014). The lack of primary evidence of agriculture in southern Norway, and central and northern parts of Scandinavia, is primarily due to poor preservation of organic material (Hufthammer 1992; 1995; Olsen 1992; Solheim 2012). This had led to an increased focus on pollen analysis in these regions (Engelmark 1978; Vorren & Nilssen 1982; Christiansson & Knutsson 1989; Vorren et al. 1990; Hjelle 2012; Jensen 2012; Prøsch-Danielsen 2012). Pollen analysis in southern Norway indicates that there were agrarian activities from the Early Neolithic onwards, whereas the central and northern parts of Scandinavia show evidence of cereals from the Middle Neolithic. However, the results from these palynological analyses are still debated and criticized because of their associated methodological problems (Prescott 1996; Rowley-Conwy 1999; Sørensen 2014). Other studies have focused upon stray finds of flint axes and battle axes, or bronze artefacts, which have often been imported to the regions of central and northern Scandinavia, thus indicating some sort of direct or indirect contact with agrarian societies to the south (Valen 2007; Asprem 2012).

6.2. ^{14}C dates and methodological restrictions

All the ^{14}C dates were calibrated with the OxCal version 4.2 program and are given in "calibrated years before Christ" (cal BC), with a standard deviation range of two sigmas resolution. Using radiocarbon as a methodological tool for investigating agrarian activities is unfortunately hindered by the reservoir effect, the hard water effect

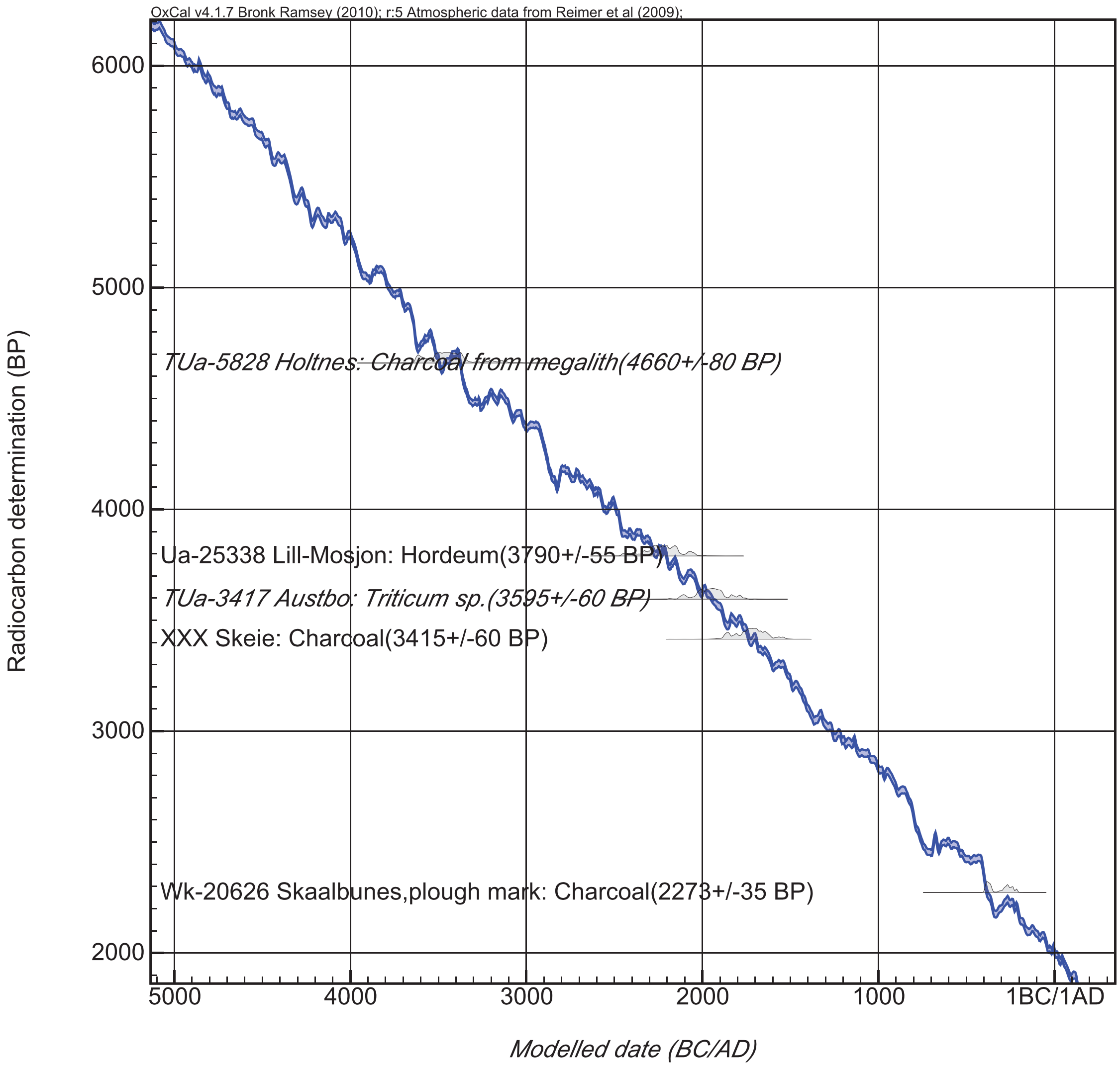


Fig. IV. 1. Plateaus in the calibration curve using OxCal version 4.2 (www.c14.arch.ox.ac.uk). Some of the significant plateaus occur between the Late Ertebølle culture/Funnel Beaker culture (4200-3800 cal BC), Funnel Beaker culture/Pitted Ware culture (3100-2700 cal BC), Battle Axe culture/Bell Beaker culture (2600-2300 cal BC) and Late Bronze Age/Pre-Roman Iron Age (800-400 cal BC). After Litt et al. 2001; Reimer et al. 2009.

and plateaus on the ^{14}C curve. The reservoir effect can be explained as a delayed exchange of carbon between the atmosphere and the ocean, which means that the carbon is already of a considerable age when it is integrated into an organism. It has often been claimed that the average reservoir effect lasts around 400 years in all the oceans, but current studies have shown that the effect varies geographically and over time, thus making it necessary to conduct analysis on a wide range of animals in every region before a reservoir period can be determined (Eriksson et al. 2013). Suspected reservoir effects can be measured when samples of archaeological materials show increased ^{15}N (12-15$^{0}/_{00}$) or decreased ^{13}C (-17 to -13$^{0}/_{00}$) values, which indicate a significant amount of freshwater or marine fish in the dated sample. Radiocarbon dates of shells, marine animals, food residues, and humans or animals with a marine diet or having eaten freshwater fish, are all associated with problematic results. The hard water effect can also result in a reservoir effect in relation to the radiocarbon dates, and is typically associated with areas of calcareous geology (Fischer 2002; Fischer et al. 2007; Philippsen et al. 2010).

The many plateaus on the ^{14}C curve also cause problems, because they have been registered at different cultural transitions associated with the introduction of agriculture in Scandinavia (Fig. IV.1). Furthermore, it is particularly vital not only to use conventional ^{14}C dates in this type of investigation, because they contain a higher uncertainty and thus a greater risk of ending up on the plateaus compared to AMS dates. Approximately 40% of all the dates in this investigation consist of conventional dates, while the remaining 60% are AMS dates. We should therefore expect a dating accuracy of at least 200 to 400 years in the various discussions concerning the introduction of farming in the various regions in Scandinavia. Nevertheless, the chronology can become narrower if several ^{14}C dates are undertaken on charcoal from sealed contexts and subjected to a Bayesian analysis (Buck et al. 1996). Such analysis has documented that the long barrows in Britain were built from 3800 to 3600 cal BC (Bayliss & Whittle 2007). The use of AMS dates are also associated with some problems, as the sample sizes are smaller, which may increase the risk of contamination of the samples with organic materials of a much later or earlier date. In connection with the City Tunnel excavations in Malmö, AMS dates of charred cereals at Sunnanå 19D (33440±1150 BP, Ua-15827) and Fosie 9A-B (14055±135 BP, Ua-16195) clearly demonstrate the risk of contamination when such small samples are dated (Claes Hadevik pers. comm.). Recently, other AMS radiocarbon dating has also produced very early dates for charred cereals from the Middle Ertebølle in South Scandinavia, clustering around 5500 to 4600 cal BC (Nord & Sarnäs 2005; Norrman 2005; Frejd & Rudebeck 2013) (Fig. IV.2). These dates could, in theory, indicate connections with Linearbandkeramik societies. However, the dates of these cereals from Pilbladet 1, Lockarp 7E and Sjogerstad 106 did not match the much later archaeological contexts that they were found in, these dating to the Early Neolithic and the Iron Age (Fig. IV.3). A similar problem was also observed at Vasagård, where a sealed Middle Neolithic pit context contained cereal grains; one cereal grain was dated to the Late Ertebølle culture, whilst three others were dated to the Middle Neolithic (Heinemeier et al. 1996; Kaul et al. 2002) (Table 47). We should therefore be critical in our approach to both the contextual origin of the finds being dated, as well as these early AMS dates for cereals. AMS dates can give false results if the samples have been contaminated. Nonetheless, it is clear that examining all the radiocarbon dates available will give an overview of when agriculture, together with structures related to agrarian societies, were introduced (Sørensen 2014). Such investigations therefore provide updated knowledge of the agricultural expansions and attempts to establish agrarian societies in various regions of Scandinavia.

6.3. Archaeobotanical material

Archaeobotanical material can be obtained from the flotation of soil samples and also be analysed in plant impressions present on pottery. Archaeobotanical information and the statistics behind each cereal species in a given period are heavily biased by the fact that excavation methods have to include systematic soil sampling in order to find charred cereals (Grabowski 2011; Kirleis et al. 2012; Sørensen & Karg 2012). Furthermore, hulled wheat species need to be roasted in order to lose their glumes, which might explain why these species are often overrepresented in the archaeobotanical record (Hillman 1981, 123ff). Cereal impressions in ceramics are also difficult to quantify, as wheat often seems to be overrepresented because it is easier to identify (Engelmark 1992, 369). Nevertheless, the most abundant cereals recorded in Early Neolithic contexts in southern Scandinavia are emmer (*Triticum dicoccum*), einkorn (*Triticum monococcum*), naked barley (*Hordeum vulgare/nudum*), bread wheat (*Triticum aestivum/compactum*) and possibly spelt (*Triticum spelta*) (Robinson 2003; Gustafsson 2004; Hallgren 2008, 118; Andreasen 2009, 34; Larsson & Broström 2011, 197; Kirleis et al. 2012). The identification of spelt in Early Neolithic contexts is still somewhat debatable, as it is considered to have first appeared during the Middle or Late Neolithic in Central Europe (Akeret 2005; Andreassen 2009; Dreslerová & Kočár 2013; Lechterbeck et al. 2014). In central and northern parts of Scandinavia there are not many finds of charred cereals, but the few published examples show that barley was the preferred crop, probably because it is quite resistant to colder weather (J. M. Renfrew 1973; Soltvedt et al. 2007; Arntzen & Sommerseth 2010; Viklund 2011). Species like oats (*Avena sativa*) and rye (*Secale cereale*) appear much later during the Late Bronze Age and Pre-Roman Iron Age in Scandinavia (J. M. Renfrew 1973; Andreassen 2009; Karg 2012). Unfortunately, cereal grains do not necessarily indicate cultivation and processing of crops as they may have been imported. Threshing waste, con-

Nr. on map (Fig. IV.3)	Country	Region	Site	Material/evidence	Lab. no.	BP	±	cal BC	References
1	Southern Sweden	Scania	Pilbladet 1, Sallerup	Charred cereal, fragment, cultural layer 6	Ua-44931	6493	44	5540-5362	Frejd & Rudebeck 2013
2	Southern Sweden	Scania	Lockarp 7E	Charred cereal, A33233, posthole in Iron Age house	Ua-16188	6110	75	5286-4836	Nord & Sarnäs 2005
3	Western Sweden	Västergötland	Sjogerstad 106	Charred cereal	Poz-5657	5870	50	4881-4596	Norrman 2005
4	Southern Sweden	Scania	Löddesborg	Cereal grain impressions on Ertebølle/funnel beaker ceramics					Jennbert 1984
5	Southern Sweden	Scania	Vik	Cereal grain impressions on Ertebølle/funnel beaker ceramics					Jennbert 1984
6	Denmark	Zealand	Lollikhuse	Bos taurus?	AAR-7410-2	5890	55	4929-4612	Sørensen 2005, 304
7	Southern Sweden	Scania	Hindbygården	Bos taurus?	Ua-1575	5570	110	4702-4173	Hadevik 2009
8	Northern Germany	Schleswig-Holstein	Grube Rosen-hof	Sus domesticus, tooth	KIA-41338	5800	25	4720-4557	Krause-Kyora et al. 2013
9	Denmark	Northern Jutland	Havnø	Ovis/Capra? (ZMK 61-P43/P117) (-21,36)	OxA-27064	5329	35	4313-4046	Present study

Fig. IV. 2. ^{14}C dates of cereals and domesticated animal bones and pointed-based vessels with grain impressions from the Ertebølle culture in southern Scandinavia. After Jennbert 1984; Nord & Sarnäs 2005; Norrman 2005; Sørensen 2005; Hadevik 2009; Frejd & Rudebeck 2013; Krause-Kyora et al. 2013.

sisting of spikelet forks or awns is, on the other hand, more secure proof of on-site processing, which have been found as macrofossils or used as temper in ceramics in Scandinavia (Soltvedt et al. 2007; Skousen 2008, 124; Andreassen 2009; Westphal 2009, 89ff; Larsson & Broström 2011). Quern stones were associated with the processing of cereals. By investigating the ^{14}C or typological dates of the archaeological contexts in which these quern stones were found, it is possible to date their introduction in connection with the expansion of agrarian societies.

6.4. Pollen analysis

Pollen analysis and the identification of cereal pollen from barley or wheat also plays an important role in the discussions about the emergence of crop cultivation in Scandinavia (Iversen 1941; Troels-Smith 1954; Engelmark 1978; Berglund 1991; S. Th. Andersen 1993; Sjögren 2003; Valen 2007; Glørstad 2010; Hjelle 2012; Jensen 2012; Feeser et al. 2012; Prøsch-Danielsen 2012; Skandfer & Høeg 2012; Solheim 2012; Lahtinen & Rowley-Conwy 2013). However, long-distance transportation of pollen has always been a problem in pollen investigations. Furthermore, pollen grains from barley and wheat, when found in limited numbers, can easily be identified incorrectly, although wheat produces larger pollen grains, thus lessening the chances of misinterpretation (Table 1). Nevertheless, pollen grains identified as barley or wheat pollen could just as well derive from different kinds of wild grasses, such as wood barley (*Hordelymus*), wild rye (*Leymus*) and sweet grass (*Glyceria*) (Beug 1961; 2004; Andersen 1978; Lahtinen & Rowley-Conwy 2013) (Fig. IV.4). An increase of charcoal dust in pollen diagrams has also been used to argue for the presence of slash-and-burn cultivation. But the totals for charcoal dust are biased, because it is not always recorded in pollen diagrams. When searching for agrarian practices using pollen analysis we should therefore concentrate on the total quantities. Preferably, there should be correspondence between peaks in cereals, ribwort plantain, charcoal dust and birch pollen (Kristiansen 1988; Digerfeldt & Welinder 1989; Berglund 1991; S. Th. Andersen 1993; 1994; Odgaard 1994; Rasmussen 2005; Rasmussen et al. 2007; Westphal 2009; Lagerås 2008; Feeser et al. 2012; Hjelle 2012; Prøsch-Danielsen 2012; Lahtinen & Rowley-Conwy 2013) (Plate 1).

In southern Scandinavia the pollen investigations used in the discussions regarding the adoption of agrarian practices, with a few exceptions, lack absolute dating

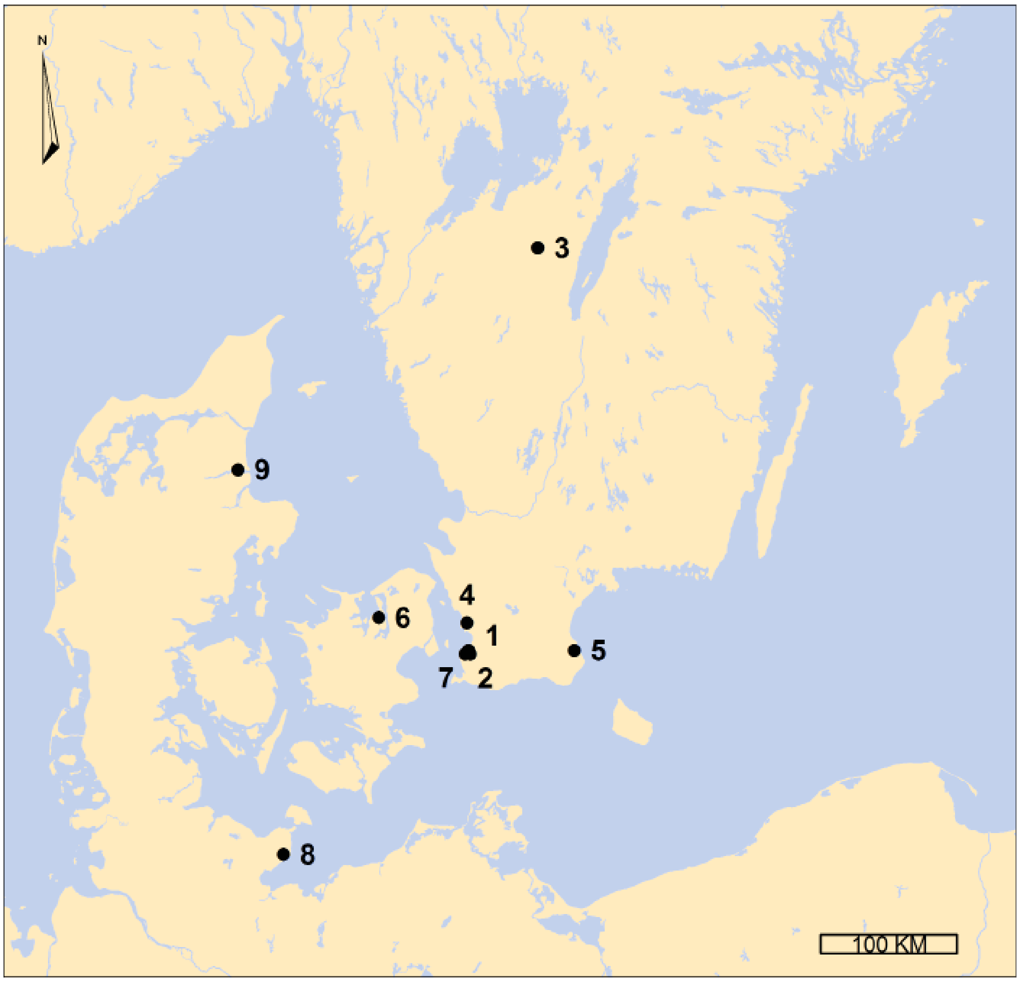


Fig. IV. 3. Distribution of sites that produced controversial ^{14}C dates for charred cereals and domesticated animals. 1. Pilbladet 1, Sallerup (cereal), 2. Lockarp 7E (cereal), 3. Sjogerstad 106 (cereal), 4. Löddesborg (ceramics with grain impression), 5. Vik (ceramics with grain impression), 6. Lollikhuse (tooth of *Bos taurus*), 7. Hindbygården (bone from *Bos taurus*), 8. Grube Rosenhof (*Sus domesticus*) and 9. Havnø (bone from *Ovis/Capra?*). After Jennbert 1984; Nord & Sarnäs 2005; Norrman 2005; Sørensen 2005; Hadevik 2009; Frejd & Rudebeck 2013; Krause-Kyora et al. 2013.

Classification	Andersen 1978	Beug 1961
Wild grass	Mean pollen size <37 ɥm, mean annulus diam. <8 ɥm	<37 ɥm, pore <2,7 ɥm, annulus diameter
	Surface pattern scabrate or verrucate	<2,7 ɥm, annulus thickness <2,0 and >3,0 ɥm
Cerealia group	No general cereal type	>37 ɥm, pore >2,7 ɥm, annulus diam. 2,7 ɥm
		Annulus thickness between 2,0 and 3,0 ɥm
Hordeum type	Mean pollen size <37 ɥm	Cerealia type that have the surface structure punkt clumpen
	Mean annulus diam. 8-10 ɥm	
	Surface pattern scabrate or verrucate	
Triticum type	Mean pollen size >40 ɥm	Cerealia type that have the surface structure punkt clumpen
	Mean annulus diam. >10 ɥm	
	Surface pattern verrucate	

Fig. IV. 4. Criteria used to classify wild grass and Cerealia. After Beug 1961; Andersen 1978; Lahtinen & Rowley-Conwy 2013.

	Percentage of Triticum boeoticum aegilopoides	Percentage of Triticum aestivum
Field	10.30%	11.80%
Edge of field	2.90%	31%
10 m. from field	2.50%	3.50%
50 m. from field	1.40%	
Thresing place	26.60%	19.20%

Fig. IV. 5. The density of Cerealia pollen in a field, at a distance from a field and at a threshing place. After Diot 1992.

(Odgaard 1994; Rasmussen 2005; Rasmussen et al. 2007; Lagerås 2008; Feeser et al. 2012) (Table 9). But evidence for agriculture is provided by pollen analysis of buried soils from underneath long barrows, dated between 3800 and 3500 cal BC (S. Th. Andersen 1993) (Plate 2). Nevertheless, the directly ^{14}C dated elm wood with galleries of *Scolytus laevis* showing Dutch elm disease at Præstelyngen on Zealand (5090±90 BP, 4040-3970 cal BC) indicates the beginning of the elm decline in South Scandinavia (Rasmussen 1995). It is therefore possible to use some of the undated pollen analyses from South Scandinavia in the discussions, if the diagrams show a marked decline of elm pollen during the early stages of the Subboreal period (Iversen 1941; Aaby 1992) (Table 9). But unfortunately most pollen samples in Scandinavia have been taken from small lakes or bogs, thus showing the environmental change on a very local scale, whereas pollen diagrams taken from larger lakes reflect changes within the landscape covering a radius of 5-10 km (Westphal 2009). Pollen from cereals is therefore rarely detected, because wheat and barley are self-pollinating species, which means that the pollen do not spread over long distances. The pollen stay within the ears, until the cereal is threshed. These observations are confirmed by experiments showing a very low dispersal of wheat pollen just 10 metres away from the crop field (1.4%) and a greater amount (26.6%) at the actual threshing place (Diot 1992) (Fig. IV.5). On the other hand, other investigations in Britain have argued that it is possible to optimize the chances of finding pollen grains by counting larger pollen grains and thus larger quantities of soil. The "optimization method" increases the likelihood of finding cereal pollen, but the method has not been used in Scandinavia (Edwards & Mcintosh 1988).

In Norway, much pollen analysis has been conducted in association with ^{14}C dates, but the uncritical use of these dates, which sometimes come from bulk samples, has created problems in the interpretation of when agrarian practices appeared (Prescott 1996; Rowley-Conwy 1999). In northern Norway and Sweden, cereal pollen were thought to have appeared during the mid-3rd millennium (Johansen & Vorren 1986; Christiansson & Knutsson 1989). But a critical review of this now concludes that the dates for cereals cluster around the Late Bronze Age (Welinder 1999; Valen 2007) (Plate 13). A similar critical review has taken place in Finland, where some researchers now argue in favour of agrarian practices during the Middle and Late Neolithic (Alenius et al. 2013), whilst others claim that farming first began during the Pre-Roman Iron Age (Lahtinen & Rowley-Conwy 2013). Generally, there are many methodological problems associated with the use of pollen analysis as evidence for the appearance of agrarian practices. But by combining archaeobotanical and pollen data it should be possible to discuss whether or not agrarian processes were taking place in various regions. Such discussions can be further supported by agrarian features and finds, such as plough marks, cultivation layers, fossil fields, ards and quern stones.

6.5. Plough marks, ards and fields

Plough marks are one of the most significant forms of evidence for cultivation practices in prehistoric times (Sherratt 1981; Fries 1995). However, such features are very difficult to find in the archaeological record, as they have often been destroyed by later cultivation. However, furrows have been preserved and found beneath numerous Neolithic burial mounds in Denmark, giving them a probable *terminus ante quem*. Their representativeness in the archaeological record is therefore biased, as they are only found below large burial structures or cultural layers in Neolithic contexts (Thrane 1991; Dehn et al. 1995; 2000; Sarauw 2006). Nevertheless, the stratigraphic dates have recently been supported by even earlier ^{14}C dates for Neolithic plough marks (Beck 2009; 2013; Mischka 2011a, 745ff). The plough marks therefore predate the

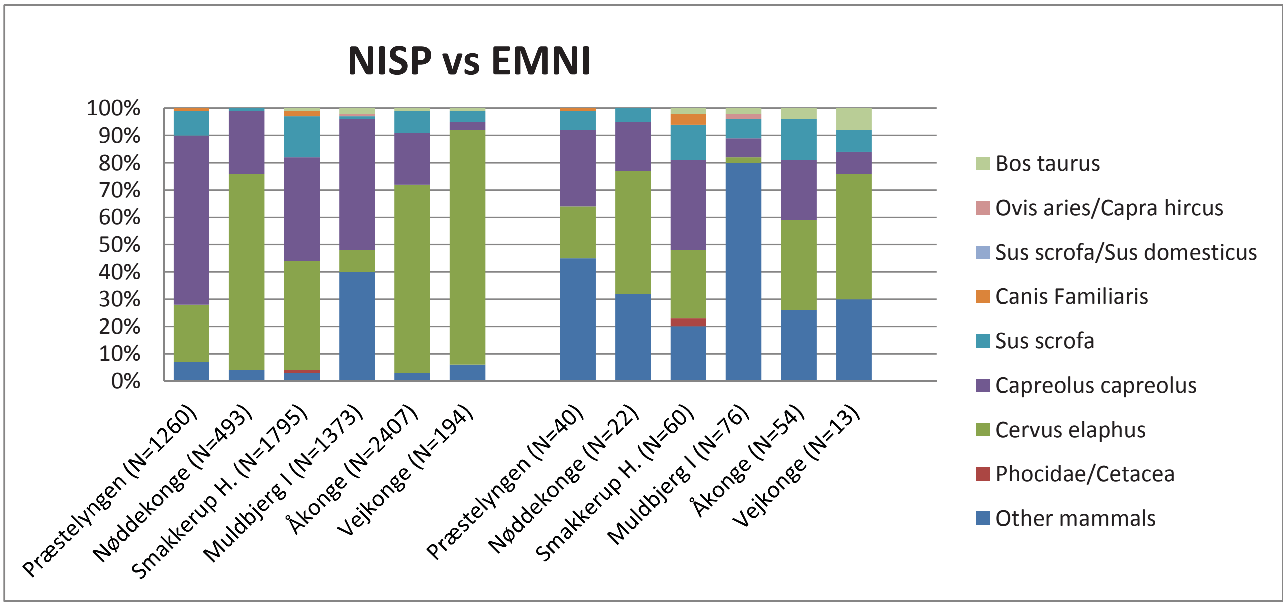


Fig. IV. 6. Faunal assemblages investigated using the NISP (number of identified specimens) and EMNI (estimated minimum number of individuals) methods, based on data from Tables 2 and 3. After Noe-Nygaard 1995, 76ff; Gotfredsen 1998, 95; Hede 2005, 94.

actual physical finds of ards, with the earliest ones of the body ard type ^{14}C dated to the Middle Neolithic (Lerche 1996; Pihl 2013). Currently no ards have been found in Norway, but a few undated plough marks have been recorded (Arntzen 2013; Asprem 2013). However, finds of black layers containing charcoal, which are several centimetres thick, have been made, especially in western Norway (Olsen 2012). These layers have been interpreted as cultivation or clearance layers from the systematic burning of heathlands or organized clearance of vegetation. Whether or not these layers represent cultivation or clearance layers is still debatable, as they may also represent layers from nearby sites (Sørensen 2014). It is therefore necessary to make more than one ^{14}C date from each layer in order to exclude the possibility that we are dealing with ordinary drifting of cultural layers. Clearance layers representing burning of heathlands should in theory cover a short time span. Other localities, especially in Trøndelag, have also produced these black layers, but here they are dated to the Early Bronze Age, suggesting that these possible clearance or cultivation layers are not a solely west Norwegian phenomenon (Stamnes 2008, 119; Engtrø 2012, 15f). Perhaps they are generally connected with the burning of heathlands to increase the grazing areas for livestock (Kaland 1986). Nonetheless, these black layers have also been found at the site of Munkeröd in Bohuslän, where the lower layers were ^{14}C dated to Early Neolithic (late EN I and EN II) and the upper ones to the Bronze Age (Lindman 1993, 64ff). The layers have been interpreted as evidence of cultivation using the slash-and-burn method, thus supporting the observations made in western Norway (Olsen 2012).

The appearance of actual fields has not been identified in the Neolithic period in Scandinavia. However, some fossil fields been recorded from the later part of the Early Neolithic in Ireland, which have been succeeded by the formation of bogs and thus preserved (Caulfield 1978; 1998). It is therefore highly possible that such more or less permanent fields did exist during the Neolithic period in South Scandinavia. The lack of fields from the Neolithic is associated with the fact that they were located in areas where both later prehistoric and current farming has been conducted. It is therefore no surprise that fossil fields have typically been found in areas covered by forests. Currently, most fossil fields in Scandinavia date to the Bronze Age and the early Iron Age (Pihl 2013).

6.6. Faunal assemblages

The problems associated with the faunal assemblages are of a taphonomic, taxonomic and stratigraphic character.

The presented faunal assemblages show the percentage of identified mammal bones, thus excluding the unidentified bones, as well as the fish and bird bones. In general, fish and bird bones are abundant in Late Mesolithic assemblages and underrepresented in Neolithic contexts. These differences may be due to the lack of sieving of cultural layers on certain sites, together with poor conditions of preservation (Ritchie 2010; Enghoff 2011; Gron 2013). Another problem associated with the faunal assemblages is the counting methods used for the bone material, which vary between the different sites, thus influencing the results. The usage of NISP (number of identified specimens) instead of EMNI (estimated minimum number of individuals) can lead to an overrepresentation of the calculated number of animals (Marshall & Pilgram 1993; Lyman 1994, 102ff). Both methods were applied to a number of Late Mesolithic and Early Neolithic faunal assemblages from southern Scandinavia (Fig. IV.6 and Tables 2-3). Nevertheless, both of the methods generally show a rather low frequency of domesticated animals. Unfortunately, very few faunal assemblages were investigated using EMNI, which has forced the author to work with NISP totals. This is particularly problematic when dealing with burnt bones, as at the sites of Mählardalen and Bergslagen in Sweden (Hallgren 2008, 124f). Moreover, some larger animals, such as cattle, count the same as a wide range of smaller mammals, when using NISP totals. It is, however, clear that the meat value of cattle is much higher than other domesticated and wild animals (Lyman 1979).

The sample sizes of faunal assemblages also represent a problem when comparing faunal assemblages from different sites dated to the Ertebølle culture and the Early Neolithic period. At each site there may be differences in the preservation, taphonomic processes and degrees of fragmentation, which lead to variations in the faunal assemblages. The degree of bone fragmentation amongst the faunal assemblages from South Scandinavia is only rarely discussed. This is unfortunate, as a high fragmentation ratio can potentially increase the number of identified bones, thus giving a false impression of the composition of various animals in an assemblage (Gron 2013). Cattle or red deer bones are more robust, therefore resulting in a low degree of fragmentation and possible underrepresentation in NISP totals. On the other hand, a higher degree of fragmentation of the bones of other domestic and wild animals may result in an overrepresentation in the faunal assemblages. Kurt Gron (2013) is one of the few scholars to have studied the degree of fragmentation present at several kitchen midden sites from the Ertebølle culture. He has observed that the average size of the mammal bones was around 5 cm, corresponding to the size of an open oyster shell. The bones had been fragmented by humans walking on them and treading them onto or in between oyster shells, which had an average measurement of five cm. These observations have serious implications for NISP totals, thus creating problems in relation to our interpretations of variations in the faunal material at these kitchen midden sites. Fortunately, studies of ethnographic bone assemblages have revealed that the variation between different species decreases when a sample size reaches over 1000 bones, thus giving more credible faunal information (Amorosi et al. 1996). However, if at least 1000 identified bones are required in a faunal assemblage, then there are only five to ten sites from the Late Ertebølle culture, two lake shore sites from the Early Neolithic and one inland site from the Early Neolithic, which have produced sufficient material (Sørensen & Karg 2012). Furthermore, most of the faunal material, especially from the Early Neolithic inland-oriented sites, comes from more or less sealed contexts, as the deposits have been found in pits. Comparison of faunal material from cultural layers with deposited bone material found in pits is also associated with problems, as both the degree of fragmentation and depositional practices can be different. The result might therefore be to dismiss faunal data, which is considered by many researchers to be of crucial importance to discussions regarding the adoption of agrarian practices (P. O. Nielsen 1994; Fischer 2002; Klassen 2004; Andersen 2008a; Sørensen & Karg 2012; Rowley-Conwy 2011; 2013). But instead of ignoring faunal data, the author has chosen to present it, although acknowledging that it is biased.

The presented faunal material, especially that from inland-oriented sites, can therefore only confirm that domesticated animals were present. Nonetheless, it seems peculiar that the patterns of variations between the various species of domesticated animals and wild fauna are almost identical, when comparing NISP percentages from large (over 1000 identified bones) faunal assemblages from the Michelsberg culture (Hachem 2011; Höltkemeier 2011) with much smaller (below 200 identified bones) assemblages from inland-oriented Early Neolithic sites (Nielsen 1985; Koch 1998; Sjögren 2003; Hallgren 2008;

Welinder et al. 2009) (Fig. V.186). Perhaps the faunal variation in these Early Neolithic pits from South Scandinavia does represent the variation in the faunal assemblages. However, the similarities in the variation might be due to the fact that the faunal material from the Michelsberg culture is from whole sites, whereas the faunal material from the inland-oriented Early Neolithic sites originates from individual pits.

The faunal assemblages are also associated with certain taxonomic problems, which become apparent when the identification of the bones of domesticated animals is undertaken. There are challenges in this respect in certain cases, such as with the bones of smaller aurochs (*Bos primigenius*) and domesticated cattle (*B. taurus)* (Hartz & Lübke 2004; Noe-Nygaard et al. 2005; Price & Noe-Nygaard 2009, 205ff; Gron 2013). It is important to mention that aurochs and domestic cattle lived at the same time in northern Germany and Jutland during the Subboreal, with the aurochs becoming extinct on the Danish islands during the Early Atlantic period (7200-6000 cal BC) and during the Middle Atlantic period in southern Sweden (6000-5000 cal BC) (Aaris-Sørensen 1998; Noe-Nygaard et al. 2005). The large quantities of domesticated cattle from the sites of Wangels, Siggeneben-Süd and most recently Havnø need to be interpreted more critically, because some of the bones may in fact belong to small aurochs (Heinrich 1999, 45; Gron 2013) (Fig. V.28). Furthermore, the distinction of domesticated pigs (*Sus domesticus*) from wild boar (*S. scrofa*) is also problematic, as discussed in section 7.2. Identification is often based on the fact that domesticated pigs are smaller than wild boars, which is reflected in the measurements of the length and anterior width of the M_3 (Magnell 2005). For this reason, the author has combined wild boar and domesticated pigs together in a separate category in all the presented faunal assemblages, with the same applying to sheep (*Ovis aries*) and goat (*Capra hircus*) bones. In general, sheep and goat bones tend to be underrepresented due to their higher degree of fragmentation, thus making it harder to distinguish them from other *bovidae* species.

In addition, it is also important to emphasize that most of the presented faunal assemblages have been retrieved from sites with complex stratigraphy, where it is difficult to separate layers dated to, for instance, the Late Mesolithic and the Early Neolithic (Jennbert 1984; Fischer 2002, 341ff; Hartz & Lübke 2004, 119ff; Price & Gebauer 2005). The same problem is also associated with the faunal assemblages from the Norwegian rock shelter sites (Prescott 1996). Furthermore, the faunal assemblages found in pits do not necessarily represent one episode, but perhaps several depositions, thus meaning that the dating of the bone material is debatable. Such issues became clear when several ^{14}C dates showed that redeposition had occurred in a number of pits at the Early Neolithic site of Almhov in Scania (Fig. V.34). It is therefore necessary to present the faunal assemblages within a quite broad chronological framework.

6.7. Archaeological records

The changes that occurred within the material culture in connection with the adoption of agrarian practices, mean that it is necessary to explore key objects and structures from periods before and after such a transition. By investigating the ^{14}C dates of the archaeological contexts of key artefacts, it should be possible to date their introduction and connection to agrarian expansion. Only then can we discuss the dynamics behind this agrarian expansion, the emergence of societies and the processes behind the establishment of larger networks. In South Scandinavia focus will be placed on the distribution of sites, characteristic structures and stray finds of key artefacts from the Late Ertebølle culture and the Early Neolithic, and the influences of the Michelsberg culture. In Central Scandinavia focus will be placed on key artefacts from the Middle and Late Neolithic period, as well as the influences of the Battle Axe and Bell Beaker cultures. In North Scandinavia emphasis will be placed on objects from the Bronze Age and the influences of the Nordic Bronze Age, as well as the Russian Ananino Culture.

In South Scandinavia key artefacts from the Late Ertebølle culture have been investigated. These include pointed-based ceramics and lamps (Koch 1998; Andersen 2011), T-shaped antler axes (Andersen 1998a), bone rings and combs (Vang Petersen 1984), Limhamn and Oringe axes and adzes (Vang Petersen 1984; Nicolaisen 2003), and core axes with specialized edges (Sørensen 2012a). A different material culture that emerges in southern Scandinavia at the beginning of the 4th millennium BC suggests the expansion into the region of migrating farmers from Central Europe. This consists of short-necked funnel beakers (Koch 1998), clay discs (Davidsen 1974, 5), pointed- and thin-butted axes (Nielsen 1977, 65), jade axes (Klassen 2004), imitations of jade axes (Sørensen 2012a), stone battle axes (Zápotocký 1992; Ebbesen

1998, 77; Hallgren 2008) and copper artefacts (Klassen 2000). The structures include two-aisled houses (Nielsen 1998, 9), flint mines (Becker, 1980, 456; Olausson et al. 1980, 183), long barrows (Rudebeck 2002, 119), causewayed enclosures (Andersen 1997) and megaliths (Ebbesen 2011). During the 3rd millennium BC later agrarian expansions into Norway and Central Sweden are associated with Bell Beaker ceramics (Vandkilde 2005; Sarauw 2006), flint daggers (Lomborg 1973), loom weights (Rindel 1993), Vestland adzes (Olsen & Alsaker 1984), copper artefacts (Vandkilde 1996; Melheim 2012) and two-aisled houses (Bech & Olsen 2013; Bech & Rasmussen in prep.). In North Scandinavia the focus will be placed upon objects from the Bronze Age and Metal Age, including bronze artefacts (Baudou 1995; Bolin 1999; Kaul & Rønne 2013), asbestos ceramics (Ågotnes 1986; Jørgensen & Olsen 1988; Hop 2011), soapstone vessels (Pilø 1990) artefacts of chert (Kaul & Rønne 2013) and slate objects (Søborg 1986; Hesjedal et al. 1996).

6.8. Problems with identification

The identification of certain artefact types has been reasonably straightforward, as I have followed the classification criteria of researchers who have worked on the typological aspects of a particular group of artefacts. However, there are some groups of artefacts that are difficult to identify and classsify. There are many overlaps between the various types of funnel beakers and their styles of decoration, which is why other scholars have divided the ceramic material into certain types according to standardized measurements of vessel profiles (Salomonsson 1970). In particular, the neck length of the vessel, combined with its rim diameter, has been acknowledged as being typologically significant (Koch 1998; Hallgren 2008; Nielsen 2009, 10). However, ideas about where exactly to take these measurements can vary between researchers, thus producing different results (Koch 1998). However, in general short-necked beakers (types 0-I) belong to the A group. Funnel beakers with a medium neck length (types II and III) are associated with the B group, whereas the C group consists of beakers with longer necks (types IV and V.1) (Koch 1998, 81ff; Nielsen 2009). Other difficulties have arisen in relation to core axes with specialized edges, which sometimes can be interpreted as preforms for pointed-butted flint axes (Ravn 2012). But the core axes with specialized edges often have a much narrower cutting edge than the pointed-butted axes. The classification of some of the pointed-butted flint axes has also caused problems for the author and other researchers, when trying to distinguish type 1 from type 2 (Hernek 1988; Karsten 1994). However, this problem only applied to a few axes, so the distribution pattern was not severely affected. Pointed-butted stone axes have also been associated with problems of identification, as axes with a double-sided cross section may be Limhamn adzes and axes. However, the Limhamn axes or adzes are not so intensively polished on the sides as the pointed-butted axes (Nicolaisen 2003). The identification of the various types of thin-butted axes (type I-VII) can also be a difficult task based on measurements of the length, width, neck, thickness, edge width and shorter

Fig. IV. 7. A jade axe found in the former Danish colony of the Virgin Islands, which bears typological similarities with Neolithic jade axes from Europe. The National Museum of Denmark.

side (Nielsen 1977, 64). The thin-butted axes are divided into seven types, with the first five types belonging to the Early Neolithic phases late EN I to EN II (types I-V), type VI from EN II to MN I and type VII to the Middle Neolithic phase MN II. The focus in this thesis has been upon the types belonging to the Early Funnel Beaker culture of types I-IV and especially those with a length of over 30 cm, as they have been interpreted as ceremonial axes (Nielsen 1977; Sundström 2003; Sørensen 2012a).

The identification of jade axes as originating from the European Neolithic rather than anywhere else in the world is also not always an easy task, as all of these are stray finds (Klassen 2004; Sørensen 2013a). In addition, the main problem with all the jade axes is that it is difficult to visually distinguish between Neolithic axes of alpine jadeite and imported axes of ethnographic origin from, for instance, the Caribbean islands (Fig. IV.7). In the past people brought back antiquities to Europe from various colonies in the Caribbean, including jade axes (Randsborg 2001). Denmark was no exception, as the Virgin Islands were a Danish colony from 1672 until 1917. Jade axes from the Caribbean display some of the same types, shapes and sizes as the Neolithic Alpine axes. The jade axes from the various Caribbean islands probably originate from Central American jadeite mines, thus indicating an organized long-distance trade network similar to the one suggested for the Early Neolithic cultures in Europe (Harlow 1993, 9ff; Harlow et al. 2006, 306ff; Knippenberg 2006; Pétrequin et al. 2012a). It is therefore important to carry out petrographic studies upon the jadeite from Central America, in order to exclude a Caribbean origin for jade axes found in Europe. Currently no research has been undertaken in order to compare the jadeite sources from the Italian Alps and the Caribbean sources using spectroradiometry and x-ray diffraction (Pétrequin et al. 2005; Harlow et al. 2007; 2011; Cárdenas Párraga et al. 2010; 2012; D'Amico 2012). However, preliminary studies have started, involving investigations of thin sections of jadeite sources from the Italian Alps, which do not look like the Caribbean jadeite (George Harlow pers. comm.). The jadeite samples from the Italian Alps are mostly combined with quartz and often contain a significant amount of rutile. Many jadeite sources in the Italian Alps are therefore distinctly green rather than whitish, which is also characteristic of the Caribbean jadeite sources. There is also considerable variation in other minerals in the Italian jadeite, such as the phengitic muscovite, zoisite, lawsonite, chlorite, carbonate and albite, which can overlap with the Caribbean sources. However, a distinctive feature of the Caribbean axes is their great width, a characteristic rarely seen amongst the Alpine jade types. More importantly, none of the jade axes from the Caribbean investigated in this study display any rusty plough marks. This is significant as such marks have been found on a few of the jade axes from southern Scandinavia (Klassen 2004, list 9, no. 2 and 10), indicating that they have lain in European soil and been exposed to modern agricultural tillage. The fact that jade axes are yet to be found in an archaeological context in southern Scandinavia is somewhat perplexing, as other exotic axes, such as shoe-last axes, have been found at several archaeological excavations. However, a number of imitations of jade axes made in local Scandinavian raw materials (flint, diabase or porphyry) have been found, both in archaeological contexts and as stray finds, in South Scandinavia, thus showing a clear influence from Neolithic societies in Western Europe (Sørensen 2012a; 2013c). Nevertheless, the typological classification of imitations of specific jade axes is also somewhat difficult, as several axe types are very similar to one another (Pétrequin et al. 2012c).

Misidentification can also occur in relation to flint daggers, which are actually strike-a-lights. In northern Norway, several objects that have been interpreted as Late Neolithic daggers, are in fact dagger-shaped strike-a-lights belonging to the Early Bronze Age (Johansen 1979; Kaul & Rønne 2013, 49). The reshaping of objects can also create problems. Some of the sub-types of shoe-last axes are more likely to be the result of resharpening, as opposed to representing actual types (Klassen 2004; Raemaekers et al. 2010). Thin-butted axes have also been reshaped and knapped into pointed-butted axes (Hallgren 2008). However, these axes can be identified, as the shorter sides display very limited polishing or none at all. The reuse and resharpening of flint sickles can also cause problems with identification, making it difficult to separate the various Late Neolithic and Early Bronze Age types from one another (Vang Petersen 1993). It is therefore necessary to work within a wide chronological framework when these flint sickles are involved in the discussion (Sørensen 2014). The same apparently applies to investigations of slate knives, for which several types and sub-types have been suggested (Søborg 1986; 1988). However, these slate knives have been reused and thus have changed shape, which again makes it necessary

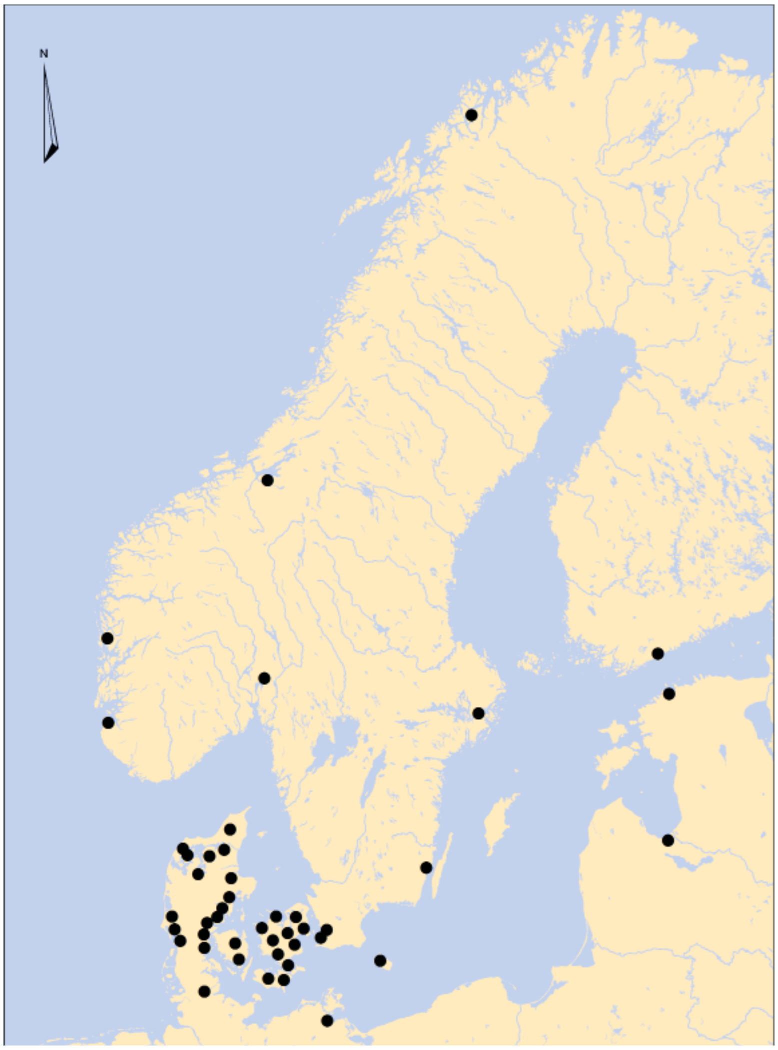


Fig. IV. 8. Museums visited in Scandinavia during the collection of data for this thesis.

to work with longer chronological periods when dealing with these artefacts (Hesjedal et al. 1996; Simonsen 1996; Ramstad 1999).

6.9. The representativeness of stray finds

Integrating unpublished stray finds with previously known sites and structures can more clearly document the range of activity in the landscape, both before and after an agrarian expansion. It is thus possible to discuss how the transitional processes of adapting agrarian practices occurred within a small and large-scale perspective in Scandinavia. Nevertheless, there are many problems attached to the use of these stray finds in the analysis. Firstly, it was important to verify their typological date with ^{14}C dated contexts that contained such artefacts. Secondly, the stray finds should, as a basic requirement, be at least connected to a parish, which meant that many finds had to be discarded from the dataset. Thirdly, if a parish could be associated with an investigated object, it was plotted in the middle of the parish on preliminary maps showing the parishes and counties in each country (Voss & Ørsnes 1961; 1963; Östergren 1999a; 1999b; 1999c). The data were then processed onto the maps published in this thesis. Combining all this available data from sites and stray finds has involved searches of literature, visits to major museums in Scandinavia and writing countless mails to

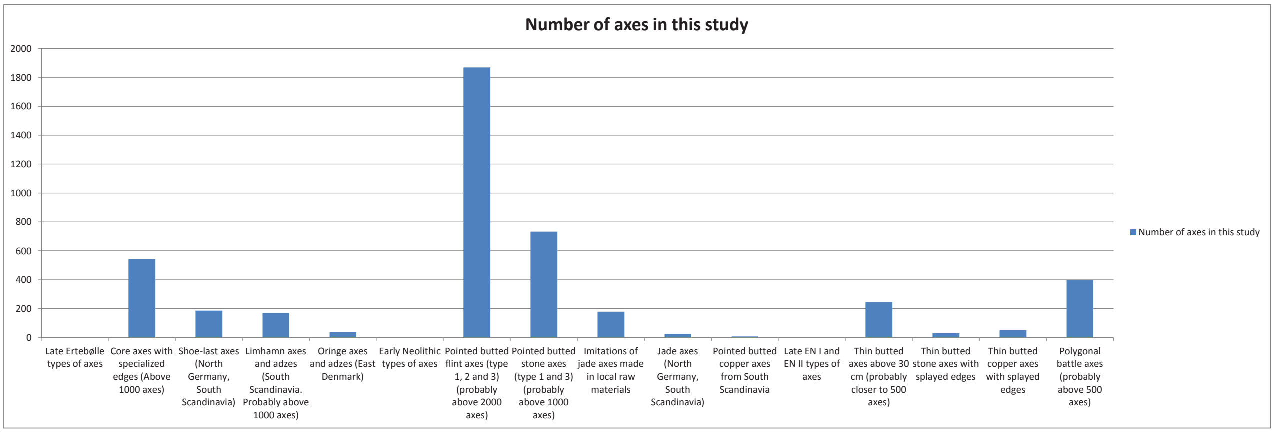


Fig. IV. 9. Number of axes studied in connection with this thesis, based on data from Table 4. Some axe types are underrepresented in the study and there are likely to be further axes, that were not examined, housed in other museums and private collections.

researchers all over Europe (Fig. IV.8). With regard to certain artefacts that are distributed extensively all over Europe, it is clear that the lack of data in some regions is caused by a lack of focus on stray finds. For instance, the absence of pointed-butted axes in Belgium is due to limited investigation, whereas the lack of these axes in Poland and Eastern Europe represents the reality, as the author and other researchers have been unable to find this type of object in Eastern Europe. The same phenomenon can be observed in the distribution of pointed-butted stone axes, which are almost absent in West Sweden.

Most of the stray finds data from Denmark comes from the National Museum of Denmark. However, it is well known that stray finds from Zealand are overrepresented in the museum's collections, because up until the 1960s the museum also acted as a local museum for Zealand. Furthermore, most of the pointed-butted flint axe assemblage at the National Museum consists of the unused and fine, polished examples. These axes were systematically selected from various local museums and private collections for the National Museum's own collection during the first half of the 20th century, thus giving a false impression, as the majority of pointed-butted axes from the local museums were often more ordinary axes that had also seen use. I have therefore gathered data from all the major local museums in Denmark, in order to create a more reliable picture of the distribution and the specific features of many types of previously unpublished stray finds. Most of the primary material has been investigated by the author in order to avoid any misunderstandings regarding the typological characterization and other distinct features studied on the various objects (Fig. IV.9). In some cases, however, other known researchers of the Neolithic and Bronze Age have contributed with data, if the author was unable to visit certain museums. The data from North Germany comes from previously published data and a search of the "Archäologisches Atlas" of stray finds at the Landesmuseum Schloß Gottorf in Schleswig. The Swedish data also comes from published material and a detailed examination of unpublished stray finds at the Swedish History Museum in Stockholm, Lund University Historical Museum and Malmö Museum. In Norway, I had the opportunity to visit all the major museums and look through their stray finds, as well as many unpublished reports and theses, which often summarize the distribution of certain types of artefacts and structures in specific regions. Processing all this data in various distribution maps has been made possible by using GIS programs that extract information from large Excel spreadsheets and published records (Table 4). Furthermore, it has not only been possible to focus on large-scale distribution, but also to integrate selected regions into the discussions of the agrarian expansions, thus documenting the complexity and variability of these processes. Such small-scale investigations have only been possible when there were large amounts of data available, which was especially the case in southern Scandinavia, Central Sweden, southern Norway and western parts of Norway (Fig. IV.10). Unfortunately, the rather dispersed distribution pattern of the sites and finds makes it difficult to document northern parts of Scandinavia in a similar way.

Fig. IV. 10. Regions where it was possible to conduct a small-scale investigation of the distribution of sites and stray finds in the transition between the Late Ertebølle culture and the Early Funnel Beaker culture.

PART V. ANALYSIS OF PRIMARY AND SECONDARY EVIDENCE FROM THE FIRST AGRARIAN SOCIETIES IN SOUTH SCANDINAVIA

7. THE ANALYSIS OF PRIMARY AGRARIAN EVIDENCE IN SOUTH SCANDINAVIA DURING THE 5TH AND 4TH MILLENNIUM BC

Firstly, the primary evidence (cereal and faunal records) of agrarian practices is presented, in order to discuss when the adoption of crop cultivation and animal husbandry occurred in South Scandinavia. Secondly, the changes in material culture from the Late Ertebølle culture to the Early Funnel Beaker culture are investigated, in order to discuss the impact the adoption of agrarian practices had on the indigenous populations. Thirdly, the identification of possible immigrating groups is discussed, together with the reasons behind the agrarian expansions into South Scandinavia. Finally, the emergence of new structures during the Early Funnel Beaker culture is debated within a European context, in order to discuss the development of both large and small-scale networks.

7.1. Evidence for cereal cultivation and processing during the transition between the Late Ertebølle culture and Early Funnel Beaker culture in South Scandinavia

Radiocarbon dates taken directly from charred cereal grains of emmer, einkorn, bread wheat and naked barley from Early Neolithic sites in southern Scandinavia show the synchronous introduction of these cultivars over a period of 300 years (4000-3700 cal BC) in the entire region of southern Scandinavia, stretching up to Bohuslän in western Sweden and Uppland in Central Sweden (Fig. V.1). It is also clear that the dated cereals are concentrated in the Malmö region, Mälardalen and Århus in Jutland, which is due to systematic and large-scale rescue excavations, thus indicating the potential for finding Early Neolithic sites (Hallgren 2008; Skousen 2008; Hadevik 2009). Nevertheless, the distribution of charred cereals from the Early Neolithic corresponds almost identically to the location of the nemoral and boreonemoral zones, which were characterized by an abundance of arable lands, a mild climate and a long growing season for crops. The finds therefore seem to respect the major vegetation border between the boreonemoral and the southern/middle boreal zones, thus suggesting that natural boundaries in the landscape may have determined the limit of this agrarian expansion during the early part of the 4th millennium BC (Fig. V.2).

The archaeobotanical cereal assemblages mainly originate from Early Neolithic inland sites located on easily worked arable soils, whereas lake shore and coastal sites show an absence of crops (Hartz et al. 2007; Andersen 2008a). Generally, the number of identified cereal grains is very low, with the exception of the material from Stensborg, where more than 3000 grains were identified (Larsson & Broström 2011, 197) (Table 6). Larger botanical assemblages have also been reported from several pits at the site of Almhov, with the grains and chaff dominated by emmer and bread wheat (Gustafsson 2004; Rudebeck 2010, 156). Recent botanical studies from Early Neolithic sites in northern Germany show that naked barley and emmer are the dominant corn species, thus showing possible regional differences in the cultivation of cereals (Kirleis et al. 2012, 224ff). Generally, it is difficult to interpret any patterns and trends within the different individual assemblages from the Early Neolithic I period (Fig. V.4). The emmer from the site of Stensborg is overrepresented, because this is the largest assemblage in southern Scandinavia. If we exclude the Stensborg material from our calculation, the assemblages consist of 873 identified charred grains, dominated by emmer and bread wheat. However, the 346 identified grain impressions on pottery, mainly from Early Neolithic inland sites, show a more even distribution of the cereal species, with a dominance of naked barley and einkorn (Tables 7). A few grain impressions are of crucial importance, as they were found on Late Ertebølle pottery sherds from the coastal sites of Löddesborg (Fig. IV.3, no. 4) and Vik (Fig. IV, no. 5) in Scania (Jennbert 1984). These early finds of cereal grains might represent a possible interaction or exchange between local hunter-gatherers and scouting farmers from Central Europe during the Late Ertebølle culture in Scania (Anthony 1990). But unfortunately, the sites contain mixed layers of Ertebølle and Early Funnel

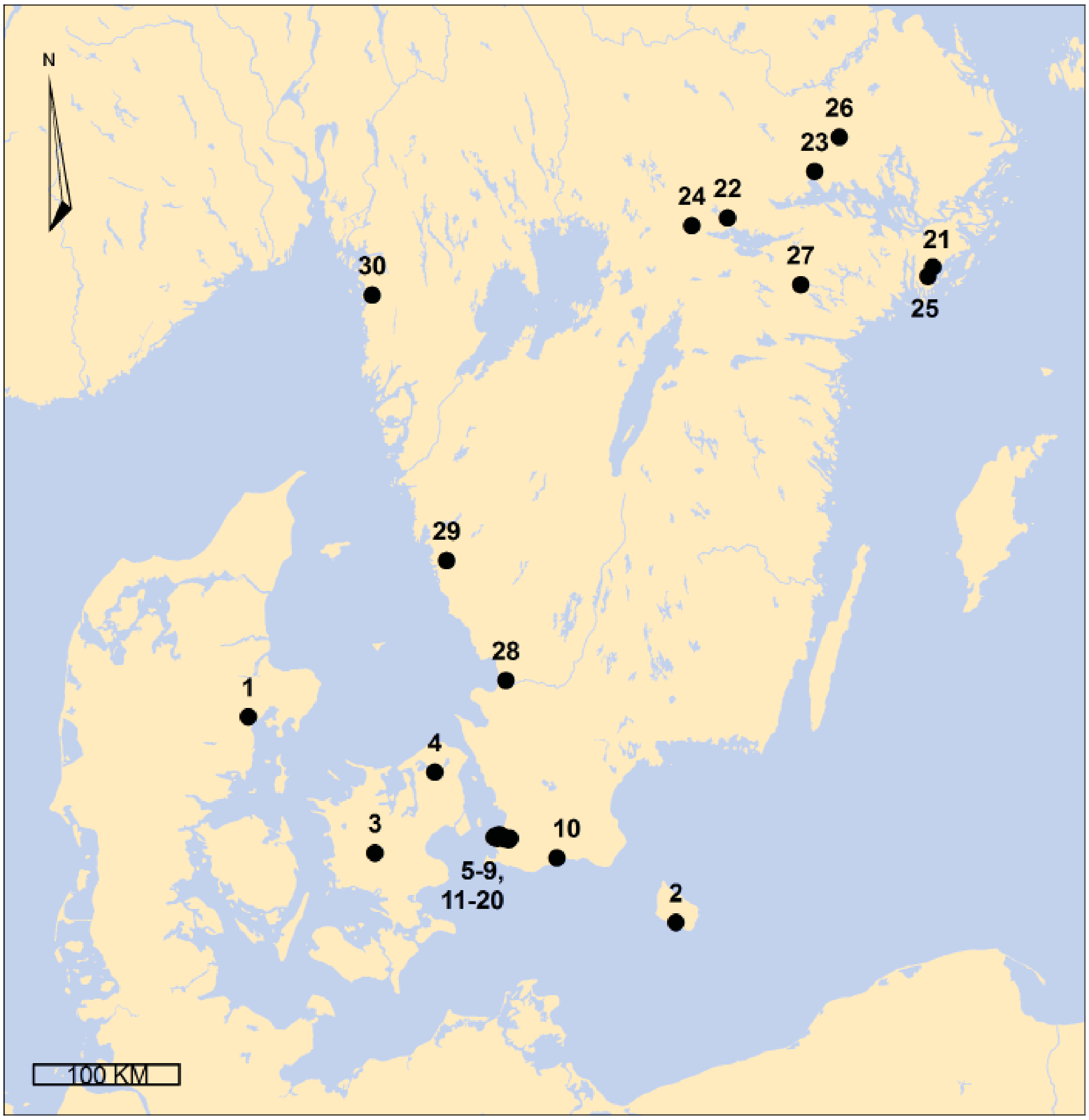


Fig. V. 1. [14]C dated cereals from the Early Neolithic in southern Scandinavia: 1. Lisbjerg Skole, 2. Limensgård, 3. Sigersted III, 4. Ullerødgård, 5. Oxie 50:1, 6. Hyllie 165:79/vattentorn, 7. Almhov, 8. Fosie 11D, 9. Svågerup industri, 10. Mossby, 11. Bunkeflostrand, 12. Lunnebjar, 13. Lockarp, 14. Fosie 11A, 15. Vintriediket, 16. Petersborg 6, 17. Svågertorp, 18. Frederiksberg 13E, 19. Bunkeflostrand, 20. Hyllie 155:91, 21. Lisseläng, 22. Skogsmossen, 23. Stensborg, 24. Hjulberga, 25. Lässmyran, 26. Nyskottet, 27. Östra Vrå, 28. Laholm 197, 29. Veddige 128/258 and 30. Skee 1616. After Larsson 1992, 74; Koch 1998; Nielsen 1999; Ryberg 2006; Hallgren 2008; Skousen 2008; Westergaard 2008; Hadevik 2009, 82ff; Rudebeck 2010, 112ff; Svensson 2010; Johansson et al. 2011; Larsson & Broström 2011, 197; Sørensen & Karg 2012. Data after Table 5.

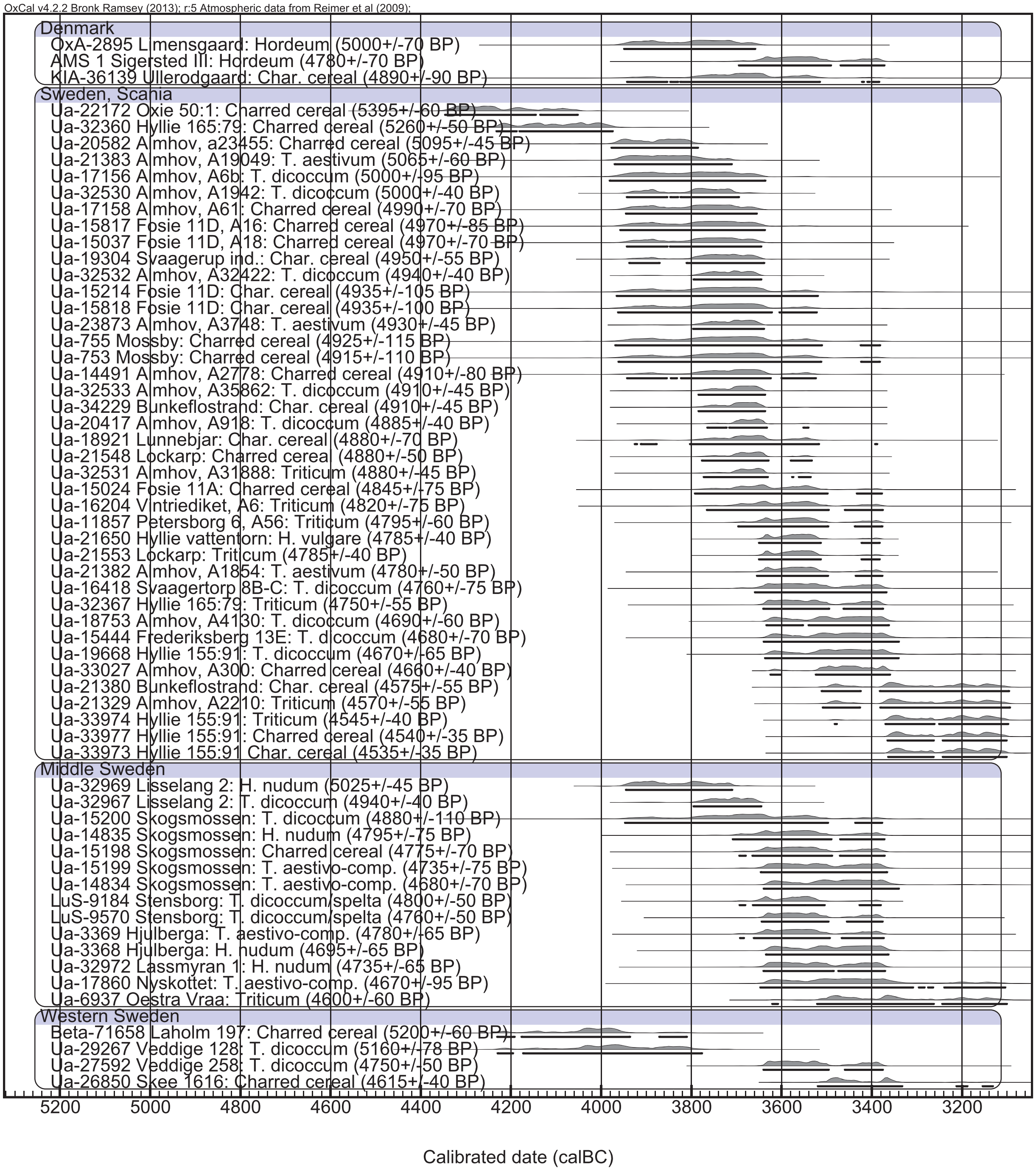


Fig. V. 2. [14]C dates of charred cereal grains from Early Neolithic sites in South Scandinavia based on data from Table 5: Denmark (Koch 1998; Nielsen 1999; Sørensen & Karg 2012), Scania (Larsson 1992, 74; Hadevik 2009, 82ff; Rudebeck 2010, 112ff), Central Sweden (Hallgren 2008; Larsson & Broström 2011, 197) and western Sweden (Svensson 2010; Johansson et al. 2011; Ryberg 2006; Westergaard 2008).

Beaker ceramics, which both have the same coarse tempering and thickness (Koch 1987, 107ff). Nonetheless, two radiocarbon dates of charred cereals from Oxie 50:1 (5395±60 BP, 4347-4053 cal BC, Ua-22172) and Hyllie 165:79 (5260±50 BP, 4233-3975 cal BC, Ua-32360) seem to support the argument that cereals were present right at the transition between the Late Ertebølle culture and the Early Funnel Beaker culture. The charred cereal from Oxie 50:1 was found in a pit containing a fragment of a polished flint axe, whereas the context from Hyllie 165:79 did not contain any diagnostic artefacts (Hadevik 2009). These ^{14}C results for cereals and their impressions, indicate that exchanges between scouting farmers and hunter-gatherers were initiated during the transition between the 5th and 4th millennium BC in certain regions of South Scandinavia (Fig. V.3). The scouting activity could afterwards, around 4000 cal BC, have resulted in small scale leapfrog migrations of pioneering farmers, thus suggesting that immigration of Central European agrarian societies was involved in the Neolithisation process. Recently Kirleis and Fischer (2014) have argued that the appearance of tetraploid free threshing wheat in the Early Funnel Beaker culture probably came from Southwestern European agricultural developments. The earliest finds of tetraploid free threshing wheat have been made at several Michelsberg sites, which may be the place of origin for some agrarian societies that immigrated to South Scandinavia.

The first evidence of cereal crop processing and the use of threshing waste from emmer wheat (*Triticum dicoccoides*) as tempering in clay discs also appear during the early part of the EN I phase, based on finds in pits from the Early Neolithic site at Lisbjerg Skole, near Århus (Skousen 2008, 124) (Fig. V.5). Hazelnut shells from these pits (A-2087, A-2092 and A2165) date to 5190±90 BP (4251-3785 cal BC, AAR-8542) and to 4975±55 BP (3942-3651 cal BC, AAR-9225). Straw or chaff tempering is also present in clay discs from the Early Neolithic site of Store Valby (Becker 1954, 134; Helbæk 1954, 198; Nielsen 1985, 119) (Table 8). Additional evidence for crop processing is recorded from a few Early Neolithic inland sites all over southern Scandinavia, such as Limensgård, Stensborg, Rastorf LA 6 and Oldenburg-Dannau LA 77 (Robinson 2003, 145ff; Larsson & Broström 2011, 197; Kirleis et al. 2012, 226ff) (Fig. V.6). Generally, evidence for cereal grains and crop processing is almost exclusively connected with Early Neolithic inland sites (Fig. V.1), in contrast to the numerous coastal or lake shore sites, where clear evidence of cultivation activities seems to be missing (Table 5). Just a few impressions of cereal grains on ceramics are documented from the coastal sites at Wangels, Bjørnsholm, Norsminde and the lake shore site of Muldbjerg I, whereas actual grains of naked barley, bread wheat and emmer are recorded in Early Neolithic layers of the Visborg kitchen midden (Helbæk 1954, 198ff; Hartz 1999a; Robinson 1999; Andersen 2008a) (Fig. V.1). Up until now, no threshing waste has been observed at any coastal or lake shore site. The strongest evidence of crop processing is reported from the long barrow located near the Bjørnsholm kitchen midden, where pollen from cereals were found (Andersen 1992, 59ff). The area surrounding Bjørnsholm is one of those locations that is characterized by sandy and easily worked arable soils.

Crop processing activities can also be revealed by the presence of quern stones, which are mostly known from Early Neolithic inland sites all over southern Scandinavia, dating from the beginning of the 4th millennium BC onwards (Lidström-Holmberg 1993; 2004; Segerberg 1999; Sundström & Darmark 2005; Hallgren 2008, 211; Nielsen 2009, 14; Rudebeck 2010, 112; Ravn 2012, 145) (Fig. V.7 and Table 8). Radiocarbon dates of pits and cultural layers containing both quern stones and short-necked funnel beakers confirm their appearance during the early EN I phase from 4000 to 3800 cal BC (Fig. V.6). Many quern stones from Denmark have also been found in connection with long barrows, thus dating them to the late EN I, from 3800 to 3500 cal BC (Table 21). It is first during the late EN I and EN II phases that a number of quern stones have been recorded from coastal sites, together with evidence of cereals (Skaarup 1973; Andersen 1991; Hallgren 2008). The results therefore document that cultivation practices during the early EN I phase were common at inland sites located on easily worked arable soils, but rare at coastal and lake shore sites. The reasons for these differences could be interpreted in two ways. Firstly, farmers may have commuted between inland and coastal zones, thus engaging themselves in different subsistence activities. Secondly, we could be dealing with cultural dualism, with farmers living in the inland zone and hunter-gatherers at coastal sites. These hunter-gatherers were not engaged in any large-scale crop cultivation, but rather in animal husbandry, keeping a few domesticated animals. Nevertheless, the difference more

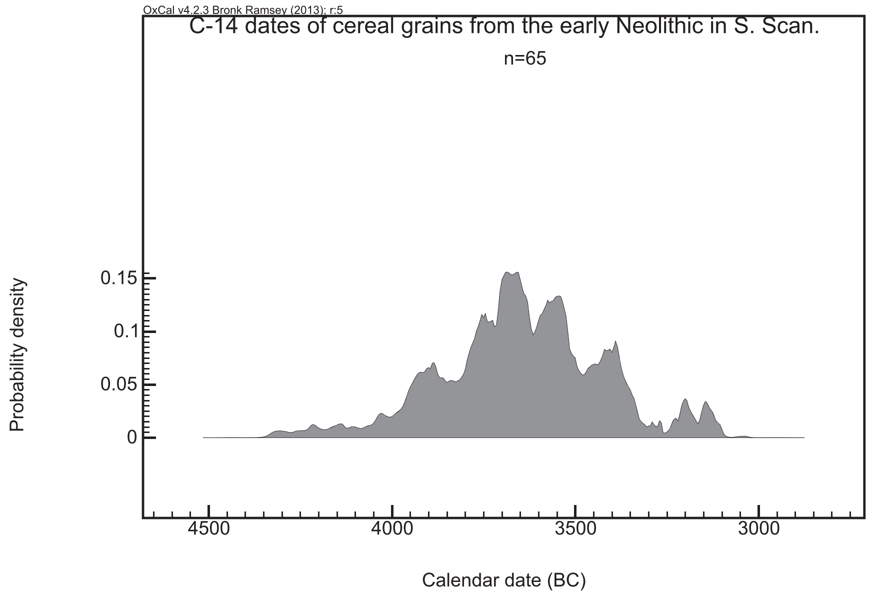


Fig. V. 3. Graph showing distribution of all ^{14}C dates of charred cereal grains from the Early Neolithic in South Scandinavia, based on data from Table 5.

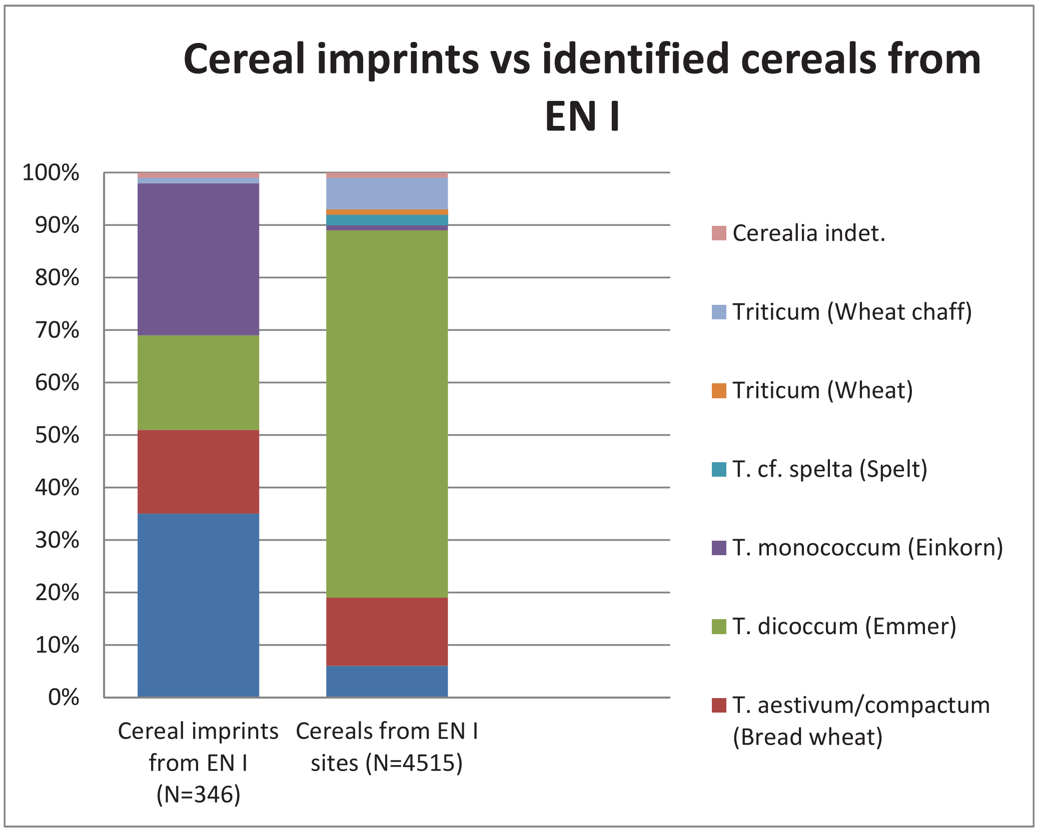


Fig. V. 4. Comparison of charred cereals and impressions of cereals on pottery from the Early Neolithic, based on data from Tables 6,7,48 and 49. After Mathiassen 1940; Helbæk 1954; Hjelmqvist 1976; Jørgensen 1976; 1981; Jennbert 1984; Larsson 1984; Andersen 1991; P. O. Nielsen 1985; 1994; Robinson 1996; 1999; 2003; Gustafsson 2004; Hallgren 2008; Skousen 2008; Rudebeck 2010; Larsson & Broström 2011.

Fig. V. 5. Threshing waste (spikelet froks and straw) from emmer wheat (*Triticum dicoccoides*) used as tempering material in a clay disc from the Early Funnel Beaker site of Lisbjerg Skole. After Skousen 2008.

or less disappeared during the late EN I, resulting in evidence of cultivation practices being found at both coastal and inland-oriented sites.

Perhaps the cultivation practices became more important or changed during the late EN I phase.

They certainly became more efficient, as evidence of cultivation has been revealed by plough marks found below the long barrow at Højensvej 7, near Egense on Funen, where the furrows covered an area of 85 square metres (Beck 2009, 7ff; 2013) (Fig. V.8). Some of the plough marks were cut by a pit, which was dated by a burnt hazelnut shell to 4900±40 BP (3770-3637 cal BC, POZ-28068), thus providing a very early date and making them the earliest from Northern Europe. Plough marks were also detected below the long barrow of Flintbek LA 3 in Schleswig-Holstein. These plough marks were, based on stratigraphic observations, assigned to the fourth construction phase of the long barrow, which based on radiocarbon dates of charcoal found in grave E was dated to 4794±30 BP (3646-3522 cal BC, KIA-41600) and 4539±30 BP (3365-3104 cal BC, KIA-41598) (Mischka 2011a, 745f) (Table 8). Plough marks of more limited extent have been detected below a number of long barrows in Jutland and on Funen, whilst later ones

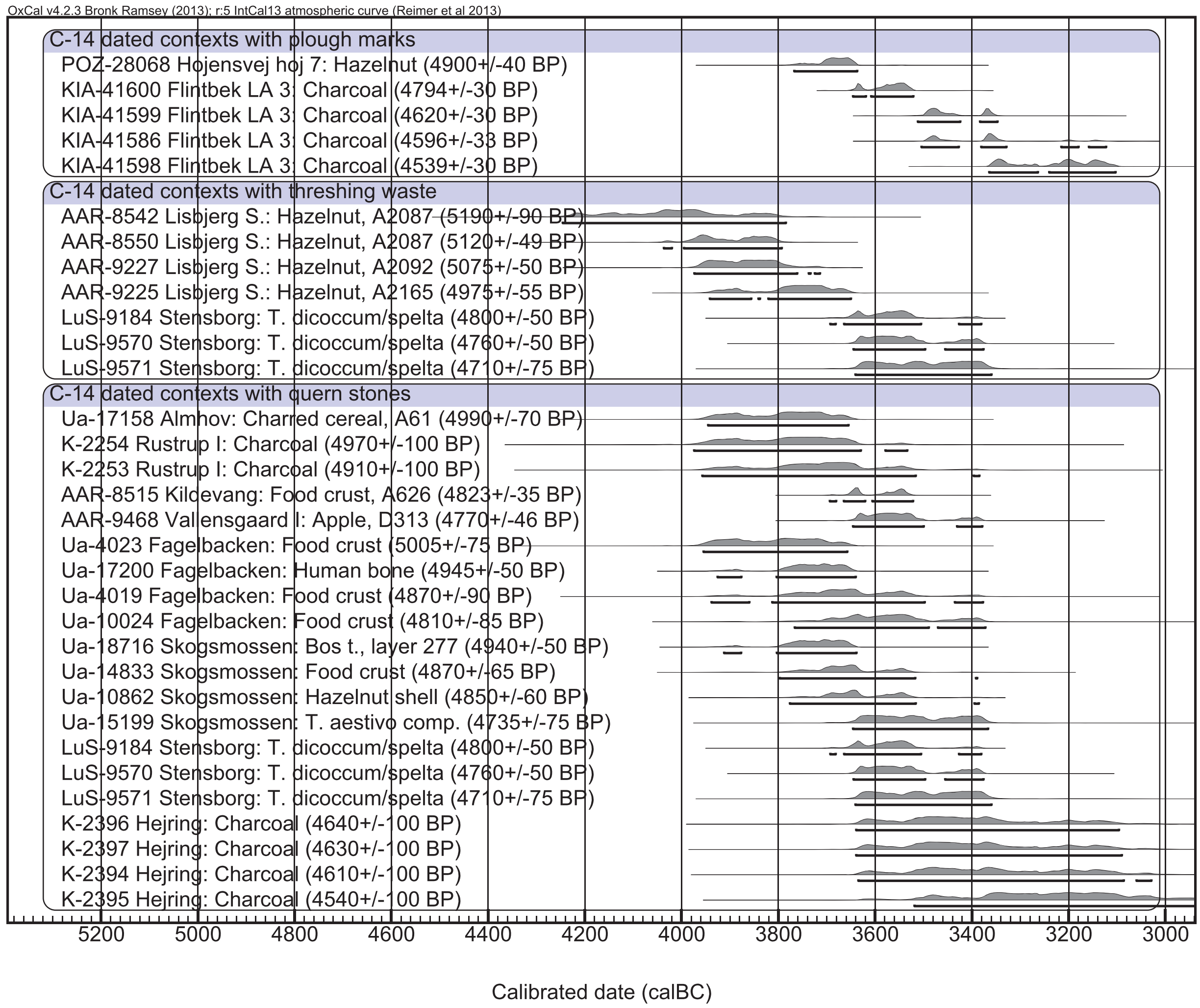


Fig. V. 6. [14]C dates of agrarian evidence consisting of plough marks, threshing waste and quern stones from archaeological contexts, based on data from Table 8. After Fischer 1976; Rudebeck 2002; 2010; Hallgren 2008; Skousen 2008; Beck 2009; 2013; Nielsen 2009; Larsson & Broström 2011; Mischka 2011b; Ravn 2011.

have been found below several megaliths (Thrane 1991; Dehn et al. 2000) (Table 29). The fact that some plough marks have been identified stratigraphically below long barrows indicates that the plough might have been used from the beginning of the Early Neolithic in South Scandinavia. Notice should definitely be taken of this clear evidence for agricultural activity in future excavations of long barrows (Jørgensen 1977, 7ff; Fischer 1980, 23ff; Thrane 1991; Ebbesen 1994, 96; N. H. Andersen 2009). The cultivation of fields using an ard to get the maximum yield from the soil was obviously a technique that was not gradually developed, but could have been almost synchronous with the appearance of the first farmers, thus supporting the argument for a rapid adoption of agrarian practices. This observation has been further supported by use-wear evidence on sickles from Early Neolithic sites, which shows cereal harvesting activities (Juel Jensen 1994). Pollen diagrams, on the other hand, first show evidence for large-scale crop cultivation practices during the late EN I and EN II phases (3800 to 3300 cal BC) in South Scandinavia.

Most of the well-dated pollen diagrams show an increase of pollen from cereals (barley or wheat), ribwort plantain, birch and charcoal dust during the late EN I and

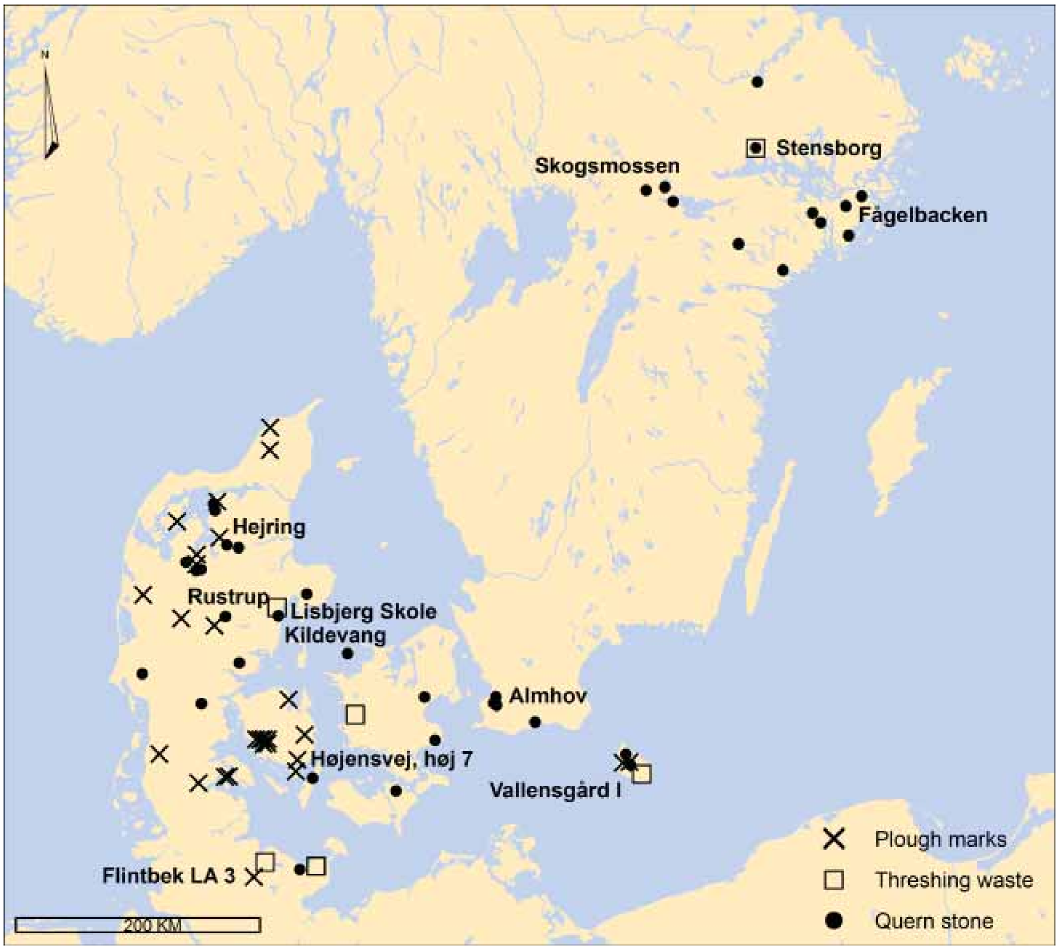


Fig. V. 7. Sites that produced evidence of plough marks, threshing waste and quern stones from the Early Funnel Beaker culture in South Scandinavia, based on data from Table 8.

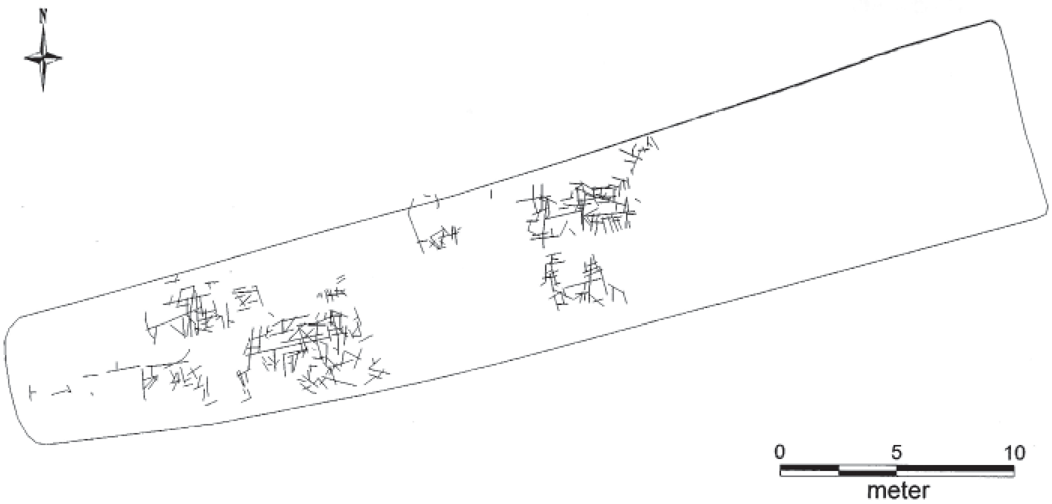


Fig. V. 8. Excavation plan from Højensvej Høj 7 showing the plough marks below the long barrow. After Beck 2013.

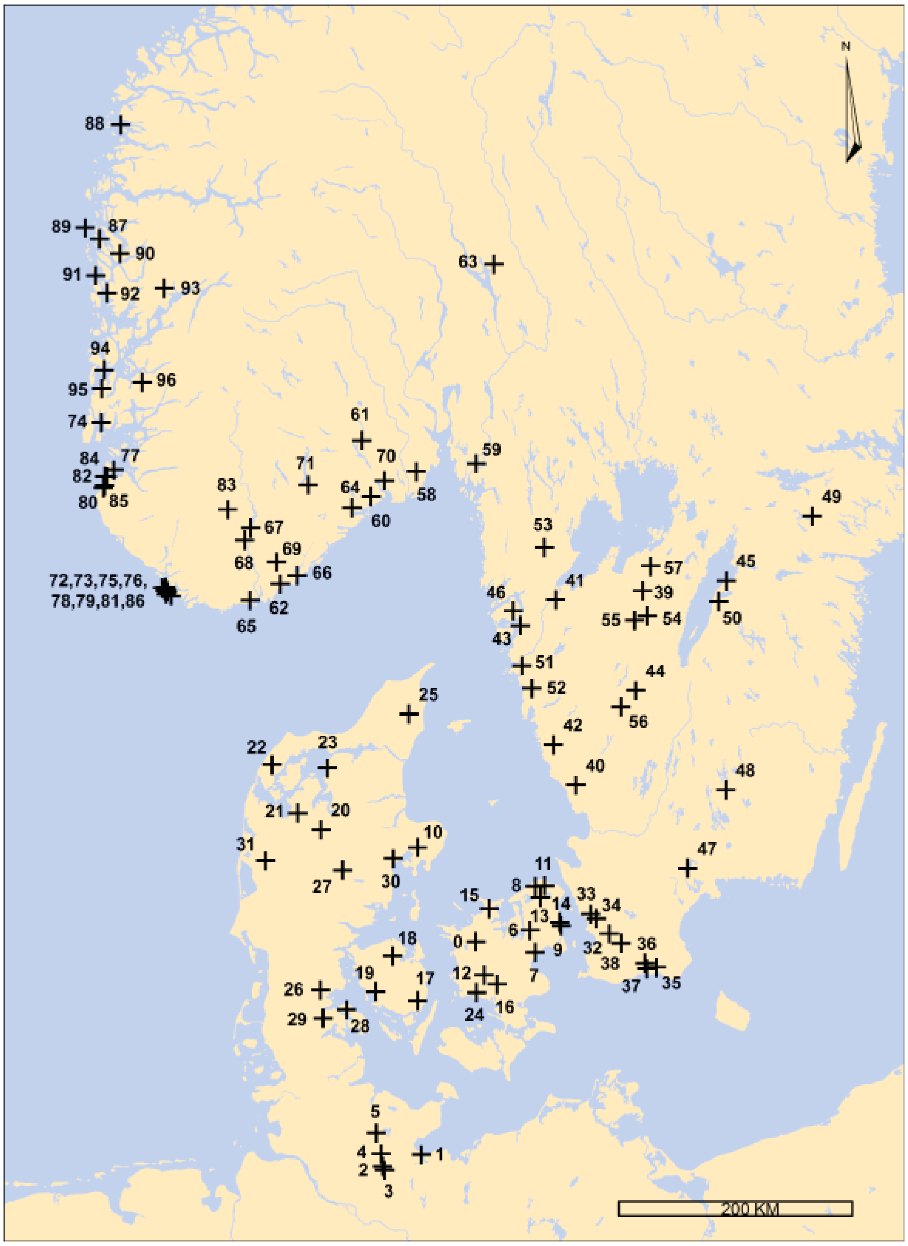


Fig. V. 9. Pollen diagrams/contexts from southern Scandinavia showing indications of animal husbandry or cultivation practices during the Early Neolithic (4000-3300 cal BC): 0. Præstelyngen (^{14}C date of elm decline), 1. Rosenhof, 2. Poggensee, 3. Lake Seefeld, 4. Grosser Segeberger See, 5. Lake Belau, 6. Gundsømagle Sø, 7. Engstrup-Stien, 8. Mønge Havegård, 9. Ordrup Mose, 10. Korup Sø, 11. Søborg Sø, 12. Næsbyholm Storskov, 13. Store Gribsø, 14. Geel Skov, 15. Trundholm 24/36, 16. Holmegårds Mose, 17. Gudme Sø, 18. Dallund Sø, 19. Strandby Skovgrave, 20. Kragesø, 21. Skånsø, 22. Ove Sø, 23. Bjørnsholm long barrow, 24. Rude long barrow, 25. Thorshøj long barrow, 26. Abkær Mose, 27. Bølling Sø, 28. Bundsø, 29. Hostrup Sø, 30. Lystrup Enge, 31. Solsø, 32. Brunnshög, 33. Kalkkällan, 34. Sjögungan, 35. Fårarps Mosse, 36. Krageholmssjön, 37. Bjärsjöholmssjön, 38. Kurarps Mosse, 39. Varnhem, 40. Tollestorpsmossen, 41. Hullsjön, 42. Sambosjön, 43. Munkeröd, 44. Dalstorpasjön, 45. Nässja, 46. Kollungerödsvattnet, 47. Ranviken, 48. Trummen, 49. Mogetorp, 50. Isberga III, 51. Tuve mosse, 52. Sagsjön, 53. Sjömyretjärn, 54. Åsle mosse, 55. Hulesjön, 56. Tranemosjön, 57. Flarken, 58. Napperødtjern, 59. Haraldstadmyr, 60. Skogtjern, 61. Sagavoll, 62. Barlindtjern, 63. Narmo, 64. Pøddetjønn, 65. Vesttjønn, 66. Tjoresteinmyren, 67. Tveitå fiskeløsvann, 68. Ullebjerg fiskeløs, 69. Verenvann, 70. Demingen, 71. Fiskejern, 72. Skjolnes, 73. Kviljotjønn, 74. Sandvikvatn, 75. Præstvann, 76. Braastadvann, 77. Lassatjern, 78. Hallandsvann, 79. Monatjønn, 80. Bybergsletten, 81. Jølletjønn, 82. Solavika, 83. Solbu stølsområde, 84. Breiavatn, 85. Ølstervatn, 86. Hanangervann, 87. Kotedalen, 88. Botnaneset, 89. Vestmyr, 90. Blautamyri, 91. Kåsa, 92. Bjorøy, 93. Osmunda regalis, 94. Storamyro/lok. 99, 95. Sveio golfbane and 96. Flaatevatn. Data and references from Table 9.

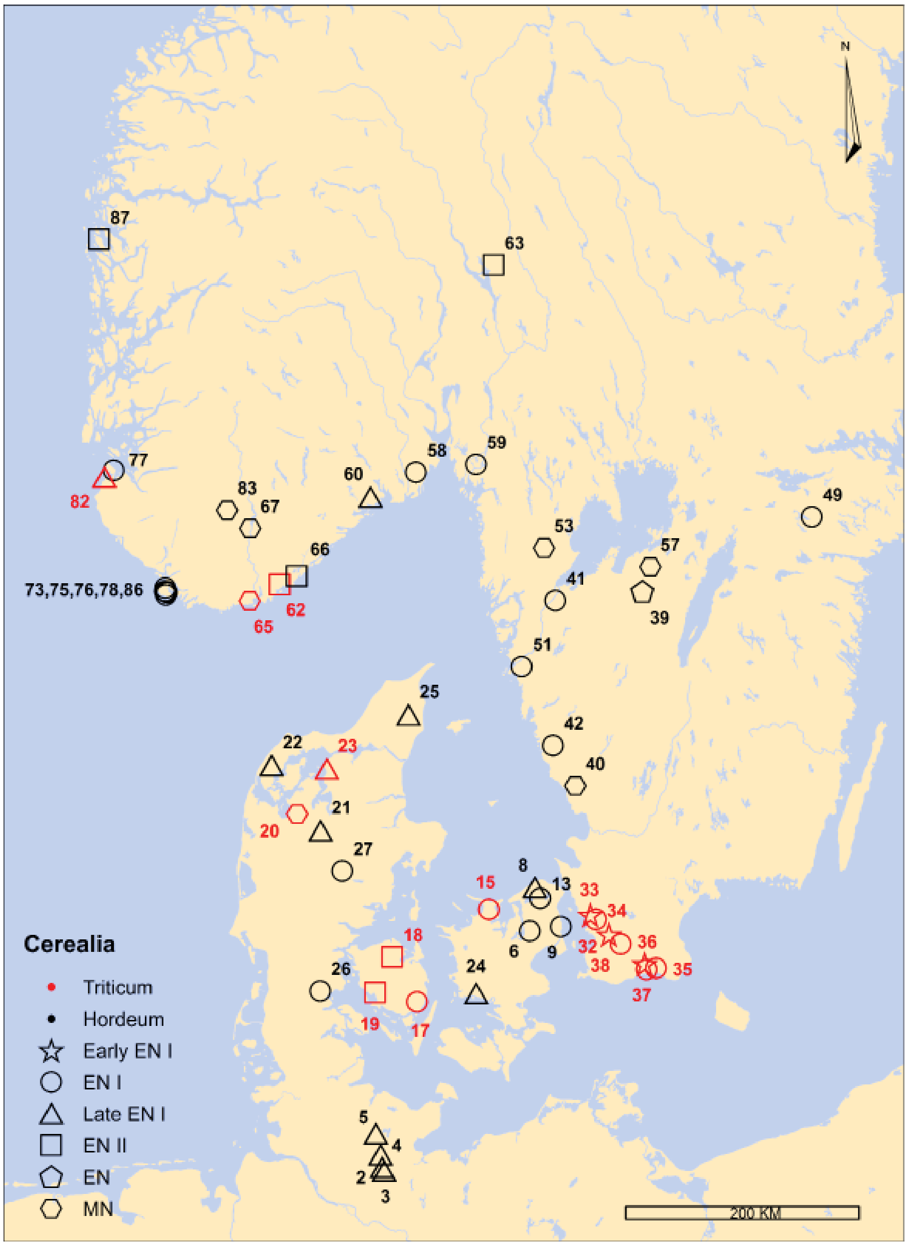


Fig. V. 10. Pollen diagrams/contexts from southern Scandinavia showing indications of cultivation based on Cerealia pollen (*Hordeum/barley*) at: 2. Poggensee, 3. Lake Seefeld, 4. Grosser Segeberger See, 5. Lake Belau, 6. Gundsømagle Sø, 8. Mønge Havegård, 9. Ordrup Mose, 13. Store Gribsø, 20. Kragesø, 21. Skånsø, 22. Ove Sø, 24. Rude long barrow, 25. Thorshøj long barrow, 26. Abkær Mose, 27. Bølling Sø, 31. Solsø (Late Neolithic), 36. Krageholmssjön, 39. Varnhem, 40. Tollestorpsmossen, 41. Hullsjön, 42. Sambosjön, 49. Mogetorp, 51. Tuve mosse, 53. Sjömyretjärn (Middle Neolithic), 57. Flarken (Middle Neolithic), 58. Napperødtjern, 59. Haraldstadmyr, 60. Skogtjern, 63. Narmo, 66. Tjoresteinmyren (Middle Neolithic), 67. Tveitå fiskeløsvann (Middle Neolithic), 73. Kviljotjønn, 75. Præstvann, 76. Braastadvann, 77. Lassatjern, 78. Hallandsvann, 83. Solbu stølsområde (Middle Neolithic), 86. Hanangervann and 87. Kotedalen. Data and references from Table 9. Pollen diagrams/contexts from southern Scandinavia, showing indications of cultivation based on Cerealia pollen (*Triticum*/wheat): 15. Trundholm 24, 17. Gudme Sø, 18. Dallund Sø, 19. Strandby Skovgrave, 20. Kragesø, 21. Skånsø, 23. Bjørnsholm long barrow, 32. Brunnshög, 33. Kalkkällan, 34. Sjögungan, 35. Fårarps Mosse, 36. Krageholmssjön, 37. Bjärsjöholmssjön, 38. Kurarps Mosse, 62. Barlindtjern, 65. Vesttjønn (Middle Neolithic) and 82. Solavika. Data and references from Table 9.

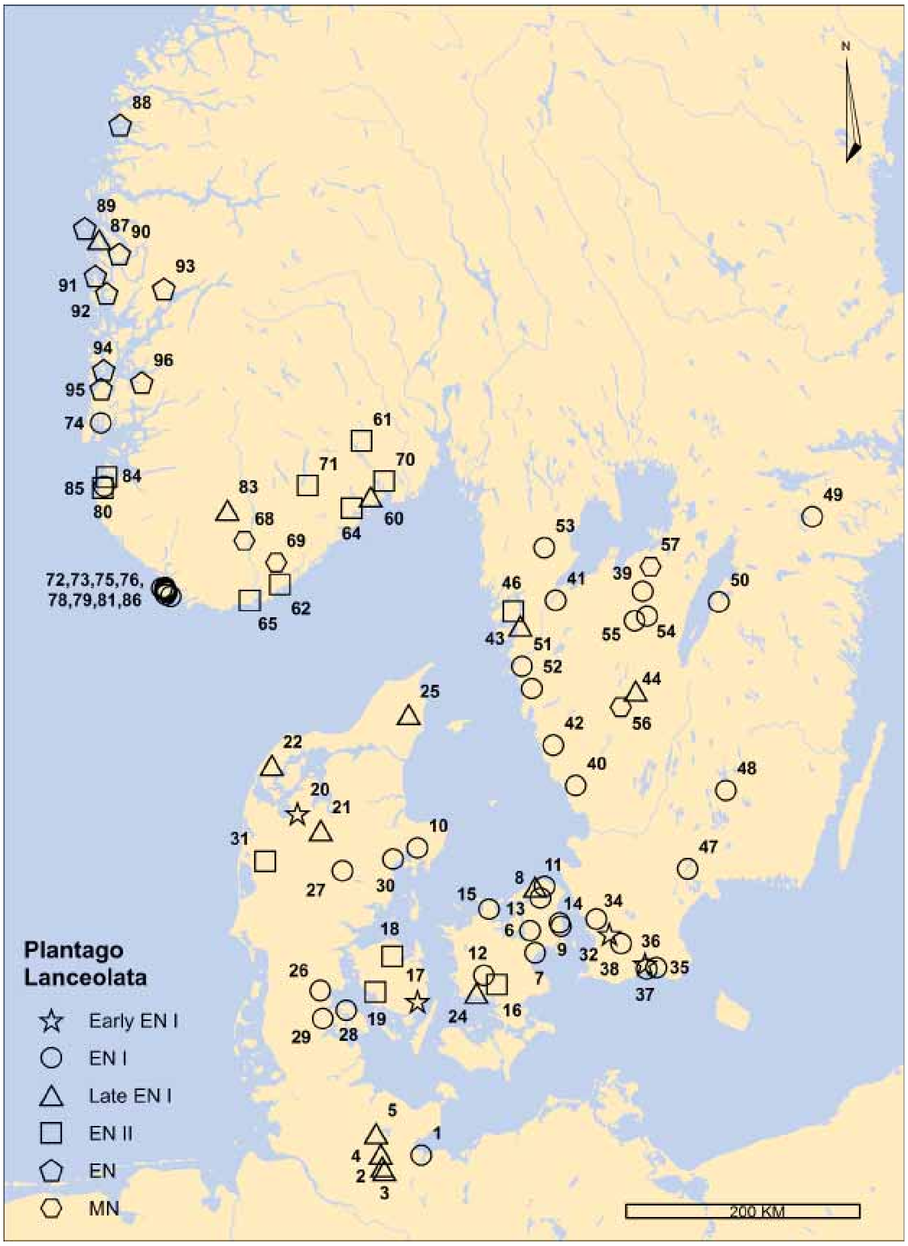


Fig. V. 11. Pollen diagrams/contexts from southern Scandinavia showing indications of animal husbandry (*Plantago lanceolata*/ribwort plantain) at: 1. Rosenhof, 2. Poggensee, 3. Lake Seefeld, 4. Grosser Segeberger See, 5. Lake Belau, 6. Gundsømagle Sø, 7. Engstrup-Stien, 8. Mønge Havegård, 9. Ordrup Mose, 10. Korup Sø, 11. Søborg Sø, 12. Næsbyholm Storskov, 13. Store Gribsø, 14. Geel Skov, 15. Trundholm 24/36, 16. Holmegårds Mose, 17. Gudme Sø, 18. Dallund Sø, 19. Strandby Skovgrave, 20. Kragesø, 21. Skånsø, 22. Ove Sø, 24. Rude long barrow, 25. Thorshøj long barrow, 26. Abkær Mose, 27. Bølling Sø, 28. Bundsø, 29. Hostrup Sø, 30. Lystrup Enge, 31. Solsø, 32. Brunnshög, 33. Kalkkällan, 34. Sjögungan, 35. Fårarps Mosse, 36. Krageholmssjön, 37. Bjärsjöholmssjön, 38. Kurarps Mosse, 39. Varnhem, 40. Tollestorpsmossen, 41. Hullsjön, 42. Sambosjön, 43. Munkeröd, 44. Dalstorpasjön, 46. Kollungerödsvattnet, 47. Ranviken, 48. Trummen, 49. Mogetorp, 50. Isberga III, 51. Tuve mosse, 52. Sagsjön, 53. Sjömyretjärn, 54. Åsle mosse, 55. Hulesjön, 56. Tranemosjön, 57. Flarken, 60. Skogtjern, 61. Sagavoll, 62. Barlindtjern, 64. Pøddetjønn, 65. Vesttjønn, 68. Ullebjerg fiskeløs, 69. Verenvann, 70. Demingen, 71. Fiskejern, 72. Skjolnes, 73. Kviljotjønn, 74. Sandvikvatn, 75. Præstvann, 76. Braastadvann, 78. Hallandsvann, 79. Monatjønn, 80. Bybergsletten, 81. Jølletjønn, 83. Solbu stølsområde, 84. Stavanger Airport, 85. Ølstervatn, 86. Hanangervann, 87. Kotedalen, 88. Botnaneset, 89. Vestmyr, 90. Blautamyri, 91. Kåsa, 92. Bjorøy, 93. Osmunda regalis, 94. Storamyro/lok. 99, 95. Sveio golfbane and 96. Flaatevatn. Data and references from Table 9.

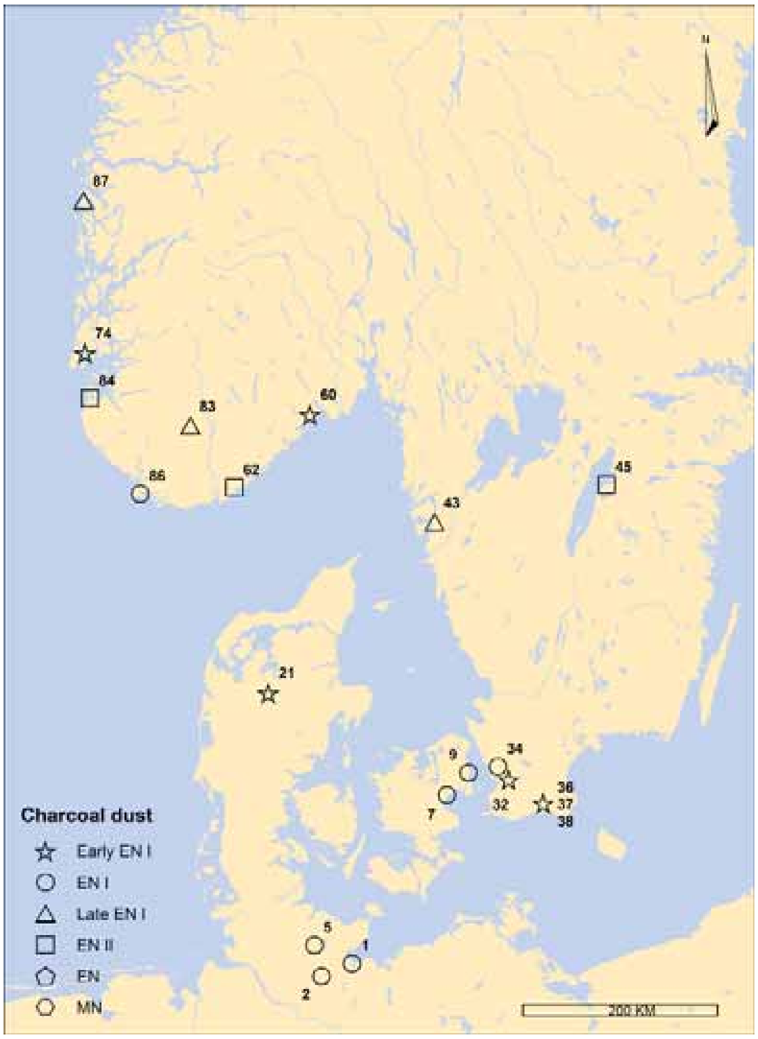


Fig. V. 12. Pollen diagrams/contexts from southern Scandinavia showing an increase of charcoal dust shortly after the *Ulmus*/elm decline: 1. Rosenhof, 2. Poggensee, 5. Lake Belau, 7. Engstrup-Stien, 9. Ordrup Mose, 21. Skånsø, 32. Brunnshög, 34. Sjögungan, 36. Krageholmssjön, 37. Bjärsjöholmssjön, 38. Kurarps Mosse, 43. Munkeröd, 45. Nässja, 60. Skogtjern, 62. Barlindtjern, 74. Sandvikvatn, 83. Solbu stølsområde, 84. Breiavatn, 86. Hanangervann and 87. Kotedalen. Data and references from Table 9.

EN II phases in North Germany, Denmark and Central Sweden (Digerfeldt & Welinder 1989; S. Th. Andersen 1993; Lindman 1993; Göransson 1994; Odgaard 1994; Rasmussen et al. 1998; Sjögren 2003; Rasmussen 2005; Feeser et al. 2012) (Figs. V.9, V.14, Table 9 and Plate 1). Notably, pollen analyses of the mounds of round and long barrows have shown significant amounts of weed pollen (S. Th. Andersen 1993; Westphal 2009) (Plate 2). The results indicate that these burial structures were situated in isolated open areas, as other regional diagrams have indicated a quite dense forest during the Early Neolithic. It is therefore questionable how important cultivation practices were during the first few centuries of the 4th millennium BC in South Scandinavia. The lack of impact in the early EN I may be due to the methodological problems discussed in section 6.4 or the fact that the clearances of the forest simply were only sporadic in many regions. However, in Scania there is evidence of a pollen increase for cereals, ribwort plantain and birch by the early EN I phase, which corresponds with the direct radiocarbon

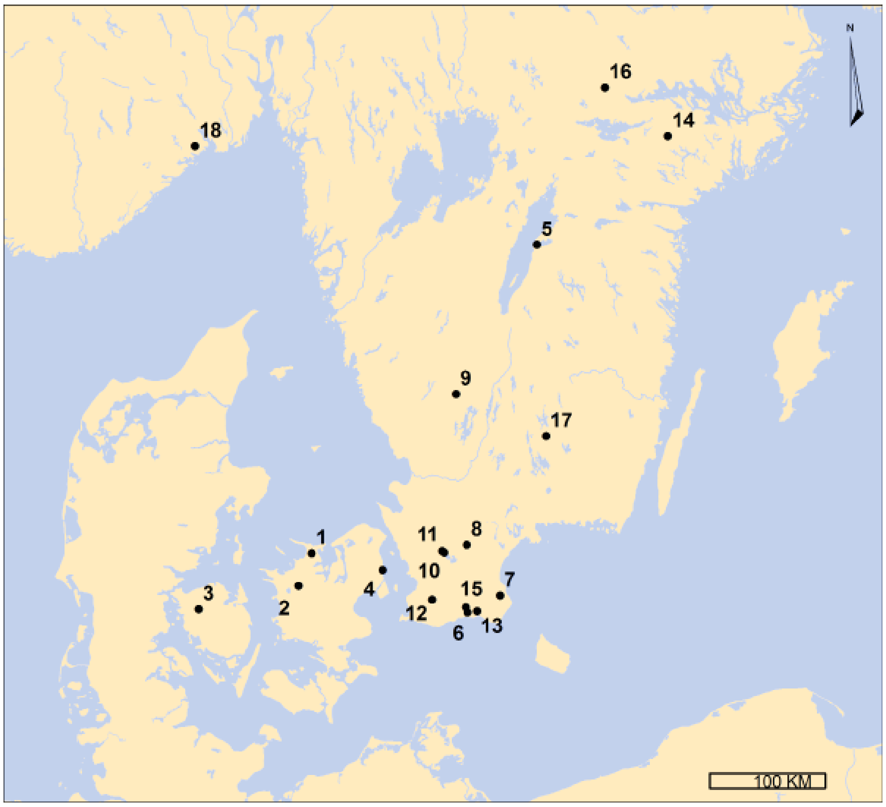


Fig. V. 13. Suggested cereals observed before the *Ulmus*/elm decline in pollen diagrams in southern Scandinavia: 1. Trundholm (Kolstrup 1988, fig. 2 & 3), 2. Aamosen (Kolstrup 1988, 508), 3. Neverkjær (Troels-Smith 1982, fig. 2), 4. Ordrup Mose (Iversen 1949, fig. 8), 5. Dags Mosse (Göransson 1986, fig. 4), 6. Bjärsjöholmssjön (Göransson 1991, diagram T), 7. Nebbe Mosse (Stjernquist et al. 1953, fig. 14), 8. Vätteryds Mosse (Tilander 1958, fig. 2), 9. Spånsjön (Fries 1958, diagram 2a), 10. Ageröd I (Nilsson 1967, fig. 5B, 15A/B, 18 & 19A), 11. Henning Boställe (Nilsson 1967, fig. 28), 12. Bökeberg III (Regnell et al. 1995, fig. 10), 13. Fårarps Mosse (Berglund et al. 1991, fig. 4.1.1), 14. Östersjön (Welinder 1974, Plate 5), 15. Krageholmssjön (Regnell 1989, Plate 1), 16. Vitmossen (Florin 1977, fig. 17), 17. Trummen (Digerfeldt 1972, diagram MBP 3) and 18. Skogtjern (Wieckowska-Lüth 2013, 11). Data after Table 10.

dates for charred cereals in Scania (Berglund 1991; Lagerås 2008; Regnell & Sjögren 2006) (Figs. V.10-11 and V.14). The adoption of cultivation practices and the opening up of the landscape may therefore have occurred at a different pace in various regions of South Scandinavia. But such observations are dependent upon well dated pollen diagrams. Nevertheless, the many pollen diagrams lacking radiocarbon dates still show an increase of pollen from cereals, ribwort plantain, birch and sometimes charcoal dust just after the decline of elm. The decline of elm, as previously mentioned, has been radiocarbon dated to the beginning of the 4th millennium BC (Rasmussen 1995). These pollen diagrams therefore show impact on the landscape caused by the pioneering farmers during the Early Neolithic period in general.

Currently, the archaeological evidence clearly supports the argument that crop cultivation activities began to be used at the beginning of the 4th millennium BC in South Scandinavia. Nonetheless, some researchers, based on pollen analysis, have argued that small-scale crop cultivation practices began to be utilized during the Late Mesolithic in southern Scandinavia. This argument has been associated with claims of Cerealia pollen being found in layers that are stratigraphically below the elm decline in South Scandinavia, thus indicating that crop cultivation practices were used during the Mesolithic (Iversen 1949; Stjernquist et al. 1953; Fries 1958; Tilander 1958; Nilsson 1967; Digerfeldt 1972; Welinder 1974; Florin 1977; Troels-Smith 1982; Göransson 1986; 1991; Kolstrup 1988; Regnell 1989; Berglund et al. 1991; Reg-

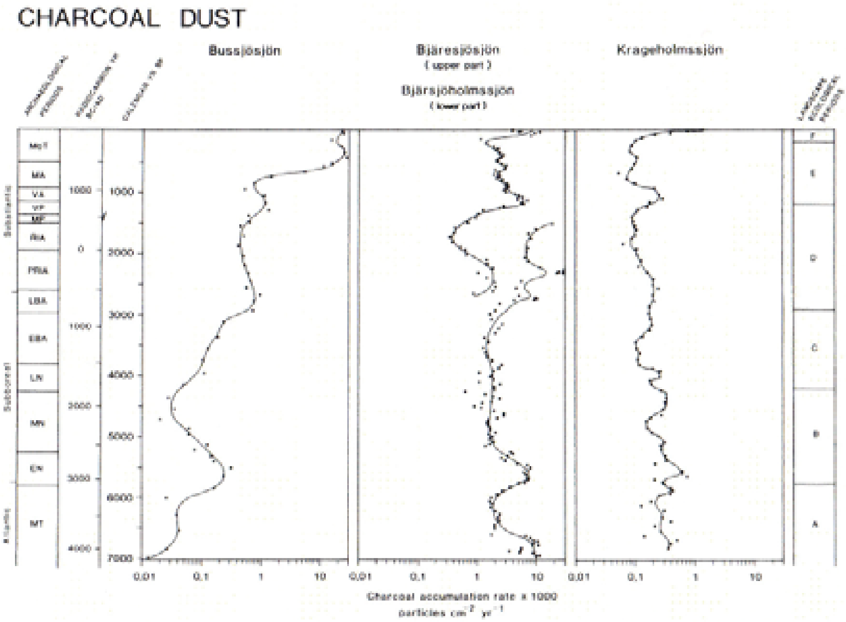


Fig. V. 14. Samples from three different pollen diagrams from south-west Sweden (Bussjösjön, Bjärsjöholmssjön and Krageholmssjön), which show an increase of charcoal dust at the beginning of the Early Neolithic around 4000 cal BC. After Digerfeldt & Welinder 1989.

nell et al. 1995) (Fig. V.13 and Table 10). However, the evidence from the pollen diagrams, as argued in section 6.4, is associated with many methodological problems. Difficulties separating pollen from wild grasses and cereals can produce misleading results. Fortunately, some researchers acknowledge that such evidence does not indicate agrarian cultivation, but instead reflects inconsistency in the definition and measurement of cereal pollen (Wieckowska-Lüth 2013). The presence of ribwort plantain (*Plantago lanceolata*) has also been suggested as evidence of an open landscape created by agrarian practices (Table 9). However, if pollen diagrams were to be taken from areas near the coast, where the landscape is already naturally open, then the claim that increased quantities of ribwort plantain has anything to do with agrarian practices seems tenuous. The continuous presence of ribwort plantain has been used to argue for the uninterrupted use of agrarian practices in western Norway throughout the Early and Middle Neolithic. However, many pollen diagrams have been sampled in coastal areas, which means that ribwort plantain cannot necessarily be used as an argument for agrarian practices in southern and western parts of Norway (Bakka & Kaland 1971; Henningsmoen 1980; Høeg 1982; 1989; 1995; 2002; Østmo 1988; Christiansson & Knutsson 1989; Vorren et al. 1990; Hjelle et al. 1992; Prøsch-Danielsen 1996; 1997; Prøsch-Danielsen & Simonsen 2000; Simonsen & Prøsch-Danielsen 2005; Prøsch-Danielsen & Selsing 2009) (Fig. V.11). The fact that many of the southern and western Norwegian pollen diagrams have been sampled in coastal zones in a more open landscape also questions the identification of Cerealia pollen, which may equally well be pollen from wild grasses.

The lack of archaeobotanical material and domesticated animal bones from southern and western Norway during the Early and Middle Neolithic, as well as the limited quantity of cereal pollen from pollen diagrams, suggest that agrarian practices were very limited (Solheim 2012). However, a recent pollen diagram from Skogtjern in Telemark shows pollen grains of Cerealia and ribwort plantain, which were recorded using very detailed counts and were dated to the late EN I and EN II (Plate 1). It is therefore possible that cultivation practices were in use in certain parts of southern and western Norway, but these interpretations really need to be verified with finds of charred cereals dated to the Early Neolithic (Wieckowska-Lüth et al. 2013). The lack of charred cereals may be explained by the limited excavation of Early Neolithic sites located on easily worked arable soils (Østmo 1988). However, large-scale rescue excavations, in which soil

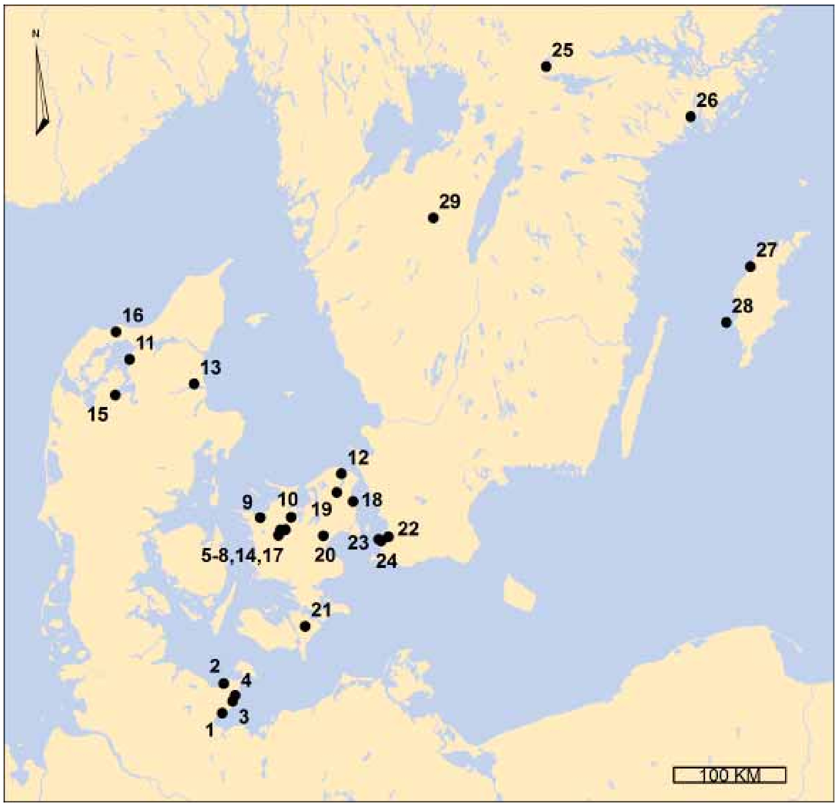


Fig. V. 15. ^{14}C dated bones of domesticated cattle from the Early Neolithic in southern Scandinavia: 1. Neustadt, 2. Wangels LA 505, 3. Rosenhof LA 58, 4. Siggeneben-Süd, 5. Knoglebo, 6. Åkonge, 7. Skolæstbo, 8. Muldbjerg I, 9. Smakkerup Huse, 10. Øgårde I, 11. Åle, 12. Snævret Hegn, 13. Visborg, 14. Bodal A, 15. Krabbesholm II, 16. Kærup, 17. Kildegård, 18. Maglemosegård, 19. Holmene, 20. Snoldelev Mose, 21. Borremose, 22. Hindbygården, 23. Bunkeflostrand 3:1, 24. Almhov, 25. Skumpaberget, 26. Trössla, 27. Stora Karlsö, 28. Grottan and 29. Karleby 10. Data from Table 11.

samples were taken, have not produced any evidence of agrarian activities (Glørstad 2010; Solheim 2012). Furthermore, there is no evidence of grain impressions on any of the numerous Early and Middle Neolithic pottery sherds that have been found in southern and western Norway.

7.2. Evidence of domesticated animals during the transition between the Late Ertebølle culture and Early Funnel Beaker culture in South Scandinavia

Bones of domesticated cattle (*Bos Taurus*) have been recorded all over southern Scandinavia in the period 4000 to 3700 BC, and are more or less contemporary with the evidence for cereal cultivation (Fig. V.15 and Table 11). The earliest finds dated to the transition between the Late Ertebølle and the Early Funnel Beaker culture have been recovered in Schleswig-Holstein, at sites like Neustadt (5235±31 BP, 4226-3968 cal BC, KIA-30590) and Wangels LA 505 (5165±45 BP, 4143-3802 cal BC, AAR-4998) (Fig. V.16). But whether the domesticated cattle bones were found in Late Ertebølle or Early Neolithic layers is uncertain, as these coastal sites in North Germany are characterized by intermixed layers caused by Late Atlantic and Subboreal transgressions (Hartz & Lübke 2004, 136; Hartz et al. 2007; Craig et al. 2011). The earliest directly dated cattle bones from Denmark date to around 4000 to 3800 cal BC, and come from several lake shore sites (Knoglebo, Åkonge, Skolæstbo, Muldbjerg I, Øgårde I, Snævret Hegn and Bodal A) located in and around the Åmose Lake. Coastal sites in Denmark tend, on the other hand, to be a little later, concentrating around 3900 to 3600 cal BC (Table 11). In Scania there are only a few direct dates for cattle bones, which come from Almhov, these also dating to around 3800 to 3600 cal BC, which is later than the evidence for crop cultiva-

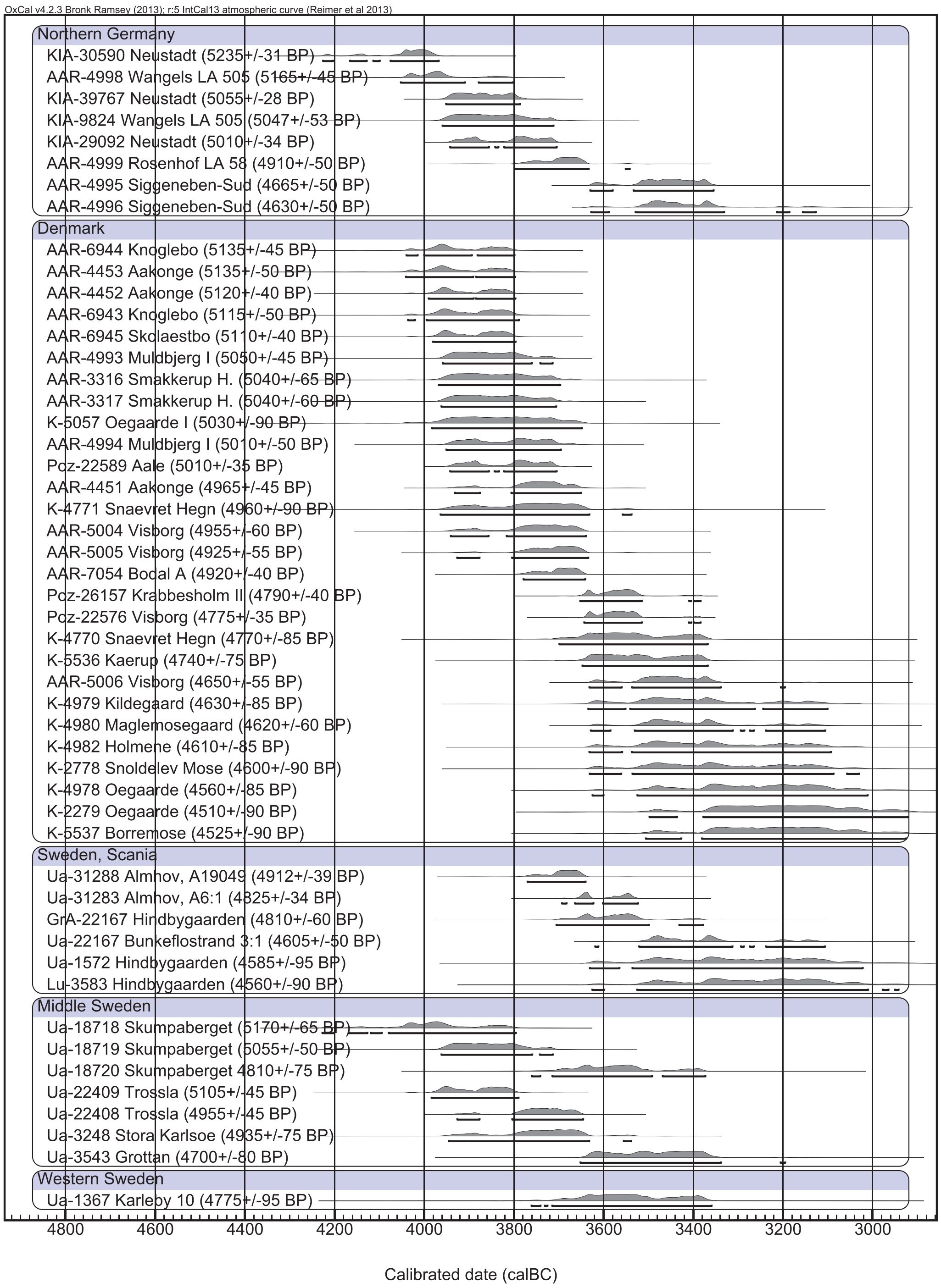


Fig. V. 16. [14]C dated bones of domesticated cattle from the Early Neolithic in southern Scandinavia. After Lindqvist & Possnert 1997; Koch 1998; Heinemeier & Rud 1999; 2000; Persson 1999; Heinemeier 2002; Hartz & Lübke 2004; Noe-Nygaard et al. 2005; Price & Gebauer 2005; Sørensen 2005; Hallgren 2008; Hadevik 2009; Craig et al. 2011; Enghoff 2011; Ola Magnell pers. comm.

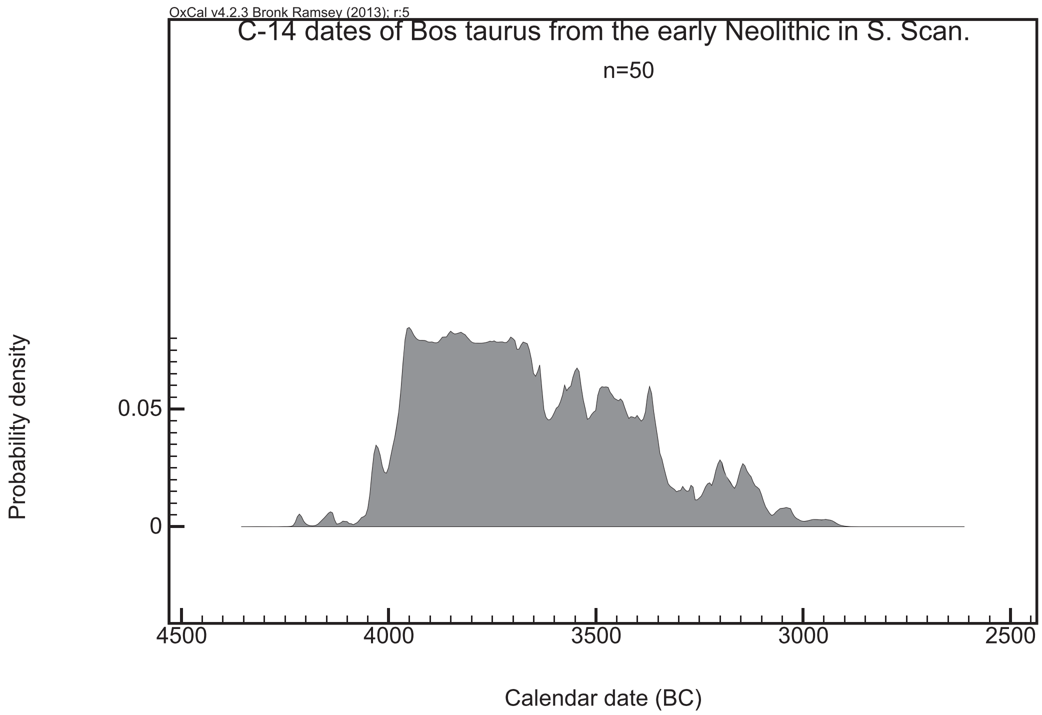


Fig. V. 17. Graph showing distribution of all ^{14}C dates of domesticated cattle bones from the Early Neolithic in South Scandinavia, based on data from Table 11.

tion practices (see section 7.1). From Gotland there is a single radiocarbon date for a cow of 4935±75 BP (3946-3539 cal BC, Ua-3248) from Stora Förvar, thus proving that early farmers transported livestock over open water during the agrarian expansions in South Scandinavia (Lindqvist & Possnert 1997; Rowley-Conwy 2011). In East Central Sweden the direct radiocarbon dates are also concentrated around 4000 to 3700 cal BC, whereas in West Sweden only one cattle bone has been dated to the Early Neolithic. The number of directly dated cattle bones varies from region to region, depending on the preservation conditions for organic material, which leads to differences in the dating of when these animals were introduced. The few cattle bones from the coastal sites of North Germany may be interpreted as the result of exchanges between scouting farmers and Ertebølle hunter-gatherers around the transition between the 5th and 4th millennium BC (Anthony 1990). However, the general abundance of directly dated cattle bones indicates that this species was introduced during the EN I phase, perhaps in connection with a minor migration of pioneering farmers (Fig. V.17).

It was previously believed that domesticated cattle came to North Germany as early as the Middle Ertebølle culture. But molecular genetic analysis can now prove that the presumed domesticated cattle from Rosenhof LA 58 and 83, dated to 4700 cal BC, were actually small aurochs (*Bos primigenius*) (Hartz & Lübke 2004; Noe-Nygaard et al. 2005). This may also apply to the presumed domesticated cattle from Hindbygården in Scania, dated to 5570±110 BP (4702-4173 cal BC, Ua-1575) (Hadevik 2009, 82ff). Another early cattle find of a tooth from Lollikhuse is dated to 5890±55 BP (4929-4612 cal BC, AAR-7410-2) (Sørensen 2005, 305). This find must now be rejected as a cattle tooth because of negative aDNA analyses results. Furthermore, the zoological identification of the tooth cannot be verified by other researchers, as it was destroyed in the process of sampling collagen for the radiocarbon date and aDNA analyses (Rowley-Conwy 2011; Brinch Petersen 2015; Knud Rosenlund pers. comm.) (Fig. IV.2). Early cattle bones from Smakkerup Huse (Fig. V.15, no. 9) support the idea that Ertebølle hunters and gatherers had access to domesticated animals (Price & Gebauer 2005). These bones derive

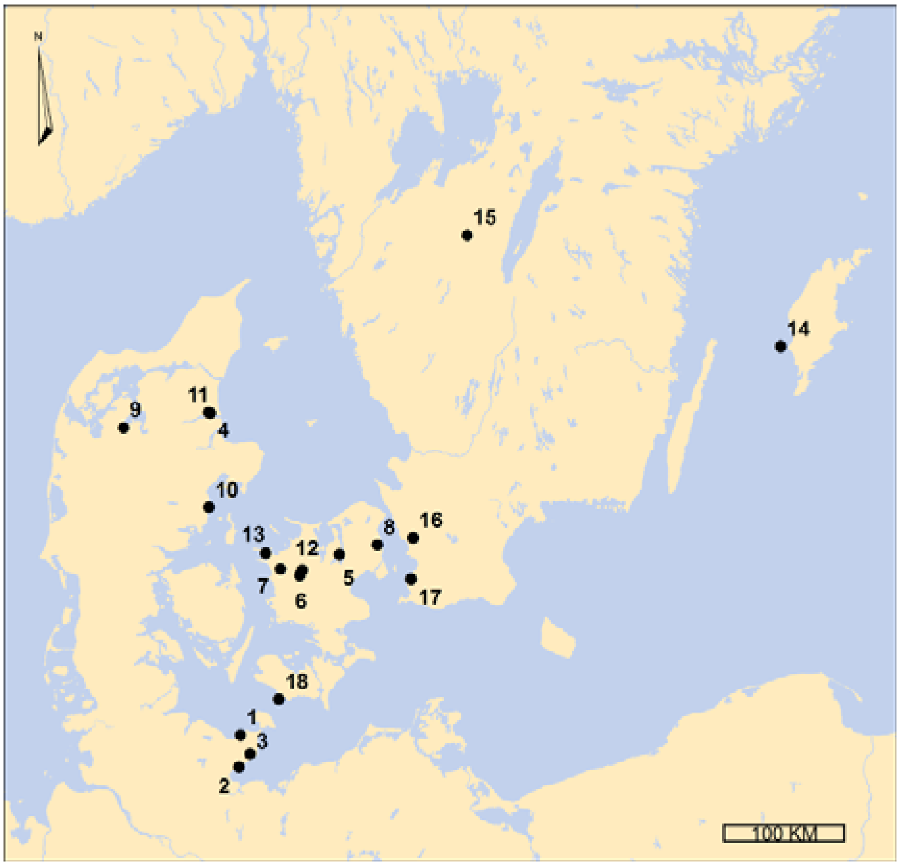


Fig. V. 18. ^{14}C dated bones of sheep and goats from the Early Neolithic in southern Scandinavia: 1. Wangels LA 505, 2. Neustadt, 3. Rosenhof LA 58, 4. Hvanø, 5. Lollikhuse, 6. Muldbjerg I, 7. Jordløse Mose, 8. Magleholm, 9. Krabbesholm II, 10. Norsminde, 11. Visborg, 12. Øgårde SV, 13. Raklev Høje, 14. Stora Förvar, 15. Karleby Log B, 16. Saxtorp SU9 and 17. Almhov. Data from Table 12. After Lindqvist & Possnert 1997; Heinemeier & Rud 1998; 1999; Hartz & Lübke 2004; Craig et al. 2011; Enghoff 2011; Sjögren, 2012; Kurt Gron pers. comm.; Lars Ewald Jensen pers. comm.; Ola Magnell pers. comm.

from stratified refuse layers that are dated to 5059±68 BP (3981-3701 cal BC, AAR-3316) and 5060±61 BP (3968-3711 cal BC, AAR-3317). It should be mentioned that the site was eroded in the Subboreal period, and it cannot be ruled out that the cattle bones could belong to an Early Funnel Beaker occupation (Sørensen & Karg 2012). This means the evidence suggesting that domestic cattle can be associated with Late Ertebølle contexts is very weak, although some of the evidence may be the result of exchanges between scouting farmers from Central Europe and the indigenous hunter-gatherers. It is also clear that domesticated cattle can be misidentified and the bones may actually come from small aurochs. It is therefore necessary to confirm the identifications with DNA analysis when working with cattle bones dated to the transition between the 5th and 4th millennium BC. It is more straightforward to work with sheep (*Ovis aries*) or goat (*Capra aegagrus hircus)* assemblages, as these species, unlike the pigs (wild boar) and cattle (aurochs), do not have wild counterparts in South Scandinavia.

Until recently, the numbers of directly ^{14}C dated bones of sheep or goats from South Scandinavia were quite small (Heinemeier & Rud 1999; Fischer 2002; Hartz & Lübke 2004). But for the purposes of this thesis, several researchers, including the author, undertook a number of radiocarbon dates of sheep and goat bones from the Early Neolithic (Craig et al. 2011; Enghoff 2011; Gron 2013; Ola Magnell personal com.) (Fig. V.18 and Table 12). It is now possible to present new knowledge about when sheep and goats were introduced into southern Scandi-

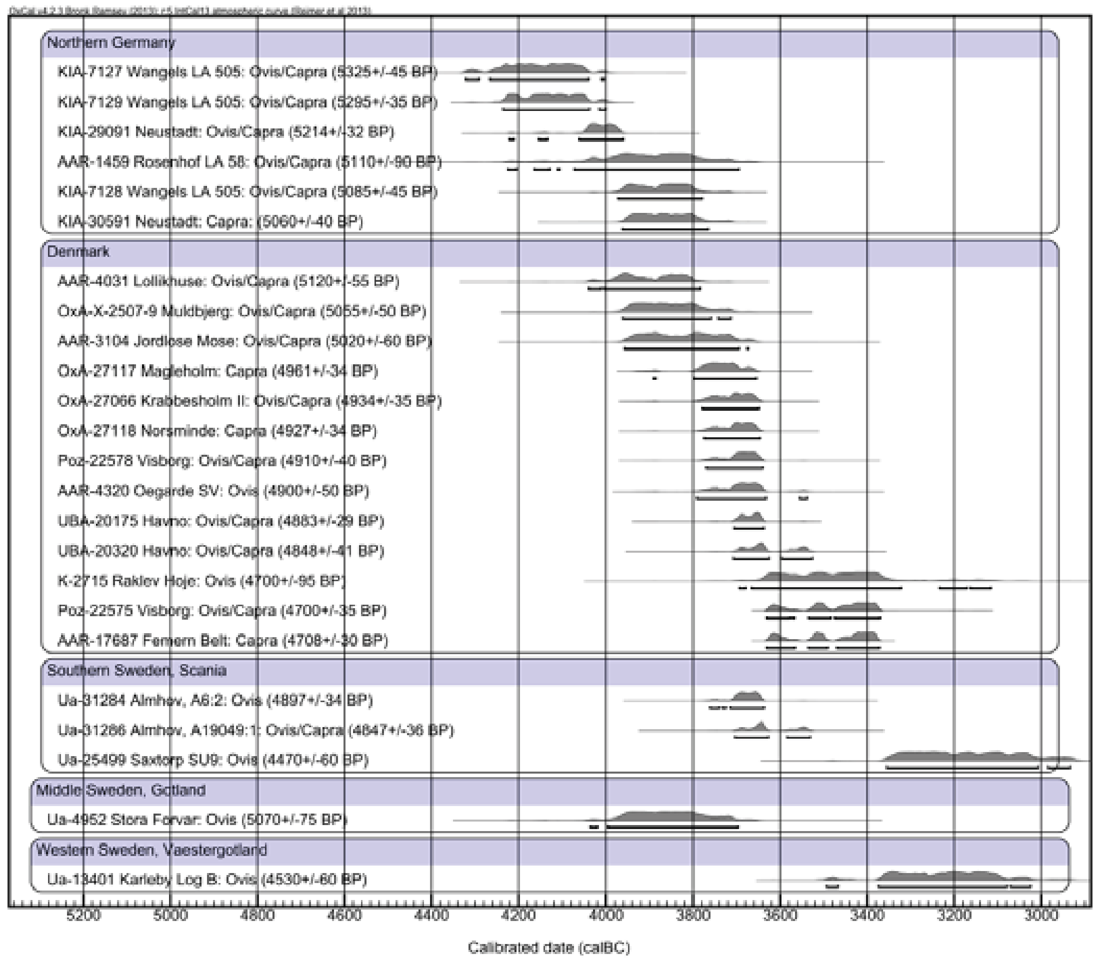


Fig. V. 19. [14]C dates of sheep and goats from the Early Neolithic in South Scandinavia, based on data from Table 12. After Lindqvist & Possnert 1997; Heinemeier & Rud 1998; 1999; Hartz & Lübke 2004; Craig et al. 2011; Enghoff 2011; Sjögren, 2012; Kurt Gron pers. comm.; Lars Ewald Jensen pers. comm.; Ola Magnell pers. comm.

navia (Craig et al. 2011) (Fig. V.19). Evidence of sheep and goats from Jutland, Zealand and Gotland is dated to 4000-3700 cal BC, in contrast to northern Germany, where they appear to be at least one century earlier, and to western Sweden, where they date to a few centuries later. Once again, the data from Central Sweden is biased, as it is based upon a single radiocarbon date. Many of the Early Neolithic sites in East Central Sweden are characterized by poor preservation of organic material, whereas West Sweden is dominated by stray finds and very few excavated Early Neolithic sites (Blomqvist 1990; Hallgren 2008; Sjögren 2012). In particular, the dates for sheep and goat bones of 5325±45 BP (4322-4005 cal BC, KIA-7127) and 5295±35 BP (4236-4000 cal BC, KIA-7129) from Wangels LA 505 and Neustadt (5214±32, 4221-3961 cal BC, KIA-29091) suggest that domesticated animals were present during the latest part of the Ertebølle culture in Schleswig-Holstein. Again, these animals could be the result of scouting expeditions initiated by Central European agrarian societies searching for new land and alliances in South Scandinavia. However, it is important to acknowledge that the radiocarbon dates are on a plateau on the calibration curve and from mixed layers, thus making it difficult to associate the bones with the Late Ertebølle culture. The new [14]C dates for sheep and goat bones from Denmark also produced several controversial results. Firstly, they demonstrated how difficult it is to find suitable bones from sheep and goats containing a sufficient amount of collagen, which is why several samples had to be discarded (Table 50). Secondly, direct

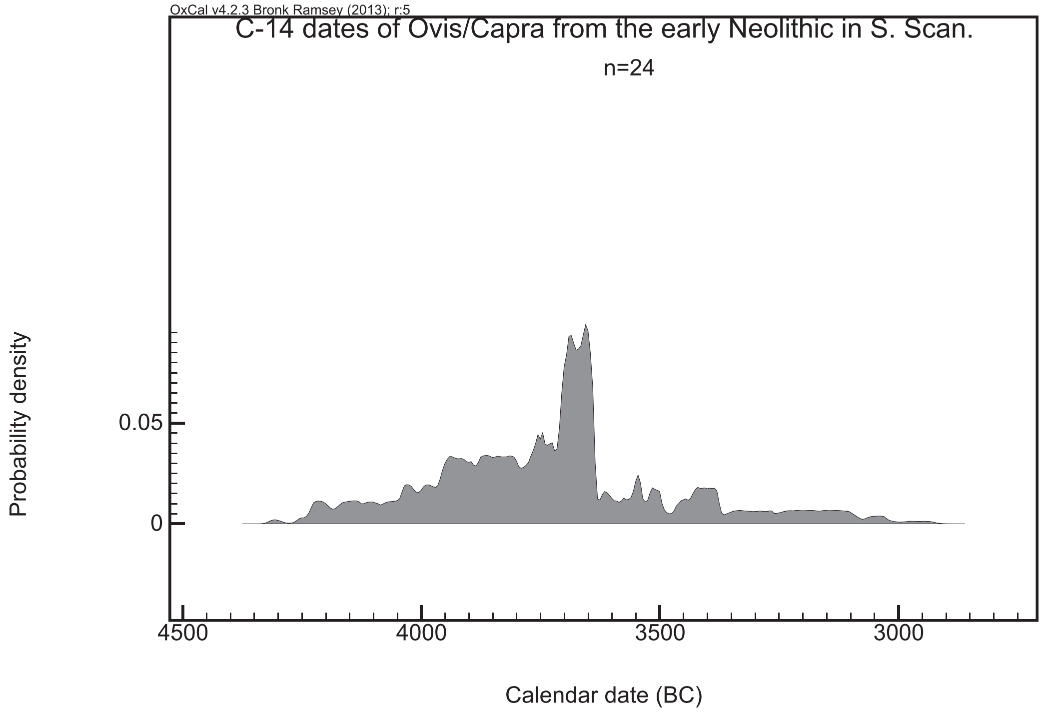


Fig. V. 20. Summary of all ^{14}C dates of sheep and goat bones from the Early Neolithic in South Scandinavia, based on data from Table 12.

^{14}C dating of sheep and goat assemblages is of crucial importance when examining data from sites excavated in the first half of the 20th century, as several bones found in Early Neolithic layers at sites like Klintesø, Kolind or Langø turned out to be from a much later period (Fig. V.21 and Table 13). Fortunately, the dates of sheep and goat bones from sites excavated during the second half of the 20th century all turned out to be from the Early Neolithic. Lastly, a possible sheep or goat bone from the kitchen midden site at Havnø in North Jutland was ^{14}C dated to 5329±35 BP (4313-4046 cal BC, OxA-27064). The sheep or goat bone in question has been classified as a right tibia. But aDNA analysis of the bone is currently being undertaken, which can confirm whether or not we are dealing with the earliest sheep or goat in South Scandinavia (Luise Ørsted Brandt pers. comm.). The stratigraphical information for the bone is also problematic, as the kitchen midden at Havnø is characterized by Late Ertebølle and Early Neolithic layers, which take the form of small depressions that are adjacent to one another (Søren H. Andersen pers. comm.). Nonetheless, we could be dealing with a short phase during the Late Ertebølle on the coastal sites, especially in Schleswig-Holstein, where hunter-gatherers adopted herding of cows, sheep and goats. The Ertebølle hunter-gatherers could have received these domesticated animals through exchanges with farmers, in connection with their scouting expeditions. These scouting expeditions may have been followed by actual immigration of pioneering farmers, thus explaining the concentration of primary agrarian evidence from 4000 to 3700 cal BC. This hypothesis is supported by the radiocarbon dates compiled for sheep and goats, which were introduced more or less at the same time around 4000 to 3700 cal BC in South Scandinavia, together with cereals and cattle (Fig. V.20).

Nevertheless, the significance of these agrarian subsistence practices has recently been questioned by recent lipid analysis of funnel beakers from sites dated to the early 4th millennium in South Scandinavia. The results show a continuation of processing marine and freshwater resources during the Early Neolithic, thus indicating that life continued as before (Craig et al. 2011). However, the selected Funnel Beaker sites in this investigation of lipids on funnel beakers are either coastal or lake shore sites, where the potential for engaging in agrarian activities is relatively low. Future studies of this kind would benefit

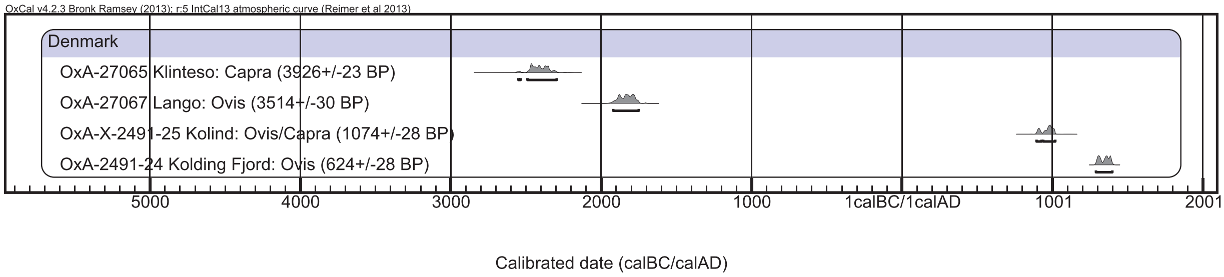


Fig. V. 21. ^{14}C dates of sheep and goats from presumed Early Neolithic layers in South Scandinavia, which gave much later dates, thus indicating the importance of taking direct radiocarbon dates from bones. Based on data from Table 13.

from integrating Funnel Beaker vessels from sites located on easily workable arable soils, where the potential for changing subsistence is better. This prediction is supported by recently published lipid analysis of selected funnel beakers found at the inland-oriented site of Skogsmossen in Västmanland. Here the heating of milk was identified, together with traces of plant, aquatic and terrestrial resources (Isaksson & Hallgren 2012). The results have been interpreted as demonstrating the introduction of dairy products from domesticated animals (cows, sheep or goats) during the Early Neolithic and that the processing of milk was being undertaken by the first farmers. However, as mentioned in section 3.12, there are problems associated with lipid analyses (Evershed et al. 2002; Craig et al. 2005).

These first farmers also brought domesticated pigs with them to South Scandinavia. But problems with distinguishing the wild boar (*Sus scrofa*) from the domesticated pig (*Sus domesticus*) make it difficult to establish exactly when the domesticated animal came to South Scandinavia (Fig. V.22 and Table 14). Recently some probable domesticated pigs were found in a pit (A27048) from the Early Neolithic site of Almhov in Scania, dated to 4960±50 BP (3937-3645 cal BC, Ua-22166) (Rudebeck 2010, 112ff). The result was confirmed by two other direct ^{14}C dates of domesticated pig bones from Almhov pit A19049 (4872±36 BP, 3758-3537 cal BC, Ua-31287) and pit A6 (4833±37 BP, 3696-3526 cal BC, Ua-31285) (Ola Magnell pers. comm.) (Tables 51 and 15). Domesticated pigs have also been suggested as being present as far north as Ångermanland, at the site of Fjällsjöälven near Ramsele, which was ^{14}C dated to 4620±55 BP (3628-3114 cal BC, Ua-36489) (George 2012a) (Fig. V.23). However, the possible pig bone could, according to Ola Magnell (pers. comm.), have been misidentified and may just as well be from a fox (*Vulpes vulpes*). Other possible domesticated pigs have been identified in many Early Neolithic contexts in South Scandinavia (Table 3). In particular, measurements of the length and width of the *calcaneus* (heel bone) of wild boar and domestic pigs show the presence of a few probable domesticated pigs at the transitional site of Åkonge (Gotfredsen 1998, 98). However, as mentioned above, the identification of domesticated pigs is also associated with problems due to possible interbreeding with wild boars during the Mesolithic and Neolithic transition in southern Scandinavia. The problem could be resolved with future DNA analysis. Recent DNA analysis has identified a possible domesticated pig at Grube Rosenhof carrying mtDNA of Near Eastern origin, which has been dated to 5800±25 BP (4720-4557 cal BC, KIA-41338) (Krause-Kyora et al. 2013) (Table 14). This controversial find could suggest that Ertebølle hunter-gatherers were engaged in animal husbandry and had contact with neighbouring Linearbandkeramik agrarian societies. However, the stable border between agrarian societies in Central Europe and the hunter-gatherers living near the coastal areas of northern Germany, may have resulted in domesticated pigs escaping into the wild and possibly interbreeding with wild boars. What in terms of genetics seemed to be a domesticated pig, could in fact be a wild boar carrying an admixture of genes. Moreover, the suggested domesticated pig from Grube Rosenhof (E24) is of considerable size, which may indicate that it is in fact a wild boar carrying mixed genes (Sönke Hartz pers. comm.). It is therefore still uncertain as to whether animal husbandry was carried out by Ertebølle hunter-gatherers from as early as 4700 cal BC in northern Germany. At present there is no secure archaeological evidence for domesticated pigs dating to earlier than 3900 cal BC in South Scandinavia, which is due to the lack of direct ^{14}C dates and problems with identification (Fig. V.24).

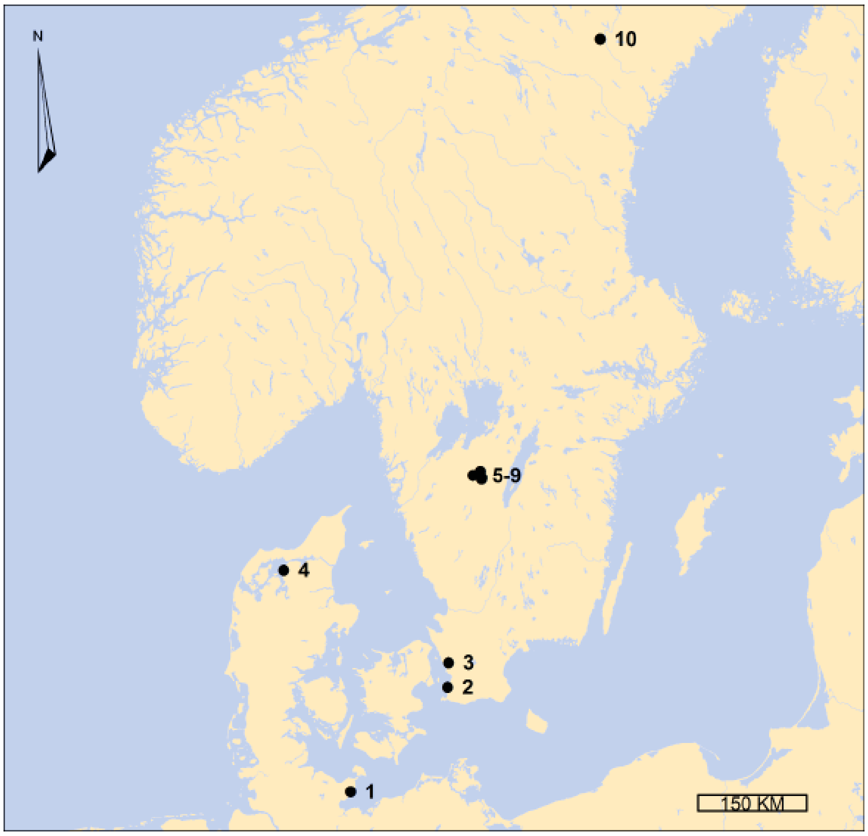


Fig. V. 22. [14]C dated bones of domesticated pig/wild boar from the Early Neolithic in South Scandinavia: 1. Grube Rosenhof, 2. Almhov, 3. Saxtorp SU9, 4. Åle, 5. Karleby Log B, 6. Valtorp 1, 7. Karleby 59, 8. Karleby 194, 9. Gökhem 31 and 10. Fjällsjöälven, Ramsele. Based on data from Table 14. After Andersson 2004; Hadevik 2009; Enghoff 2011; George 2012a; Sjögren 2012; Krause-Kyora et al. 2013; Ola Magnell pers. comm.

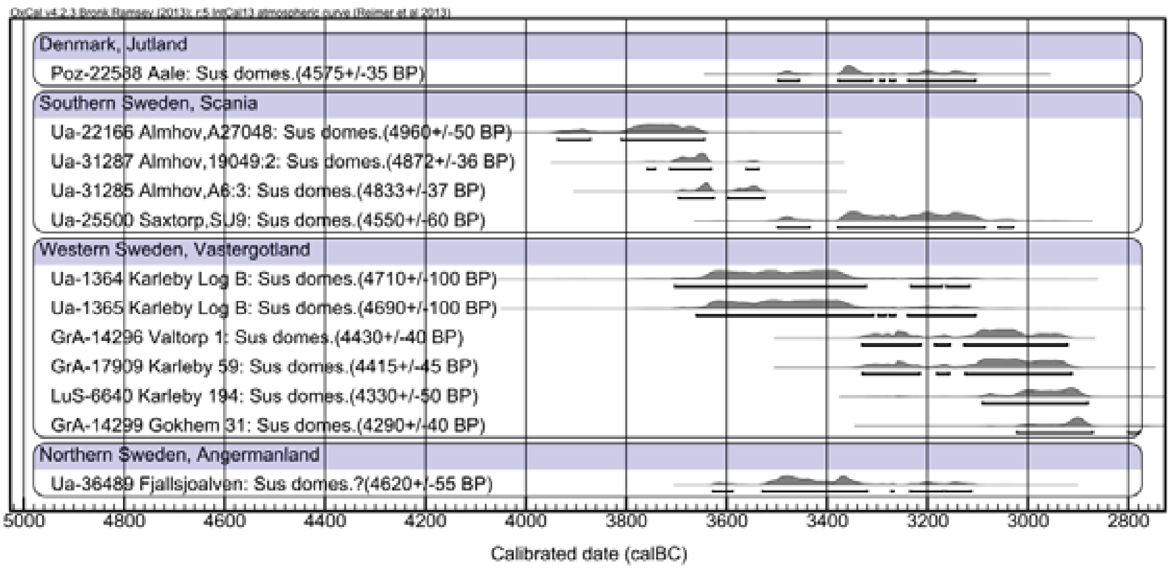


Fig. V. 23. [14]C dates of domesticated pig/wild boar from the Early Neolithic in South Scandinavia, based on data from Table 14. After Andersson 2004; Hadevik 2009; Enghoff 2011; George 2012a; Sjögren 2012; Ola Magnell personal com.

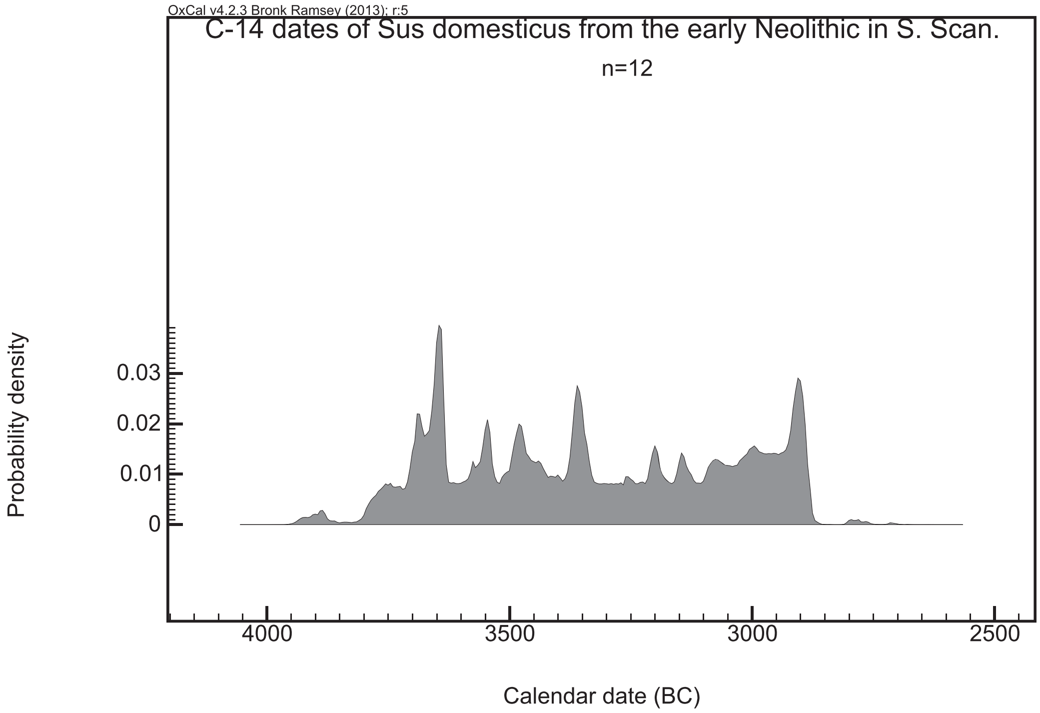


Fig. V. 24. Graph showing distribution of all [14]C dates of domesticated pig/wild boar from the Early Neolithic in South Scandinavia, based on data from Table 14. After Andersson 2004; Hadevik 2009; Enghoff 2011; George 2012a; Sjögren 2012; Ola Magnell personal com.

Currently, the direct [14]C dates of the domesticated animals of cattle, sheep, goats and pigs indicate that these species were introduced to South Scandinavia around the same time and rapidly between 4000 and 3700 cal BC, during the early Funnel Beaker culture (Fig. V.25). The small amount of evidence for cereals and domesticated animals from the Late Ertebølle culture could be the result of exchanges during scouting activities by Central European farmers between 4200 and 4000 cal BC, which were followed by immigration during the Early Neolithic (Fig. V. 26). However, the appearance of domesticated animals and their economic importance to these Early Neolithic agrarian societies is still debatable (Skaarup 1973; Nielsen 1987; Madsen 1987; Fischer 2002; Hartz et al. 2007; Andersen 2008b; Sørensen & Karg 2012; Rowley-Conwy 2013). It is therefore necessary, despite the many methodological problems discussed in section 6.6, to present a comparative overview of the faunal assemblages from various types of sites during the transition between the Late Ertebølle and Early Funnel Beaker culture.

7.3. Faunal assemblages from the Late Ertebølle and Early Funnel Beaker culture

The coastal and lake shore sites of the Late Ertebølle culture show a complete dominance of wild fauna, which primarily consists of red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*) and wild boar (*Sus scrofa*) (Figs. V.27-28 and Tables 2-3). But a number of faunal assemblages have also revealed that some sites were used for the seasonal hunting of birds, seals or other furred animals (Møhl 1971; 1979; Andersen 1998a; Enghoff 2011; Gron 2013). The fish bone assemblages from the Ertebølle sites have also revealed some local differences in the fish species caught in various regions of South Scandinavia (Enghoff 2011). At sites located in North-West Zealand and in the Vedbæk fjord, hunter-gatherers fished primarily for cod and flounder, whereas in the Limfjord area eel and other fish species were caught (Ritchie 2010) (Fig. V.29). The fish bone assemblages therefore document that fishing was a specialized activity, focusing upon certain species of fish, using both stationary and more active fish-

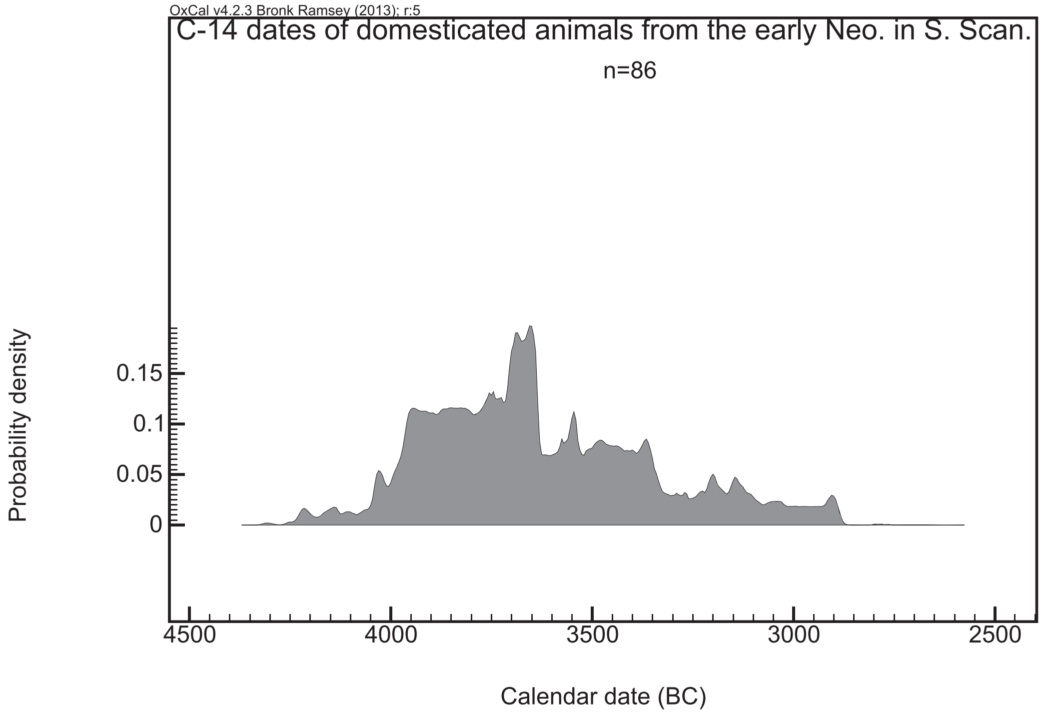


Fig. V. 25. Graph showing distribution of all ^{14}C dates of domesticated cattle, sheep, goats and pigs from the Early Neolithic in South Scandinavia, based on data from Tables 11, 12 and 14.

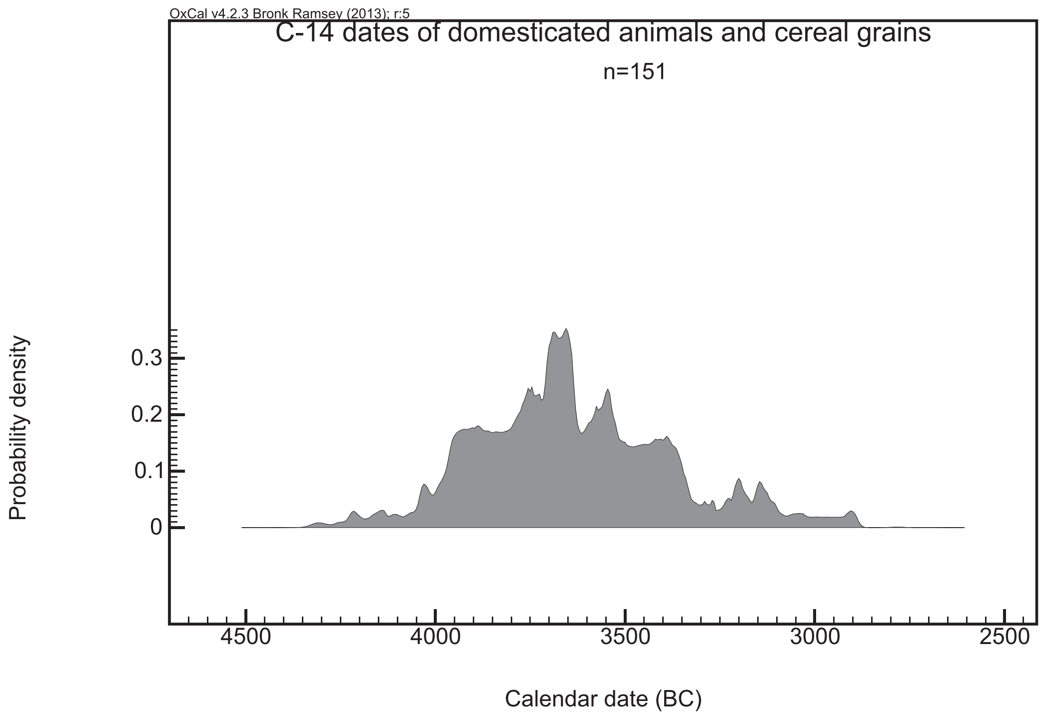


Fig. V. 26. Graph showing distribution of all ^{14}C dates of charred cereals and domesticated animals from the Early Neolithic in South Scandinavia, based on data from Tables 5, 11, 12 and 14.

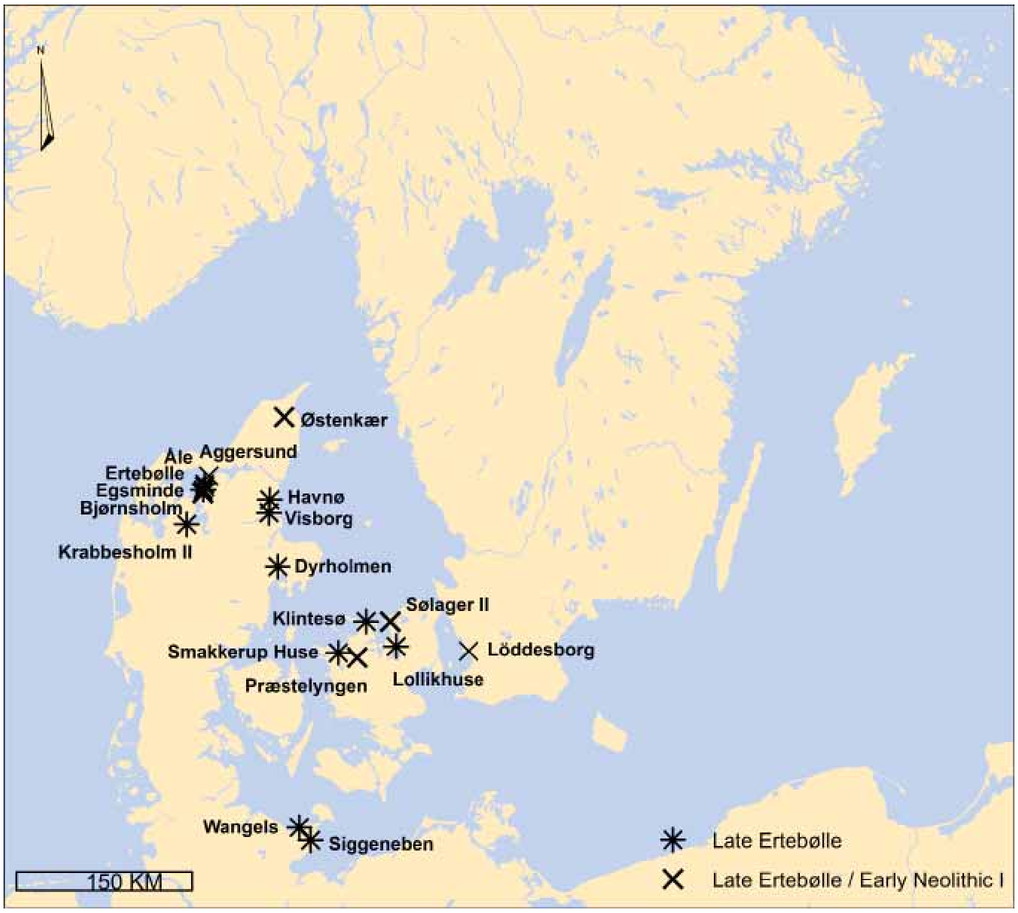


Fig. V. 27. Faunal assemblages from selected Late Ertebølle and transitional Late Ertebølle /Early Neolithic I coastal and lake shore sites from southern Scandinavia. Late Ertebølle sites: Østenkær, Ertebølle, Bjørnsholm, Aggersund, Visborg, Sølager II, Löddesborg and Præstelyngen. Transitional Late Ertebølle/Early Neolithic sites: Wangels, Siggeneben, Åle, Havnø, Visborg, Egsminde, Krabbesholm II, Dyrholmen, Klintesø, Smakkerup Huse and Lollikhuse. After Madsen et al. 1900; Skaarup 1973; Hallström 1984; Bratlund 1993; Noe-Nygaard 1995; Heinrich 1999; Hede 2005; Enghoff 2011.

ing methods (Andersen 1998b). The Late Ertebølle sites operated in a range of seasons covering most of the year, and utilised newborn mammals, furred animals, various fish species and winter birds (Enghoff 2011) (Fig. V.35). The seasonal pattern does not necessarily reflect permanent habitation, but was more likely associated with several occupations, as indicated by the numerous heaps of shells in the kitchen middens (Johansen 2006; Andersen 2008a).

The abundance of fish bones from Mesolithic sites changes around 4000 cal BC, which is synchronous with the transition to the Early Neolithic. In general, there is a lack of fish bones from Early Neolithic sites located near the coast or inland lakes. It has been argued that in the transitional process of becoming a farmer, the indigenous hunter-gatherers changed their view of marine food resources, which came to be regarded as less prestigious than agrarian products (Milner et al. 2004). Such an interpretation could explain the sharp shift in diet from a marine to a terrestrial diet, as indicated by isotope values (Tauber 1981; Fischer et al. 2007). But these analyses lack data from the remains of humans who lived at the Early Neolithic coastal sites, thus indicating that people did exploit marine food sources. Furthermore, it is very unlikely that the exploitation at the many Early Neolithic coastal sites would have stopped with the adoption of agrarian practices. There are simply too many coastal sites, fishing tools and traps from the Early Neolithic, which show that fishing activities did not end (Pedersen 1995; Andersen 2008a).

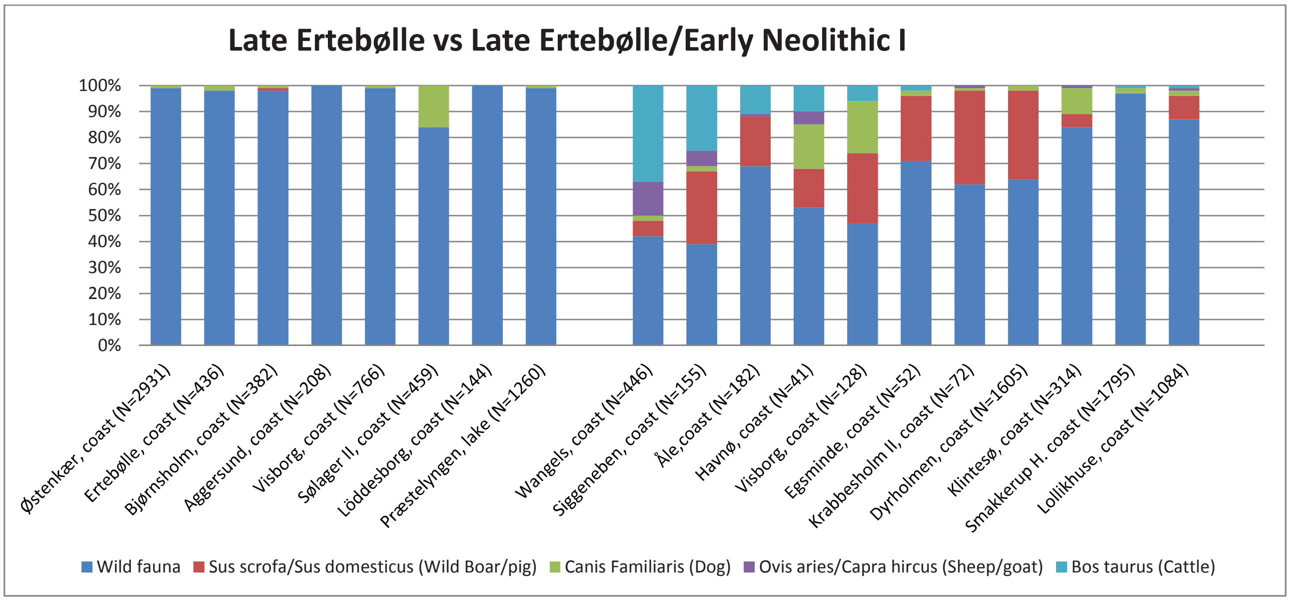


Fig. V. 28. Faunal assemblages from coastal and lake shore sites dated to Late Ertebølle and the earliest phase of the Early Neolithic in southern Scandinavia, based on data from Table 3. After Madsen et al. 1900; Skaarup 1973; Hallström 1984; Bratlund 1993; Noe-Nygaard 1995; Heinrich 1999; Hede 2005; Enghoff 2011.

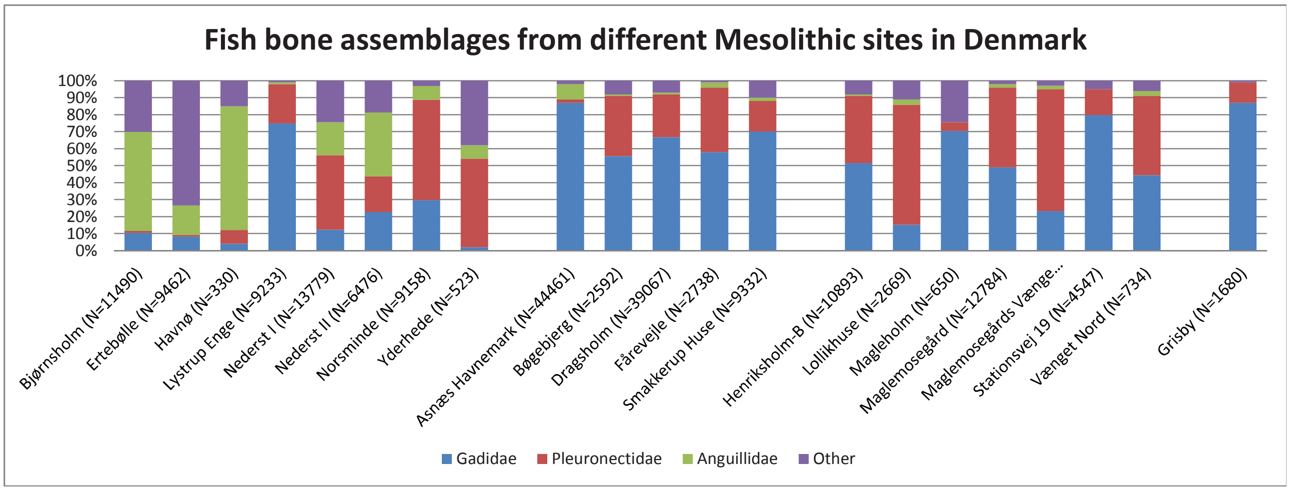


Fig. V. 29. Fish bone assemblages from Mesolithic sites in Denmark. After Ritchie 2010.

It should be noted, that it is still uncertain how much marine food intake is required in a diet before it can be measured in isotope values (Tables 16 and 17). The isotope values only show the dominant food intake, which may have been supplied by marine resources (Tauber 1981; Fischer et al. 2007). The lack of fish bones may be due to poor preservation; the layers from Early Neolithic kitchen middens are not as thick, because they cover a shorter timespan than the Ertebølle layers (Andersen 2008a). The excavation methods may also have resulted in a lack of fish bones, if deposits from the Early Neolithic sites were not sieved. But modern excavations of kitchen middens in the Limfjord region, where sieving has been undertaken, have also only produced a few fish bones (Andersen 1991; Enghoff 2011). The lack of fish bones at Early Neolithic sites may be explained by different processing techniques that appeared during the Funnel Beaker culture.

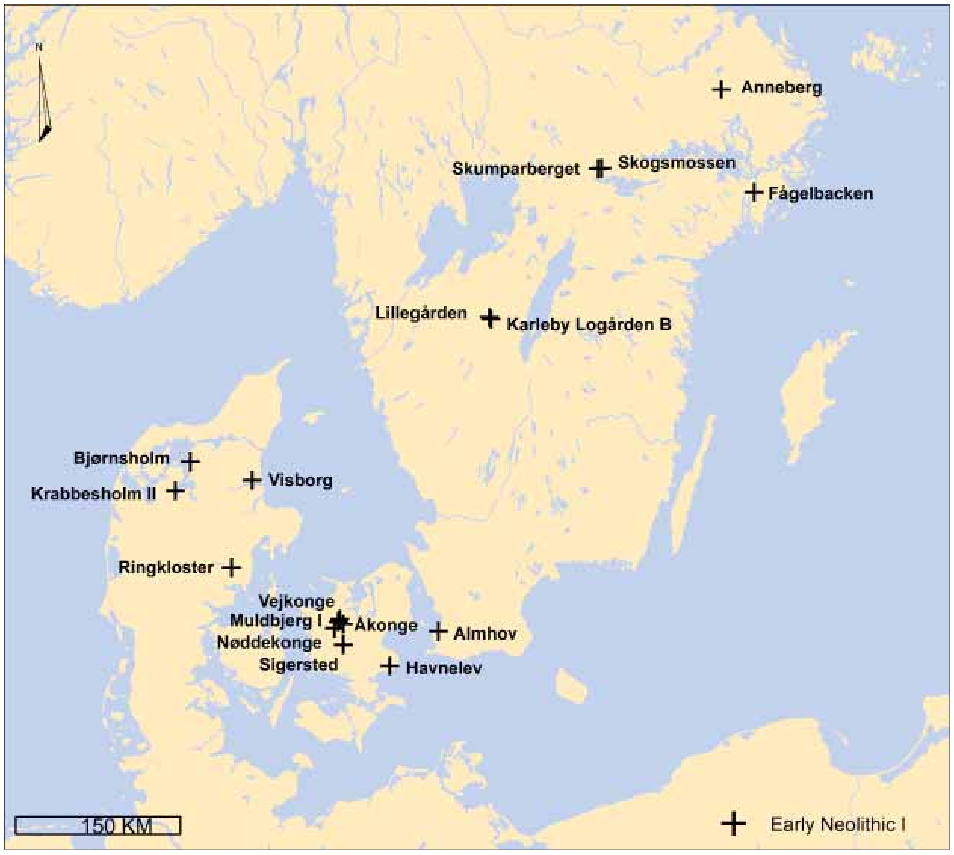


Fig. V. 30. Faunal assemblages from coastal, lake shore and inland sites dated to the EN I phase. Coastal and lake shore sites: Visborg, Krabbesholm II, Bjørnsholm, Anneberg, Fågelbacken, Ringkloster, Vejkonge, Nøddekonge, Åkonge and Muldbjerg I. Inland-oriented sites: Sigersted, Havnelev, Almhov, Skumparberget, Skogsmossen, Lillegården and Karleby Logården B. After Nielsen 1985; Bratlund 1993; Noe-Nygaard 1995; Lekberg 1997; Gotfredsen 1998; Koch 1998; Segerberg 1999; Sjögren 2003; Hallgren 2008; Welinder et al. 2009; Enghoff 2011.

The faunal assemblages of mammals dated to the Mesolithic-Neolithic transition and EN I phase at coastal and lake shore sites, are characterized by a low number of identified domesticated animal bones (Figs. V.30-31 and Table 3). This has been interpreted as clear evidence of a continuation of the hunter-gatherer lifestyle at these sites, where the deposition of faunal remains in cultural layers is similar to the practices observed at Mesolithic settlements (Bratlund 1993, 101; Noe-Nygaard 1995, 76; Lekberg 1997; Gotfredsen 1998; Segerberg 1999; Enghoff 2011) (Fig. V.28). A different picture emerges when investigating the faunal assemblages from the inland sites located on easily worked arable soils. Here the percentage of domesticated animals is higher, thus supporting the interpretation that agrarian subsistence was more important at these sites (Fig. V.31). Furthermore, distribution practices at these sites had changed, as most artefacts and faunal remains were found in pits. The Early Neolithic site of Almhov in Scania is one of the most important inland-oriented sites located on easily worked arable soil, at which several large pits were excavated (Rudebeck 2010) (Fig. V.32). The pits contained bones of domesticated animals, charred cereals, quern stones, short-necked funnel beakers, clay discs and a high concentration of pointed-butted axes, thus connecting them to an agrarian economy. Studies of the faunal remains show that certain parts of the animals were deposited in the pits, in particular the skulls of various domesticated animals. Many of the pits were placed next to one another, and produced similar diagnostic artefacts from the Early Neolithic, which is why they have been interpreted as being in pairs (Tables 51 and 15). Paired pits have been reported from both northern France, where the pits were dated to the mid-5th millennium BC, and Britain, where the dating is early 4th

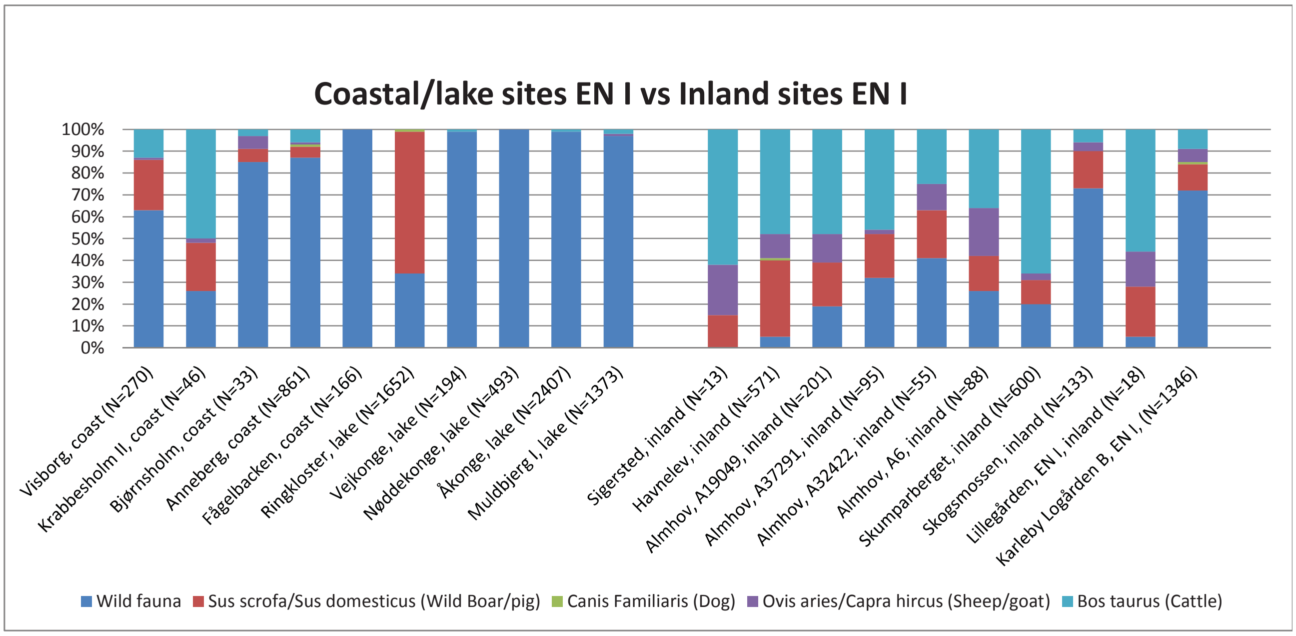


Fig. V. 31. Faunal assemblages from coastal, lake shore and inland sites dated to the earliest phase of the Early Neolithic in South Scandinavia, based on data from Table 3. After Nielsen 1985; Bratlund 1993; Noe-Nygaard 1995; Lekberg 1997; Gotfredsen 1998; Koch 1998; Segerberg 1999; Sjögren 2003; Hallgren 2008; Welinder et al. 2009; Enghoff 2011.

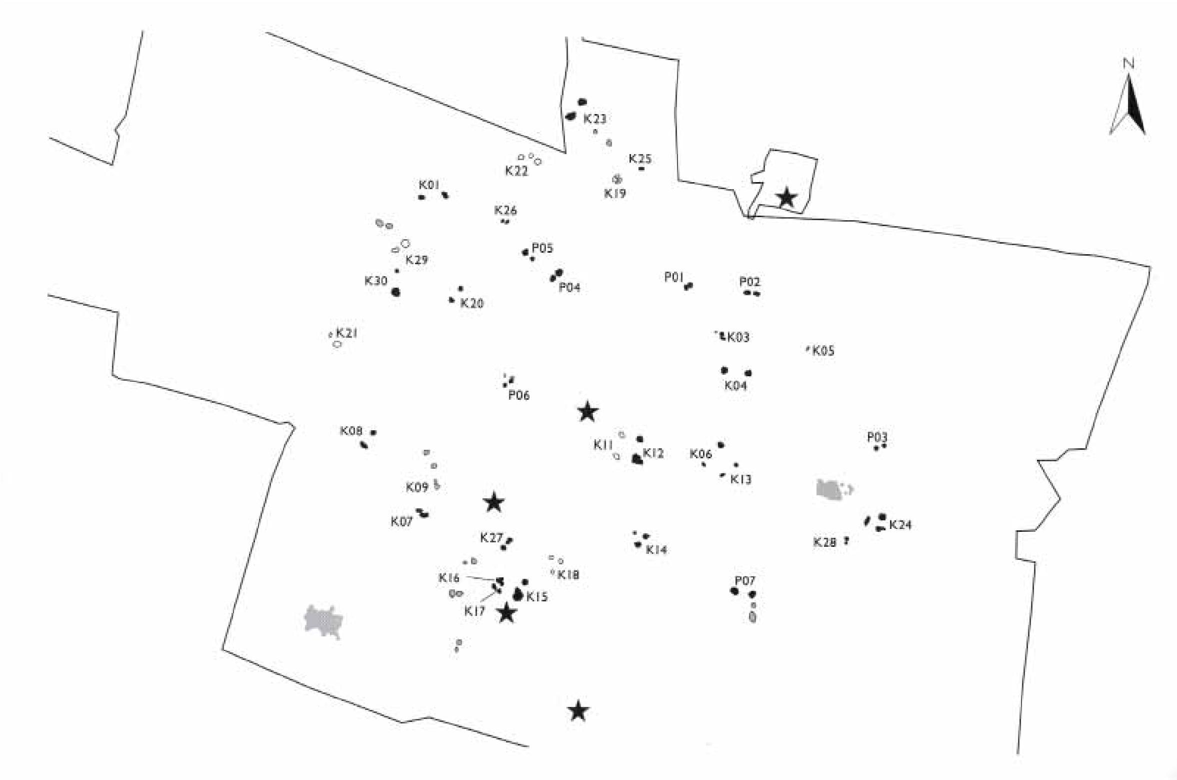


Fig. V. 32. Excavation plan of the site at Almhov in Scania, showing one of the largest concentrations of pits, which were interpreted as paired pits from the Early Funnel Beaker culture in South Scandinavia. After Rudebeck 2010.

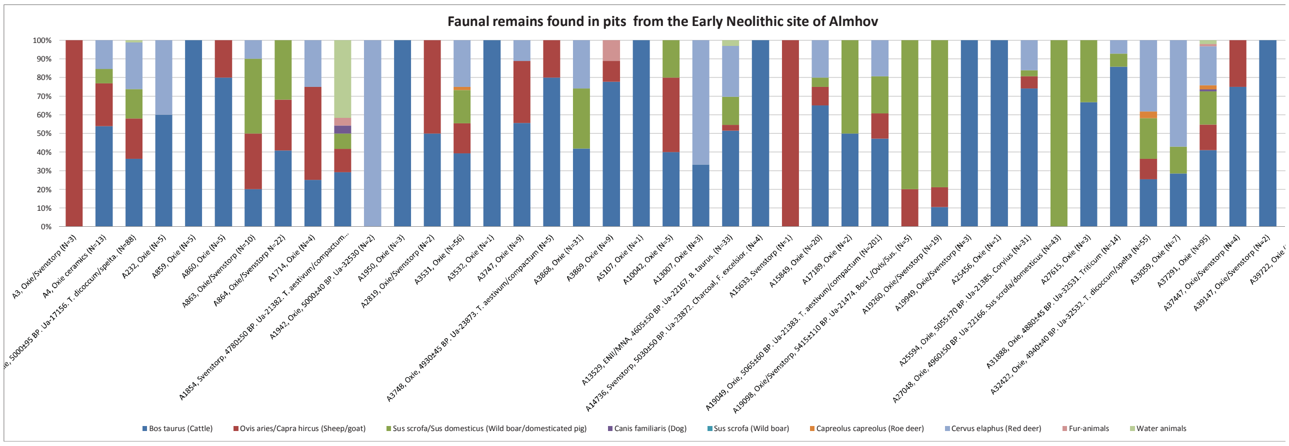


Fig. V. 33. Faunal remains found in the Early Funnel Beaker pits at Almhov. After Welinder et al. 2009; Rudebeck 2010; Macheridis 2011.

millennium BC, which will be discussed in detail in section 10.2 (Cassen et al. 1998; Beadsmoore et al. 2010).

A few of the presumed paired pits at Almhov contained a considerable amount of bones from wild species (primarily red deer), whilst most were dominated by bones of domesticated animals (primarily cattle) (Fig. V.33). These patterns could either be the result of different refuse management for wild and domesticated fauna, or represent intentional depositions connected with new symbolic behaviour (Rudebeck 2010; Macheridis 2011). The ^{14}C dates of charred cereals from most of these pits at Almhov place their contents within the EN I phase, clustering around 4000 to 3700 cal BC, thus confirming the chronology of short-necked funnel beakers of the A group and pointed-butted flint axes (Nielsen 1977; 1994; Larsson 1984; Koch 1998). But more recently conducted ^{14}C dating of the faunal material from some of the same pits (A19049 and A6) has produced a later result, clustering around 3800 to 3600 cal BC (Fig. V.34). The uneven radiocarbon results suggest that repeated depositions could have occured in some of these pits over a long period, covering at least a couple of generations. The continuity of the depositional activity clearly indicates that some of these pits were of special importance to the first agrarian societies in the region. The interpretation is supported by the fact that some pits (A15849 and A19049) contained intentionally burnt and unburnt pointed-butted flint axes (Table 15). Feature A19049 was one of the largest pits, measuring 4.9 x 3.9 metres, with a depth of 0.74 metres, and contained at least 60 vessels and 20 kg of debris from flint production. The pit was stratified into seven layers, which suggests that it was open for a long time (Andersson 2013) (Fig. V.163). It is therefore no surprise that the ^{14}C dated materials from the pit produced some uneven results, these consisting of a charred cereal of bread wheat (5065±60 BP, 3970-3710 cal BC, Ua-21383), together with domesticated bones from a cow (4912±39 BP, 3770-3641 cal BC, Ua-31288), pig (4872±36 BP, 3758-3537 cal BC, Ua-31287) and sheep or goat (4847±36, 3705-3531 cal BC, Ua-31286) (Fig. V.34). Besides burnt flint axes, this pit also contained the largest faunal assemblage, consisting of 201 identified bones, which were dominated by cattle bones (Fig. V.33). The pit had probably been used to dig out clay, thus implying that it was an ordinary feature. However, in the north of the pit the excavators found a stone-packed posthole, which had held a large post. The post had probably marked the location of this particular feature for a long time, which may reflect the repeated depositional practices that occurred in the pit (Gidlöf et al. 2006). Such continuous depositional practices have also taken place within structures associated with causewayed enclosures (Andersen 1997). Causewayed enclosures were in use by the first half of the 5th millennium BC in Central Europe in the Michelsberg culture, but seem to appear later on in South Scandinavia, during the EN II phase (Nielsen 2004; Geschwinde & Raetzel-Fabian 2009). However, recently discovered enclosure-type sites may be as early as the late EN I phase, as discussed in section 10.4. Perhaps these paired pits from Almhov, together with the repeated depositional practices, represent the earliest evidence of social gathering places associated with seasonal feasts, which were

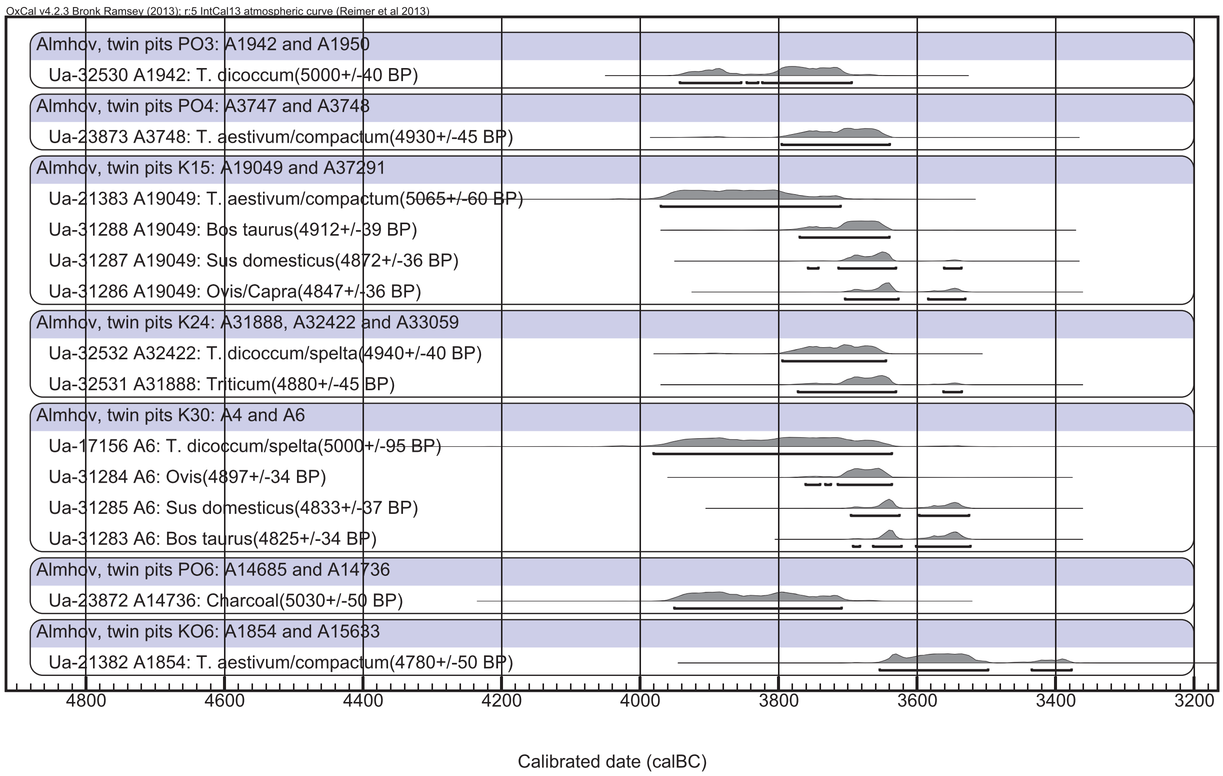


Fig. V. 34. [14]C dates of charred cereals and domesticated animals from some of the paired pits at Almhov, demonstrating repeated deposition and that they were left open for a long time. After Welinder et al. 2009; Rudebeck 2010; Macheridis 2011; Ola Magnell pers. comm. Data after Table 15.

used by the first generations of pioneering farmers in South Scandinavia (Rudebeck 2010). Unfortunately, the possible seasonal gatherings at Almhov cannot be further investigated, as we do not have any seasonal data from the faunal assemblages.

Indicators of seasonality, based on faunal material, have only been investigated at a few lake shore sites near or in the Åmose Lake (Muldbjerg I, Vejkonge, Nøddekonge and Åkonge), which are grouped from May to October based on data from mammals (Troels-Smith 1957; Gotfredsen 1998, 99; Noe-Nygaard et al. 1998, 57f) (Fig. V35). These Åmose sites are all dominated by red or roe deer, thus suggesting that there were seasonal occupations connected to the hunting of deer and gathering activities from the late spring until early autumn. Seasonal indicators have also been reported from an Early Neolithic coastal site at Norsminde, where the analysis of oyster shells documents that they were collected from March to August (Milner 2002). However, no systematic investigations based on faunal material have been undertaken at Early Neolithic sites located on easily worked arable soils, thus making it difficult to compare seasonal use between different site types. Such seasonal investigations could clarify whether these Early Neolithic coastal sites were used during the transitional process as short-term seasonal sites, as argued by Jørgen Skaarup (1973), or as more permanent sites of habitation, as suggested by Søren H. Andersen (2008a).

During EN II and MN I-II phases there is a more even distribution of domesticated animals between the inland, coastal and lake shore sites (Fig. V.36 and Table 3). However, there are coastal sites like Sølager, where domesticated animals are rare, or are dominant, as at the site of Grottan, thus showing differing economic strategies (Fig. V.37). At the beginning of the Middle Neolithic, a few sites still show a low number of identified bones from domesticated animals, such as the lake site Storelyng VI. Red and roe deer are the dominant species, characterizing the sites as specialized hunting camps (Skaarup 1973; Koch 2003, 209ff). In general, the faunal indicators of seasonality at the EN II and MN I-II hunting sites and agrarian inland sites provide evidence of habitation

Site	Date	Location	Based on:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	References
Norsminde	EN I	Coastal	Oyster shells			X	X	X	X	X	X					Milner 2002
Muldbjerg I	EN I	Lake shore	Juv. m., seeds, twigs from a fish traps					X	X	X	X	X				Noe-Nygaard et al. 1998, 57f; Troels-Smith 1957
Vejkonge	LEBK/EN I	Lake shore	Juv. mallard (Anas platyrhyn-chos)					X	X	X	X	X	X			Gotfredsen 1998, 99
Vejkonge	LEBK/EN I	Lake shore	Juv. eurasian Coot (Fulica atra)						X	X	X	X	X			Gotfredsen 1998, 99
Vejkonge	LEBK/EN I	Lake shore	Juv. red deer (Cervus elaphus)									X	X			Gotfredsen 1998, 99
Nøddekonge	LEBK/EN I	Lake shore	Juv. mallard (Anas platyrhyn-chos)					X	X	X	X	X	X			Gotfredsen 1998, 99
Nøddekonge	LEBK/EN I	Lake shore	Juv. eurasian Coot (Fulica atra)						X	X	X	X				Gotfredsen 1998, 99
Nøddekonge	LEBK/EN I	Lake shore	Juv. red deer (Cervus elaphus)						X	X	X	X	X			Gotfredsen 1998, 99
Nøddekonge	LEBK/EN I	Lake shore	Shed antler from roe deer (Capreolus capreolus)					X	X	X	X	X				Gotfredsen 1998, 99
Åkonge	LEBK/EN I	Lake shore	Shed antler from roe deer (Capreolus capreolus)				X	X	X	X	X	X				Gotfredsen 1998, 99
Åkonge	LEBK/EN I	Lake shore	Juv. mallard (Anas platyrhyn-chos)					X	X	X	X	X	X			Gotfredsen 1998, 99
Åkonge	LEBK/EN I	Lake shore	Juv. eurasian Coot (Fulica atra)					X	X	X	X	X				Gotfredsen 1998, 99
Åkonge	LEBK/EN I	Lake shore	Unshed antler from red deer (Cervus elaphus)					X	X	X						Gotfredsen 1998, 99
Åkonge	LEBK/EN I	Lake shore	Juv. red deer (Cervus elaphus)						X	X	X	X	X			Gotfredsen 1998, 99
Åkonge	LEBK/EN I	Lake shore	Juv. roe deer (Capreolus capreolus)							X	X	X				Gotfredsen 1998, 99
Åkonge	LEBK/EN I	Lake shore	Juv. pine marten (Martes martes)							X	X					Gotfredsen 1998, 99
Åkonge	LEBK/EN I	Lake shore	Juv. fox (vulpes vulpes)							X	X	X				Gotfredsen 1998, 99
Åkonge	LEBK/EN I	Lake shore	Juv. Hedgehog (Erinaceus europaeus)								X	X	X			Gotfredsen 1998, 99
Åkonge	LEBK/EN I	Lake shore	Juv. swan (Cygnus)								X	X				Gotfredsen 1998, 99
Åkonge	LEBK/EN I	Lake shore	Shed antler from red deer (Cervus elaphus)	X	X	X						X	X	X	X	Gotfredsen 1998, 99
Præstelyng	LEBK	Lake shore	Juvenile mammels				X	X	X	X	X	X				Noe-Nygaard et al. 1998, 57f
Østenkær	LEBK	Coastal	Juv. pine marten (Martes martes)					X	X	X	X	X				Enghoff 2011, 73
Østenkær	LEBK	Coastal	Roe deer, attached antlers (Capreolus capreolus)				X	X	X	X	X	X	X	X	X	Enghoff 2011, 73
Østenkær	LEBK	Coastal	Winter birds	X	X	X							X	X	X	Enghoff 2011, 73
Østenkær	LEBK	Coastal	Fur-bearing animals	X	X	X							X	X	X	Enghoff 2011, 73
Østenkær	LEBK	Coastal	Shed antler from red deer (Cervus elaphus)		X	X										Enghoff 2011, 73
Østenkær	LEBK	Coastal	Red deer, attached antlers (Cervus elaphus)	X	X					X	X	X	X	X	X	Enghoff 2011, 73
Østenkær	LEBK	Coastal	Juv. roe deer (Capreolus capreolus)	X	X	X	X								X	Enghoff 2011, 73
Østenkær	LEBK	Coastal	Roe deer shed antlers (Capreo-lus capreolus)										X	X		Enghoff 2011, 73
Ertebølle	LEBK	Coastal	Garfish				X	X	X	X	X	X				Enghoff 2011, 101
Ertebølle	LEBK	Coastal	Saith otoliths									X				Enghoff 2011, 101
Ertebølle	LEBK	Coastal	Eel									X				Enghoff 2011, 101
Ertebølle	LEBK	Coastal	Winter birds	X	X	X							X	X	X	Enghoff 2011, 101
Ertebølle	LEBK	Coastal	Fur-bearing animals	X	X	X							X	X	X	Enghoff 2011, 101
Ertebølle	LEBK	Coastal	Newborn, red deer (Cervus elaphus)						X							Enghoff 2011, 101
Ertebølle	LEBK	Coastal	Juv. red deer (Cervus elaphus)												X	Enghoff 2011, 101
Ertebølle	LEBK	Coastal	Red deer, attached antlers (Cervus elaphus)	X	X					X	X	X	X	X	X	Enghoff 2011, 101
Ertebølle	LEBK	Coastal	Juv. roe deer (Capreolus capreolus)											X	X	Enghoff 2011, 101
Krabbesh-olm II	LEBK	Coastal	Summer fishes				X	X	X	X	X	X				Enghoff 2011, 119
Krabbesh-olm II	LEBK	Coastal	Horse mackerel, juv. Garfish								X	X				Enghoff 2011, 119
Krabbesh-olm II	LEBK	Coastal	Fur-bearing animals	X	X	X							X	X	X	Enghoff 2011, 119
Visborg	LEBK	Coastal	Garfish				X	X	X	X	X	X				Enghoff 2011, 153
Visborg	LEBK	Coastal	Winter birds	X	X	X							X	X	X	Enghoff 2011, 153
Visborg	LEBK	Coastal	Fur-bearing animals	X	X	X							X	X	X	Enghoff 2011, 153
Visborg	LEBK	Coastal	Juv. red deer (Cervus elaphus)				X	X								Enghoff 2011, 153
Visborg	LEBK	Coastal	Red deer, attached antlers (Cervus elaphus)	X	X					X	X	X	X	X	X	Enghoff 2011, 153
Yderhede	Early EBK	Coastal	Summer fishes				X	X	X	X	X	X				Enghoff 2011, 54
Yderhede	Early EBK	Coastal	Juv. roe deer (Capreolus capreolus)			X	X	X	X	X						Enghoff 2011, 54
Yderhede	Early EBK	Coastal	Winter birds	X	X	X							X	X	X	Enghoff 2011, 54
Yderhede	Early EBK	Coastal	Fur-bearing animals	X	X	X							X	X	X	Enghoff 2011, 54

Fig. V. 35. Indicators of seasonality, based on faunal assemblages from coastal sites dated to the Late Ertebølle culture and lake shore sites from the Early Neolithic in South Scandinavia. After Troels-Smith 1957; Gotfredsen 1998, 99; Noe-Nygaard et al. 1998, 57f; Milner 2002; Enghoff 2011.

Fig. V. 36. Faunal assemblages from coastal, lake shore and inland sites dated to the EN II phase. EN II coastal and lake shore sites: Bistoft LA11, Ørum Å, Strandegård, Grottan and Sølager II. EN II inland-oriented sites: Stengade house I, Stengade house II (late EN I-EN II), Lindegård Mose, Toftum, Hunneberget, Fuchsberg and Saxtorp SU9. MN I-II coastal and lake shore sites: Storelyng VI, Sølager II, Sørbylille, Signalbakken, Lyø. MN I-II inland-oriented sites: Troldebjerg, Sarup, Fannerup and Blandebjerg. After Madsen et al. 1900; Troels-Smith 1954; Nobis 1962; Skaarup 1973; Møhl 1975; Madsen 1978; Johansson 1979; Andersen 1981; Rowley-Conwy 1984; Nyegaard 1985; Lindqvist & Possnert 1997; Koch 1998; Nilsson 2003; Magnell 2007; Skousen 2008; Enghoff 2011.

during spring, summer and autumn, whereas the winter months have been more difficult to identify (Madsen et al. 1900, 135; Troels-Smith 1954, 23; Nobis 1962, 18; Skaarup 1973; Møhl 1975, 210; Madsen 1978, 177; Johansson 1979, 82; Andersen 1981; Rowley-Conwy 1984; Nyegaard 1985, 447ff; Koch 1998, 246; Nilsson 2003, 294; Magnell 2007, 51ff; Skousen 2008, 155; Enghoff 2011). Normally, focus has been placed on the mobility patterns of people, who during the later part of the Early Neolithic and Middle Neolithic travelled between the coastal and inland zones. But strontium analysis of cattle teeth from Funnel Beaker sites in Falbygden, Väster Götland, dated between 3300 to 3000 cal BC, indicate that 50% of the analysed cattle teeth were from animals raised in a region of Precambrian rock. The Fallbygden region is dominated by Cambro-Silurian rocks, thus indicating that domesticated animals were moved over large distances in the Middle Neolithic. Pigs, on the other hand, were mostly local. In addition, the percentage of humans born elsewhere was about 25%; these individuals were interpreted as immigrants. The cattle therefore show a higher mobility than humans, which may suggest that these animals were traded and exchanged between Fallbygden and neighbouring regions. The cattle could thus

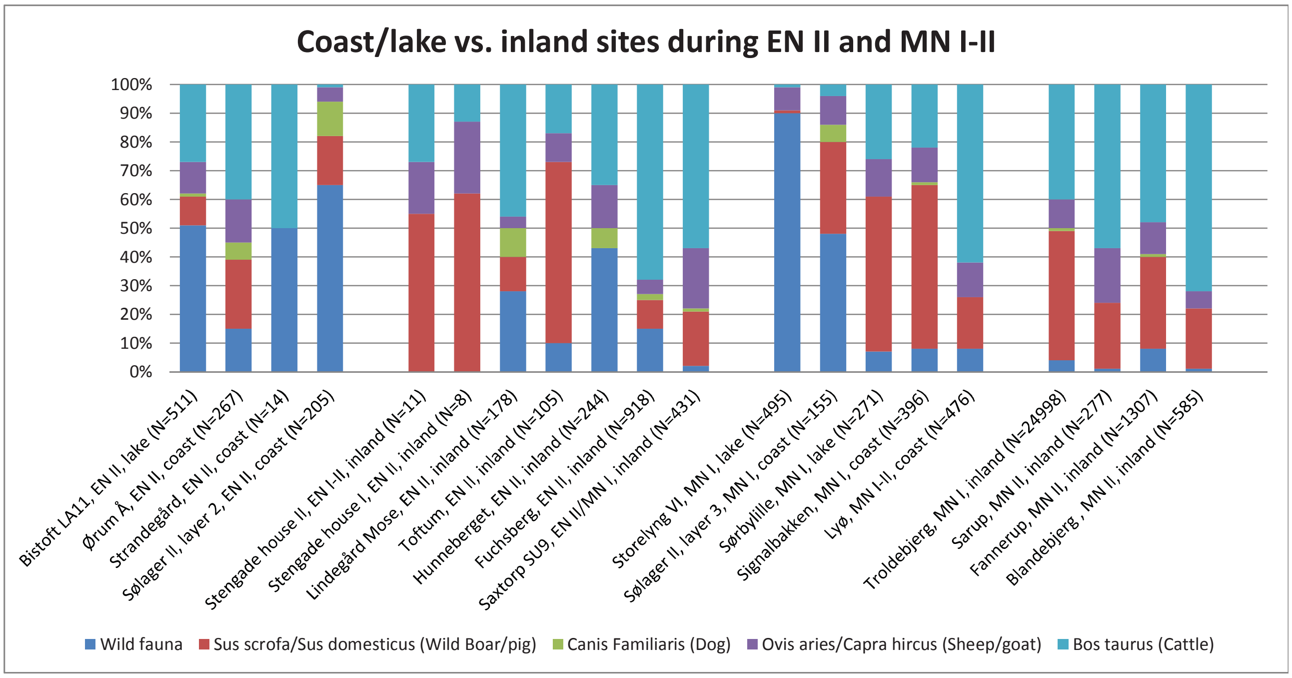


Fig. V. 37. Faunal assemblages from coastal, lake shore and inland sites dating to EN II and MN I-II, based on data from Table 3. After Madsen et al. 1900; Troels-Smith 1954; Nobis 1962; Skaarup 1973; Møhl 1975; Madsen 1978; Johansson 1979; Andersen 1981; Rowley-Conwy 1984; Nyegaard 1985; Lindqvist & Possnert 1997; Koch 1998; Nilsson 2003; Magnell 2007; Skousen 2008; Enghoff 2011.

have formed an important part of the economic systems, but more investigations are needed in order to document whether such an exchange system already existed in the Early Neolithic (Sjögren & Price 2013).

In general, the primary evidence for cultivation and animal husbandry practices indicates that these activities were more common at inland sites, located on easily worked arable soils, than at coastal or lake shore sites during the EN I phase. These inland sites, located at least one km from the coast, probably represent pioneering farmers, who cleared the forest in order to cultivate new land in South Scandinavia. The collected evidence enables a discussion to take place about how the early farmers cultivated land with shifting cultivation using the slash-and-burn method, and established permanent fields with the help of manuring practices, or combined both of these methods.

7.4. Shifting cultivation versus permanent fields

Pollen analysis from South Scandinavia tends to favour the shifting cultivation model, based on increased quantities of birch pollen (*Betula*), which is one of the pioneering trees that dominates forest fallows (Iversen 1941; Berglund 1991; Aaby 1992; S. Th. Andersen 1993; Göransson 1994; Odgaard 1994; Rasmussen et al. 1998; 2007; Sjögren 2003) (Table 9). The increase in charcoal dust in some pollen diagrams also indicates that the slash-and burn method was used to clear the forest (Fig. V.14). The Early Neolithic site of Munkeröd in Bohuslän is one of the few localities where thick charcoal layers have been interpreted as the result of systematic slash-and-burn. The thick charcoal layers have been ^{14}C dated, this showing that they begin around the late EN I phase and continue all the way through the Neolithic period. The observations are further supported by artefacts from a nearby site dated to the late EN I phase, as well as a pollen diagram showing an increase in charcoal dust and ribwort plantain from late EN I (Lindman 1993, 64ff). Here, it appears as if the slash-and-burn method was used as a systematic strategy. However, whether or not the slash-and-burn method was used in a systematic rotational strategy, rather than for permanent fields, is still difficult to document during the Early Neolithic in South Scandinavia, as the peaks in charcoal dust cover a considerable period. Nonetheless, evidences from the early parts of the Middle Neolithic indicates that the slash and burn of secondary hazel forests was part of a long term cultivation strategy in some parts of South Scandinavia (S. Th. Andersen 1993; Dehn et al. 2000). However, most of the peaks in charcoal dust are concentrated in the Early Neolithic, which may indicate that permanent fields were established after this, as argued by Rowley-Conwy (1981). Peter Rowley-Conwy has argued that keeping livestock fits in with a strategy of more permanent fields, because cattle can produce 9-14 tons of manure per year and provide traction, this assuming that early farmers knew about the positive effect manuring had on crops. Moreover, he argues that pigs, sheep and goats could have been actively used in the tillage of fields, thus claiming that cultivation and animal husbandry practices are interacting agents in the same system. The synchronous introduction of domesticated animals and cereals may support the hypothesis proposed by Rowley-Conwy (1981). A similar symbiosis between animal husbandry and crop cultivation has been proposed by Troels-Smith (1984) in his investigations at Weir in Switzerland. Fundamental to both hypotheses is the ability to use manuring techniques on the fields in order to improve the nitrogen quantities in the soil. If manuring practices had been used, then it would be possible to observe higher values in the cereal grains resulting from animal manuring. Recent analysis of ^{15}N values of cereal grains from different sites, dating from the later part of the Early Neolithic (EN II) to the Iron Age, has confirmed a long-term increase in manuring intensity in relation to the emmer crop. Naked barley also revealed significantly higher ^{15}N values in the Pre-Roman Iron Age, thus indicating an intensification of manuring practices (Kanstrup et al. 2012; 2013).

Although these results tend to support the theory of permanent fields, they also stress that we are dealing with a long-term process. We therefore should not rule out one strategy against another, as both systems could have been in use at the same time. Permanent fields used for decades would have required a relatively large amount of manuring and rotation of crops, followed by fallows of shorter duration, almost corresponding to the crop rotation of historical times. However, the ^{15}N values of the Neolithic assemblages were not as high as might have been expected for permanent fields, thus supporting the argument for the shifting cultivation strategy, as the fallows in this system are of a longer duration and require only limited manuring (Kanstrup et al. 2013). However, the representativeness of the few cereals selected for ^{15}N analysis can of course be questioned, as well as whether the increased ^{15}N values really represent animal manuring or ordinary household refuse. We therefore need more of these ^{15}N analyses of charred cereals from the earliest part of the Neolithic in order to test the hypothesis of permanent fields.

7.5. Human skeletal remains, isotope values and mtDNA analysis in the transition between the 5th and 4th millennium BC

Another source of data closely related to the primary evidence for the adoption of the agrarian way of life and its practices, are the human remains. One of the largest assemblages of human skeletal remains from the Mesolithic and Early Neolithic is found in southern Scandinavia (Table 18). Unfortunately, the human bones are in varying states of preservation, as they have been found in a variety of contexts, from bog sites, kitchen middens and ordinary settlement sites, to simple inhumation graves, long barrows with timber structures and megalithic tombs, thus resulting in problems relating to collagen content and contamination (Bennike & Alexandersen 2007, 132f). Nevertheless, the important investigations of stable isotopic analysis (^{13}C) initiated by Henrik Tauber revealed that the Mesolithic diet mainly consisted of marine food (-17 to $-13^0/_{00}$), whereas the Neolithic diet was dominated by terrestrial food (-19 to $-21^0/_{00}$) (Tauber 1981) (Fig. V.38). Later studies confirmed the conclusions made by Tauber, but also included the ^{15}N content of the human bones, which could distinguish a carnivore diet ($10\text{-}11^0/_{00}$) from a vegetarian one ($5\text{-}6^0/_{00}$). It was also possible to detect a shift towards a higher consumption of freshwater fish, if the ^{15}N values were around $12\text{-}15^0/_{00}$ (Richards & Koch 2001; Fischer et al. 2007, 2125ff.) (Table 16). Current studies reveal that Ertebølle hunter-gatherers had a marine diet (-17 to $-13^0/_{00}$) and ^{15}N values show consumption of freshwater fish ($>+12^o/_{oo}$) The Neolithic farmers, on the other hand, lived mainly of terrestrial resources, with ^{13}C values (-19 to $-21^0/_{00}$) and ^{15}N values indicating a diet that consisted of herbivores and domesticated animals (Tauber 1981; Bennike & Ebbesen 1987; Noe-Nygaard 1995; Fischer et al. 2007, 2125ff; Brinch Petersen 2015). A similar pattern is also documented in the British Isles during the Mesolithic and Neolithic transition (Bayliss & Whittle 2007). Nevertheless, it is important to acknowledge that the isotope analysis only shows the main food intake, with the rest of the diet unknown. Furthermore, samples from different bones or teeth from skeletons have also resulted in differing ^{13}C values, according to the life stage of each individual (Eriksson et al. 2013). There are still many methodological aspects of isotope research that need to be investigated further. But as previously mentioned, the main problem with respect to isotope analysis are the samples of human bones. The lack of data for human remains found on coastal sites dated to the early EN I phase in South Scandinavia is a major problem, as these may document the continuous importance and exploitation of marine resources during the Early Neolithic (Sørensen & Karg 2012). The isotope analysis of four human bones found at the Swedish coastal sites at Alby 25 on Öland and Evensås in Bohuslän illustrate the problem, as they all indicated a marine diet (Lidén et al. 2004; Sjögren 2012). Their ^{14}C dates are right at the Mesolithic and Neolithic transition, but their marine diets have created a reservoir effect, therefore resulting in radiocarbon dates that might be too old, thus placing these individuals in the Early Neolithic. In Denmark there are only two Early Neolithic human males from the coastal sites, and these point in different directions. The individual from Sejerø's diet is dominated by marine food, whereas the Dragsholm man had a terrestrial diet (Fig. V.38). In general, the isotope values clearly prove that from the late EN I, around 3800 cal BC onwards, the main diet consisted of terrestrial food resources. However, the picture in the transition around 4100 to 3800 cal BC still remains unclear. But primary evidence of cultivation is almost absent at coastal sites in the early EN I phase, which could explain why the dominant diet still consisted of marine food sources during this period.

The fact that there was a change from the 5th and 4th millennium is also confirmed by anthropological analysis of the human bones from the Mesolithic and Early Neolithic (Bennike & Alexandersen 2007, 139). Incidences of enamel hypoplasia, or enamel deficiency in teeth, suggest that periods of stress are just as frequently reflected in Early Neolithic as Mesolithic human assemblages. It is therefore not certain that the health situation improved when people shifted their subsistence strategy from foraging to agrarian activities. Another factor which did not change was traumatic injuries, which were present during both the Late Mesolithic and the Early Neolithic period. However, the Early Neolithic skeletons found in bogs show a large number of individuals who display evidence

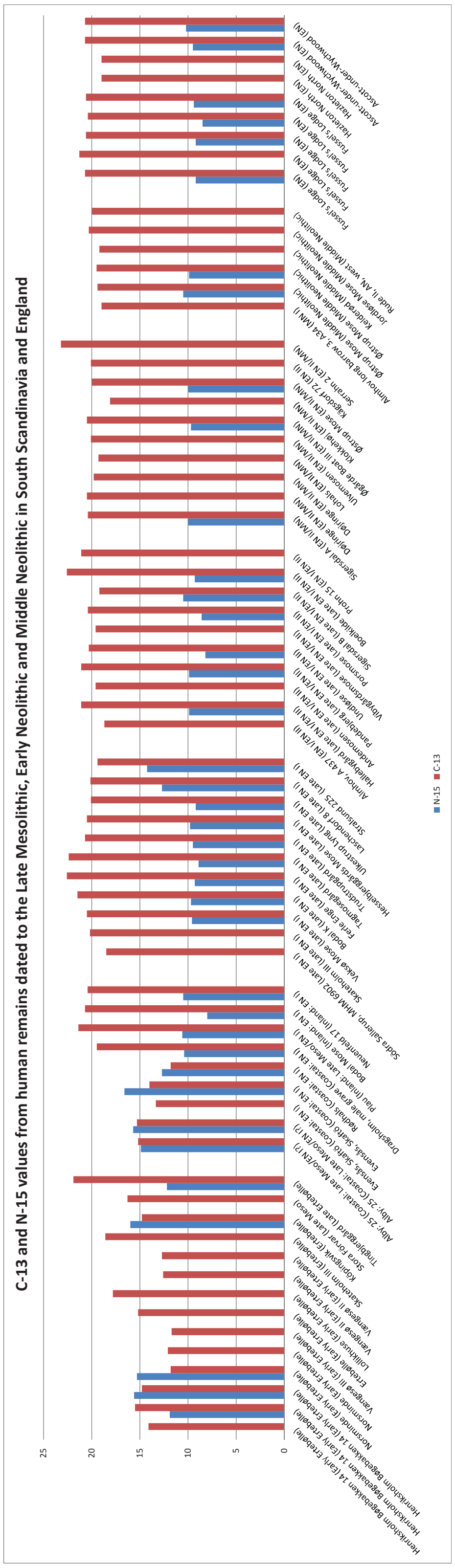


Fig. V. 38. Chart showing selected human remains from Late Mesolithic, Early Neolithic and Middle Neolithic contexts, of which ^{13}C and ^{15}N values have been analysed. After Tauber 1981; Bennike & Ebbesen 1987; Ebbesen 1994; Lindquist & Possnert 1999; Heinemeier & Rud 2000; Rudebeck 2002; Lidén et al. 2004; Woll 2003; Bayliss & Whittle 2007; Fischer et al. 2007; Price et al. 2007; Eriksson et al. 2008; Gidlöf 2009; Hadevik 2009; Hansen 2009; Lübke et al. 2009; Sjögren 2012; Brinch Petersen 2014; Søren A. Sørensen pers. comm.

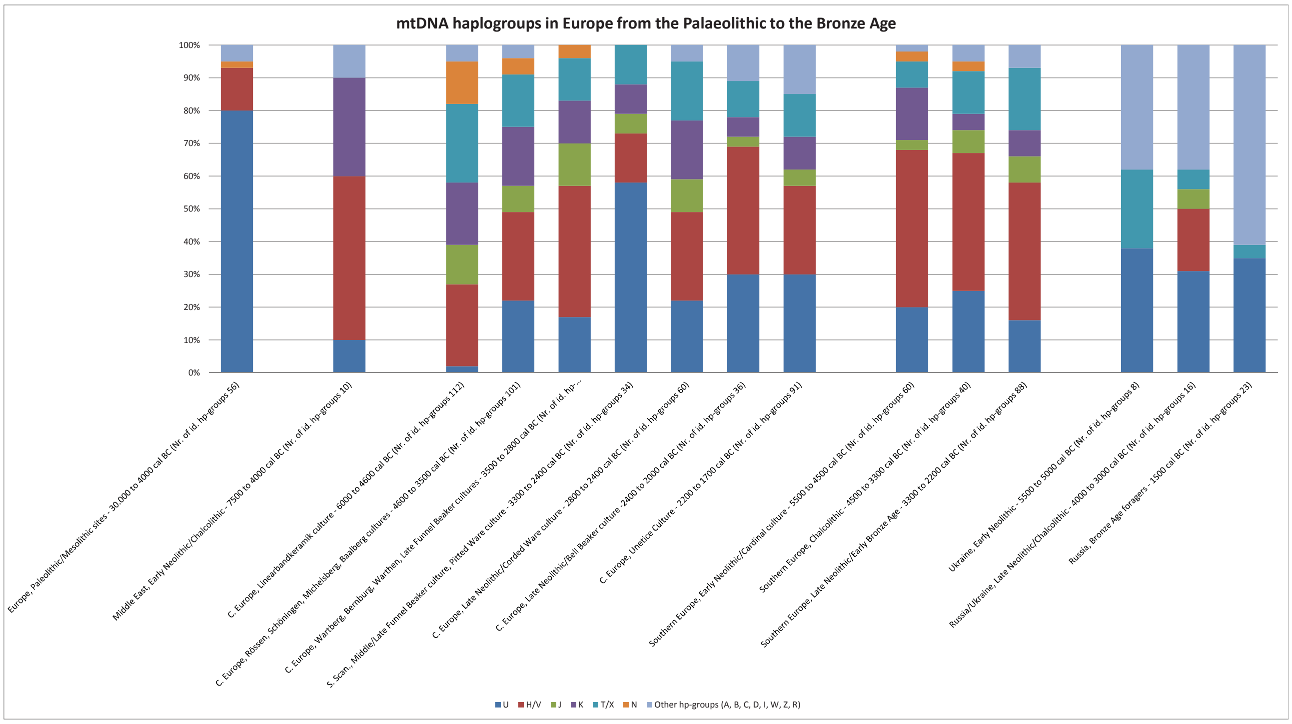


Fig. V. 39. The distribution of the various mtDNA haplogroups according to prehistoric cultures. Data and references based on the lists in Tables 19 and 20.

of violence, such as cranial lesions, arrowheads embedded in bones or signs of strangulation (Bennike 1999). Most of the Early Neolithic skeletons in the bogs were juveniles aged between 16 and 20, who might have been sacrificed in ceremonial rituals or executed for breaking the rules of an agrarian society, thus showing the emergence of new practices. There was also a change in the amount of individuals showing signs of caries. Dental caries was non-existent in humans in the Late Mesolithic, whereas in the Early Neolithic it was present in six out of 21 individuals in South Scandinavia. The difference in the prevalence of caries is connected to a change in the diet, from marine food and carbohydrate-rich plant foods to a mixture of fish, meat, vegetables, cereals and dairy products. Other differences have been observed by measuring the thickness of human skulls. The skulls from Mesolithic people are generally thicker than those of Early Neolithic individuals, thus suggesting a possible migration of incoming agrarian societies from Central Europe. However, according to Bennike and Alexandersen (2007), it is currently impossible to determine whether this difference in the thickness of skulls was caused by immigration or a change of diet.

Recent results from mtDNA analysis have supported the argument for migrationism in connection with the emergence of Linearbandkeramik in Central Europe and funnel beakers in South Scandinavia (Bramanti et al. 2009, 139; Haak et al. 2010, 2; Skoglund et al. 2012, 466ff; 2014) (Tables 19 and 20). The most important Neolithic mtDNA lines interpreted as being associated with farmers are haplogroups (Hg) J (Hg J1a and Hg J1b) and N (Hg N1a) (Fig. V.39). These lines are absent among the Mesolithic hunter-gatherer populations in Central Europe, where Hg D and especially Hg U4 and U5 Hg are widespread. Hg U represents the hunter-gatherers, who survived the Last Glacial Maximum (18000-14000 cal BC) in refuge areas of Southern Europe (Sykes 2003; Haak et al. 2010, 8). The results of human genetic studies of the agrarian Linearbandkeramik culture suggest a migration, but there is still a lack of consensus with regard to the percentage of the Near Eastern contribution to the European gene pool, and therefore the degree of the Neolithic contribution to the European gene pool is still actively debated (Haak et al. 2010; Skoglund et al. 2012). Most mtDNA and Y chromosome studies indicate that Near Eastern lineages contributed approximately 25% of

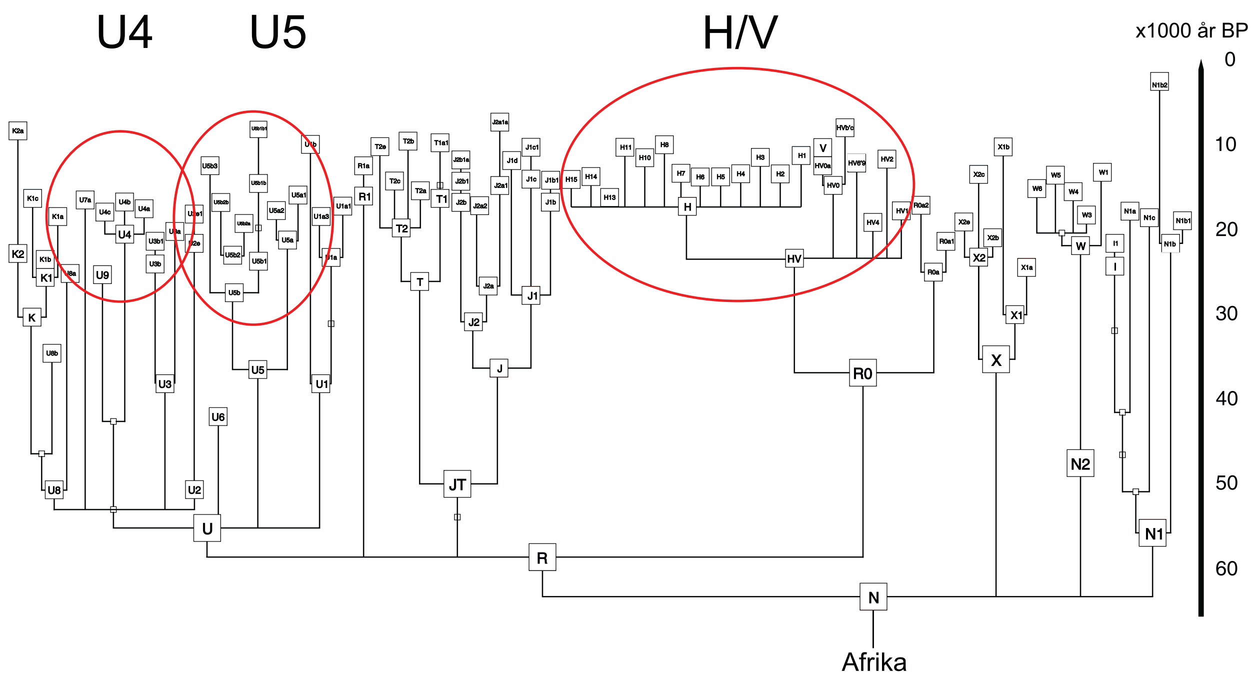


Fig. V. 40. Relationship between the different mtDNA haplogroups and their approximate dating. After Soares et al. 2010; Persson 2012.

the European gene pool. The total Neolithic contribution to modern Europeans lies somewhere between 12-23% on the female side and 20-25% on the male side, depending on how many individuals were of Middle Eastern lineage in Europe in recent times (Richards 2003, 152ff). Differences between mtDNA and Y-chromosome results may be due to gender differences in movement patterns and marriage alliances (Sykes 2003, 324). Nonetheless, archaeogenetic investigations of human remains from South Scandinavia are characterized by the study of very few individuals. Furthermore, the radiocarbon dates of the humans from the Funnel Beaker culture are not from the actual transition, but several hundred years later. The problem has been exemplified recently by Skoglund et al. (2012, 466ff), who were able to extract mtDNA from a female skeleton found in the passage grave Gök 4 at Falbygden, Sweden. The woman was ^{14}C dated to 4341±44 BP (3090-2889 cal BC, AAR-10235) and carried Hg H, which is currently observed in the Mediterranean area. The result suggested that agriculture was introduced to southern Scandinavia through a process of migration, in which the Fallbygden area, known for its many passage graves, may be interpreted as an enclave displaying very little integration between migrating farmers and local hunter-gatherers. However, the haplogroups from people living in the Mid-Funnel Beaker period could also be the result of later immigrations and do not necessarily have anything to do with the adoption of agriculture during the Early Neolithic (Skoglund et al. 2012; 2014). However, no mtDNA analysis has been undertaken on human bones dated to the transition between the Late Ertebølle culture and Funnel Beaker culture in southern Scandinavia.

In Central Europe mtDNA analysis has been conducted on human remains dated between 4600 and 3600 cal BC from the agrarian Rössen, Schöningen, Michelsberg and Baalberg cultures, which are important in connection with the agrarian expansion to South Scandinavia (Bramanti et al. 2009; Deguilloux et al. 2010; Adler 2012; Bollongino et al. 2013; Brandt et al. 2013; Lee et al. 2013). These investigations showed a few individuals carrying the U5 haplogroup, which is normally associated with Palaeolithic or Mesolithic populations of Europe (Fig. V.40). The data was interpreted as evidence of an agrarian expansion to southern Scandinavia, which through marriage alliances resulted in a return migration of women carrying the U haplogroup (Brandt et al. 2013). However, other mtDNA results combined with isotopic analysis from the first half of the 4th millennium at Blätternhöhle have also demonstrated that hunter-gatherers were living in enclaves surrounded by agrarian societies

(Bollongino et al. 2013). A degree of integrationism could also be suggested for the mtDNA results from the Osttorf burials, located near the Lake Schwerin, from the late 4th millennium BC. The burials were interpreted as part of a hunter-gatherer enclave surrounded by agrarian societies. The grave goods (arrowheads, fishing hooks and animal tooth pendants) in particular indicated a hunter-gatherer identity, which was supported by isotope analysis showing the individuals consumed a large amount of aquatic food resources (Lübke et al. 2009, 130ff; Schulting 2011, 21). Archaeogenetic studies have been carried out on seven sets of human remains (Ostorf SK28a, SK8d, SK35, SK12a, SK45a, SK18 and SK19) dated to 3200-2900 cal BC. Three burials contained individuals with Palaeolithic/Mesolithic haplogroups U5 and U5a (SK8d, SK35 and SK19), whilst the remains in the four other burials displayed Neolithic haplogroups J (SK45a), K (SK28a) and T2e (SK18) (Bramanti et al. 2009, 139). The haplogroup J from burial SK45a is especially interesting, as it is often associated with humans living in an agrarian society. However, the individual from Ostorf died as a hunter-gatherer, although his ancestors may have lived as farmers. On the other hand, we may be dealing with evidence of marital alliances between agrarian and hunter-gatherer societies, which resulted in a change of diet for these individuals. The individuals from Ostorf could, however, also represent a migration from South Scandinavia. Generally, a counter reaction seems to have taken place to the sometimes hard life of a farmer, which could attract groups of people to become less dependent on agrarian subsistence and more dependent on hunting and gathering. The emergence of the Pitted Ware culture may represent an example of this.

The people buried at Osttorf were surrounded by agrarian societies, thus showing a late adaptation to foraging activities. In these environments people could change their subsistence strategy, if the surrounding conditions allowed for such a change. It is therefore generally problematical to associate certain types of haplogroups with either farmers or hunter-gatherers, when transitional periods between foraging and agrarian societies are investigated. Furthermore, there is one important criticism associated with mtDNA analysis, as mitochondria are inherited exclusively from the mother. We are therefore only documenting half of the story, which is why current DNA research is focused on extracting core DNA from archaeological samples. In general, the explanations that have been suggested in connection with the mtDNA are somewhat oversimplified, but new studies, like those from Blätternhöhle and Osttorf, demonstrate the complexity of agrarian expansions. Nevertheless, mtDNA investigations are increasingly being undertaken so that the results, together with a full-scale integration of other archaeological data, will play an important role in understanding the expansion of agrarian societies in the future.

8. THE ANALYSIS OF SECONDARY EVIDENCE OF AGRICULTURE IN SOUTH SCANDINAVIA DURING THE 5TH AND 4TH MILLENNIUM BC

The investigation into the secondary evidence focuses on the material culture (ceramics, axes, lithics and copper tools) and structures (flint mines, long barrows and enclosures) from the late 5th and early 4th millennium BC in both Central Europe and South Scandinavia, in order to document and discuss whether the changes are just as abrupt as the primary evidence demonstrated. It is thus possible to gain a more nuanced understanding of the emergence of agrarian societies, as well as the creation of communities of practice and networks, at both a local and regional level in South Scandinavia.

8.1. Ertebølle and Funnel Beaker ceramics

Researchers have argued that the coarse Ertebølle ceramics evolved into the finer Funnel Beaker ceramics based on independent innovation, which occurred without any interference from outsiders, thus supporting the theory of a gradual adoption of agriculture between the late 5th and early 4th millennium BC (Troels-Smith 1954; Jennbert 1984; Koch 1998; Persson 1999; Fischer 2002; Andersen 2008b; Glykou 2011). Other scholars have claimed that the funnel beakers were the result of small-scale leapfrogging migration of farmers from Central Europe, thus supporting the theory of a major cultural change to an agrarian society from 4000 cal BC onwards (Becker 1947; Schwabedissen 1968; 1972; Nielsen 1987; Rowley-Conwy 2011). It has also been argued that these migrations were not random expansions, but part of a large-scale advance of agrarian societies around 4000 cal BC originating from the Michelsberg culture (Becker 1954; Klassen 2004; Sørensen 2012a). In the following section patterns of continuity and change will be discussed, based on the

Fig. V. 41. Pointed based vessel and a blubber lamp from the Late Ertebølle culture. After Jensen 2001, 212.

ceramic material from the Late Ertebølle culture and the Early Funnel Beaker culture.

8.2. Chronology and typology of ceramic assemblages during the Late Ertebølle and Early Funnel Beaker cultures

The hunter-gatherers of the Late Ertebølle culture began to produce pointed-based vessels and flat-based blubber lamps approximately between 4800 cal BC and 4600 cal BC (Mathiassen 1935; Andersen 2011; Brinch Petersen 2011; Hartz 2011) (Fig. V.41). The distribution of Ertebølle ceramics is concentrated in southern Scandinavia, northern Germany and Poland. The interpretation of the origin of the pointed-based Ertebølle pottery has changed from being the result of relations with Western European "subneolithic groups" to showing closer affiliations with pottery traditions of hunter-gatherer groups on the Russian plains (Hulthén 1977; van Berg 1990; Timofeev 1998; Raemaekers 1999; Klassen 2004; Louwe Kooijmans 2007; Hallgren 2008; Gronenborn 2009; Povlsen 2014). A connection between the Ertebølle and Swifterband pottery should, however, not be totally dismissed, as our knowledge of Late Mesolithic pottery finds from Lower Saxony and the northern parts of the Netherlands is limited (Deichmüller 1969; Schindler 1962; de Roever 2004; Hartz 2011). There are regional style differences within the ceramic material of the Ertebølle culture, which have also been observed in the shape of the base (Hulthén 1977) (Fig. V.42). A cylinder-shaped base has been observed on the Ertebølle vessels in Scania and on Bornholm, whereas a more pointed base has been documented from Zealand, Funen, Jutland, Schleswig-Holstein and northern Poland (Prangsgård 1992; Hartz 2011; Kabaciński & Terberger 2011). Other regional variations within the Ertebølle culture have been proposed by measuring vessel wall thickness, and investigating the manufacturing techniques and shapes of the vessels (Andersen 2011) (Fig. V.43). The eastern and north-eastern part of Denmark and Scania are dominated by thick sherds made using the H-built technique, with cylindrical and S-shaped vessels found together. The west and south-western parts of Denmark are dominated by thinner sherds made using the U-built technique and by S-shaped vessels (Andersen 2011). The regional differences in the ceramic assemblages

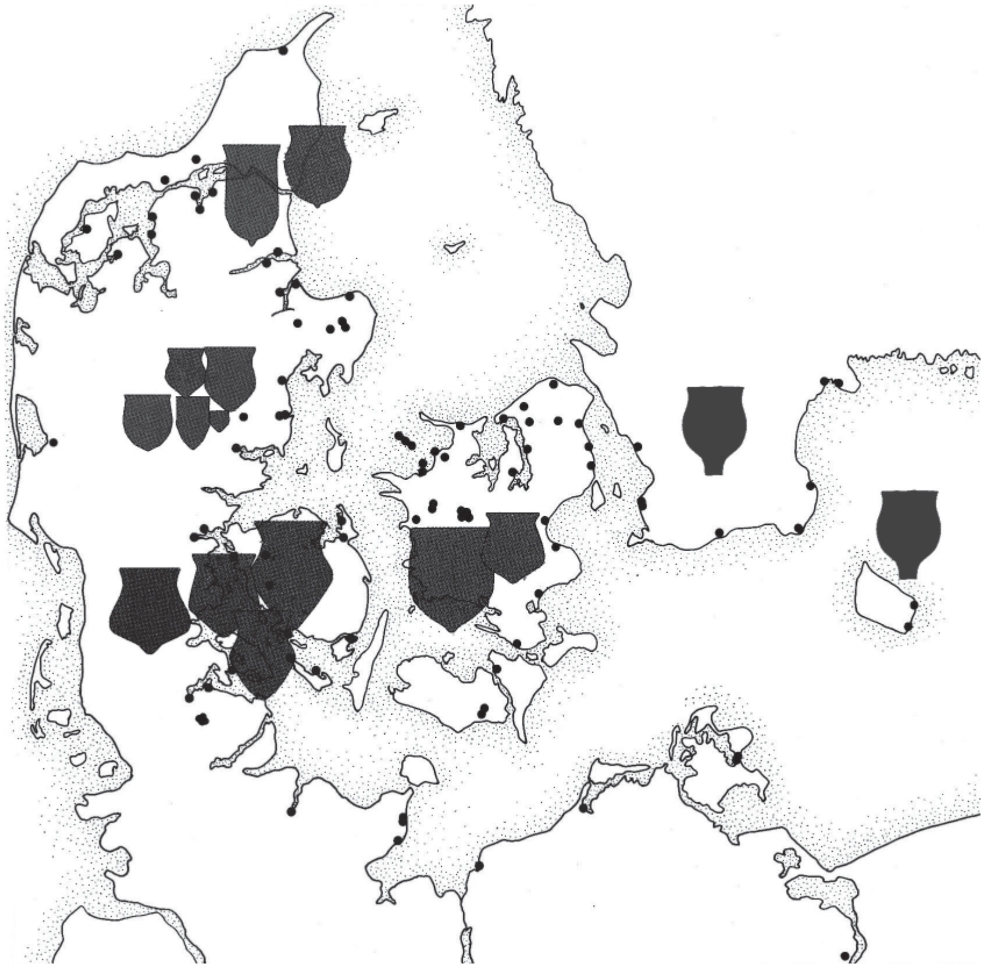


Fig. V. 42. Distribution of pointed based Ertebølle vessels and their regional variation. After Jennbert 1984; P. O. Nielsen 1994; Vang Petersen 2001; Andersen 2011.

during the Late Ertebølle culture could indicate a hunter-gatherer society, characterized by several tribal groups. But around 4000 cal BC the characteristic pointed-based pottery, as well as the typical lamps, disappeared (Fischer 2002; Meurers-Balke 1983). Continued use of the lamps into the Early Neolithic was formerly only supported by data from sites like Siggeneben-Süd and Åkonge, where it is difficult to separate the stratigraphic layers from the Late Ertebølle and Funnel Beaker culture. However, a lamp with nail impressions on its rim was found at the Polish site of Dąbki. Such decoration is similar to the ornamentation found on Early Funnel Beaker vessels, thus supporting the argument for a continued production of the lamps into the earliest part of the Funnel Beaker culture (Czekaj-Zastawny et al. 2011a, 61).

Funnel beakers emerge in southern Scandinavia around 4000 cal BC, together with flasks, bowls, discs and spoons (Fig. V.44). The distribution of funnel beakers covers most of South Scandinavia, including parts of Central Sweden, thus showing the same distribution as cereals and domesticated animals (Hallgren 2008). Traditionally, the earliest types of funnel beakers in southern Scandinavia have been associated with various typological groups, primarily based upon rim decoration and vessel shape. The earliest groups were associated with either the A group or the Oxie/Wangels group, belonging to early EN I dated from 4000 to 3800 cal BC (Becker 1947; Larsson 1984; Madsen & Petersen 1984; P. O. Nielsen 1985; 1994; Stilborg 2002a; Müller 2011a; Hartz 2011). These beakers were characterized by a short neck and simple

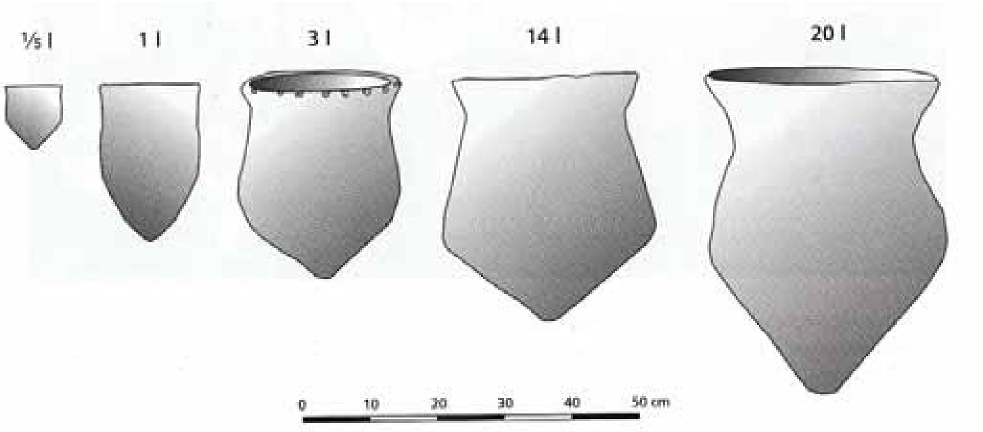


Fig. V. 43. Various sizes of pointed based Ertebølle vessels. After Andersen 2011.

rim decoration of either nail or stamp impressions. This phase was followed by a B group and the non-megalithic C group in Becker's typology. The B group is associated with the late EN I from 3800 to 3500 cal BC (Fig. V.45).

The beakers from the B group were sub-divided into several regional groups, based on minor differences in the ornamentation and its placement on the vessels (Fig. V.46). Whether these minor differences really represent the emergence of regional groups is dependent on how various researchers interpret the differences and similarities in the shape and ornamentation of the vessels. Beakers from Schleswig-Holstein and Langeland are associated with the Siggeneben-Süd/Sattrup/Stengade II group, which includes vessels typical of the A and B groups. The reason for this overlap is mainly connected to the fact that the Siggeneben site has been dated from 4100 to 3600 cal BC, and includes vessels from all the first stages of the Early Neolithic (Meurers-Balke & Weninger 1994, 261f). Volling beakers, on the other hand, are concentrated in Jutland, whereas Svaleklint beakers are mainly found on Zealand. The difference between them can be seen in the rim ornamentation, which is dominated by stick-stabs and stab-and-drag ornaments on Svaleklint vessels, whereas the Volling vessels are dominated by two-ply cord impressions or stab-and-drag decoration (Koch 1998, 45). However, recently the Volling group has been interpreted as being contemporary or even earlier than the Oxie group (Müller 2011b). This observation was based on radiocarbon dates of charcoal from 4000 to 3800 cal BC taken from features associated with long barrows (Table 21). Several of these long barrows contained Volling ceramics as grave goods. If this interpretation is correct, then long barrows came to southern Scandinavia around 4000 cal BC together with the first farmers. Volling beakers do have parallels in the Chasséen culture from around 4500 cal BC and in the Michelsberg ceramic assemblages after 4200 cal BC, thus indicating that these types of vessels may appear in southern Scandinavia from the early EN I (Müller 2011a). However, there are many problems associated with placing the Volling group before the Oxie group. Firstly, all the discussed radiocarbon dates from the long barrows are conventional dates, thus giving a lower dating resolution of at least 200 to 400 years. Secondly, many of these radiocarbon dates could originate from earlier occupation in the Early Neolithic, which has been observed stratigraphically below several of the barrows in question (Madsen 1975; Skaarup 1975; Madsen & Petersen 1984; Liversage 1981; 1992; Larsson 2002; Rudebeck 2002; Beck 2009) (Table 21). Thirdly, the dated charcoal may originate from large oak trees, which could have been 200 to 300 years old, thus giving earlier radiocarbon dates. In addition, stratigraphic observations from the Norsminde kitchen midden have confirmed that Volling ceramics were found in layers above the Oxie ceramics (S. H. Andersen 1993, 91) (Table 52). Finally, it should also be mentioned that several new AMS radiocarbon dates of charcoal from pits or cultural layers containing Volling ceramics are concentrated between 3800 and 3600 cal BC (Skousen 2008; Ravn 2011) (Fig. V.47 and Table 22). All these arguments point towards an introduction of the Volling ceramics and the long barrows around 3800 cal BC.

In Scania and Blekinge the beakers belonging to the B group are ornamented in the Svenstorp/Mossby/Sire-

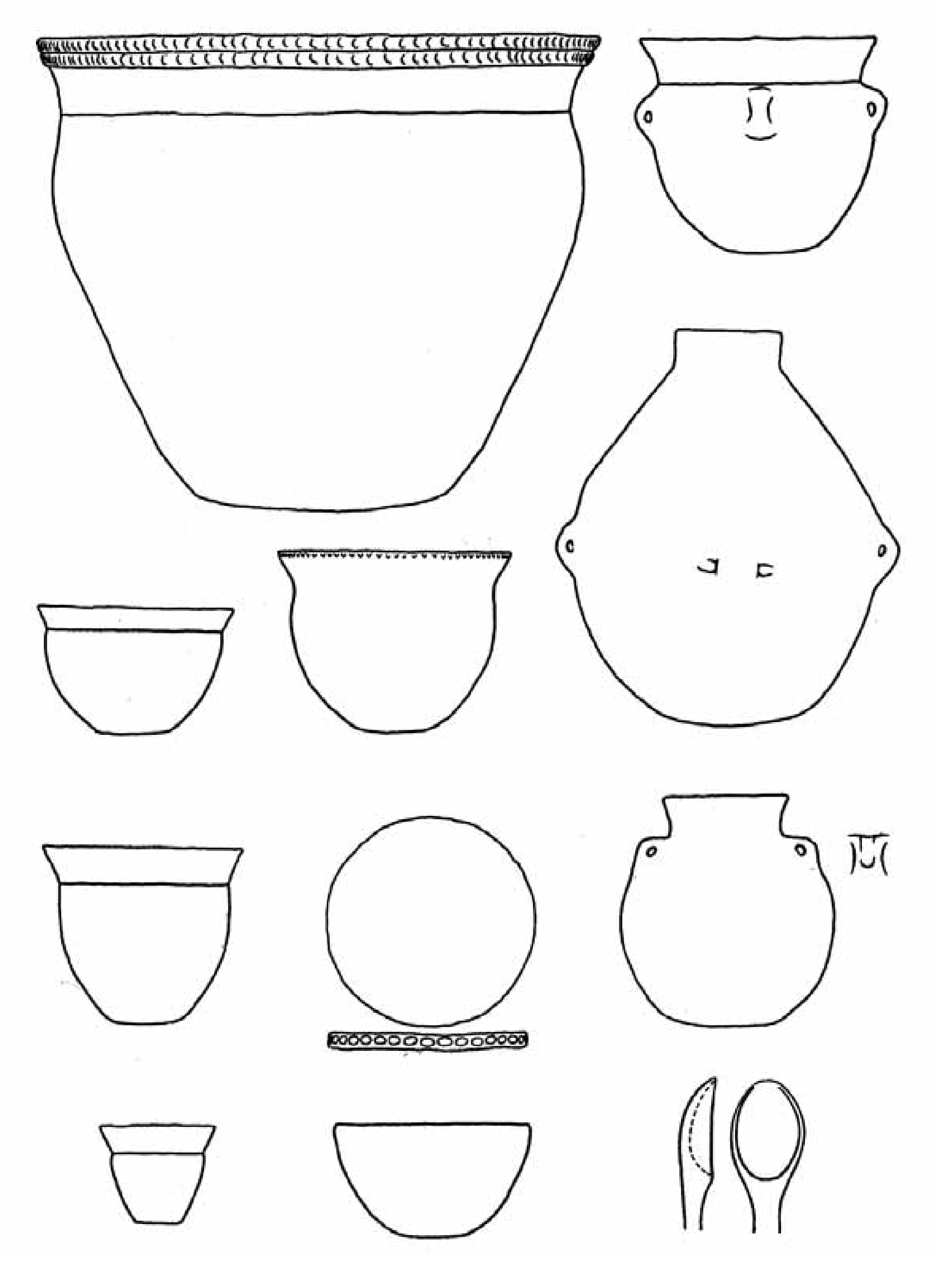


Fig. V. 44. Funnel beaker vessels, discs and spoons belonging to the A-group. After P. O. Nielsen 1994.

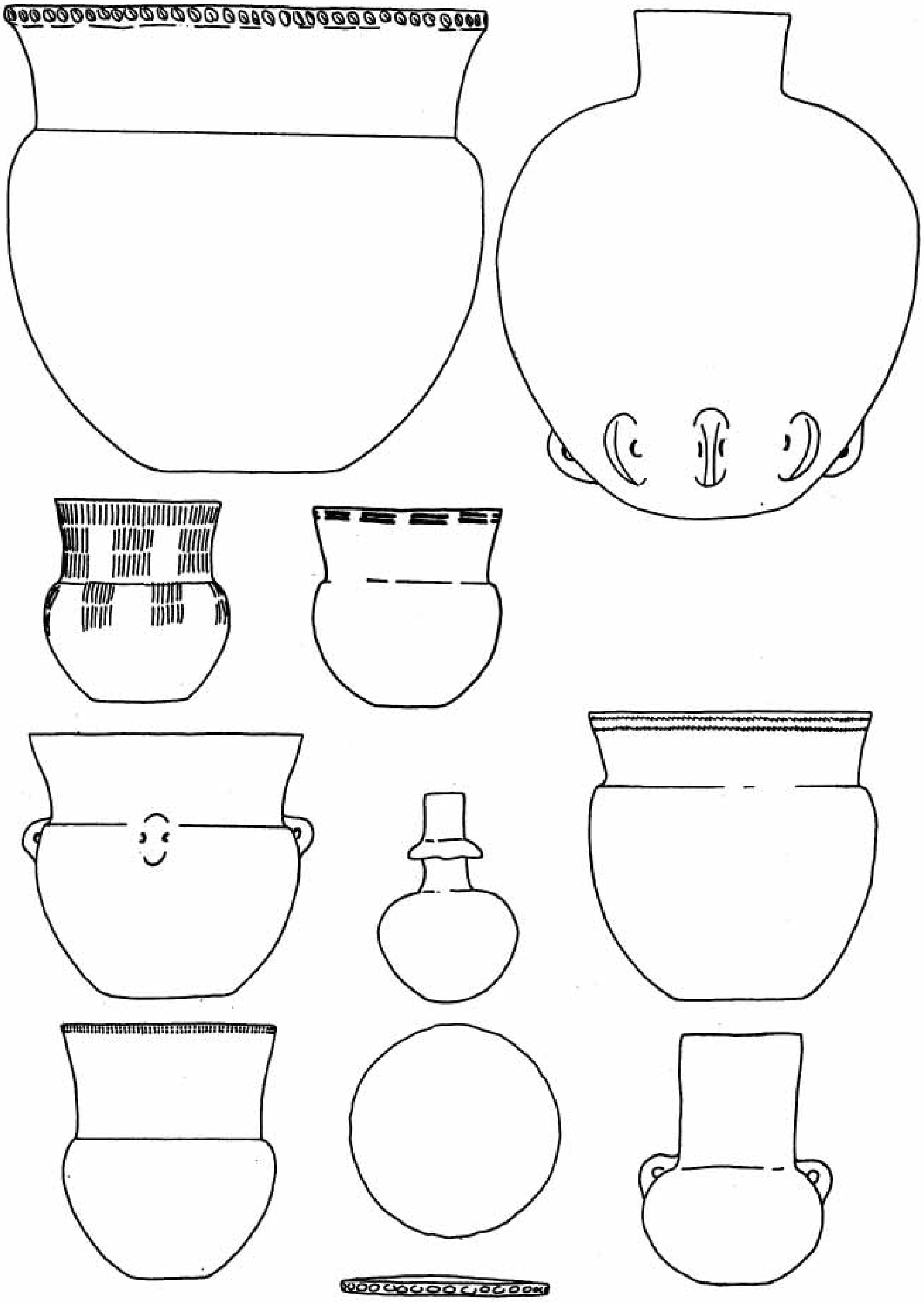


Fig. V. 45. Funnel beaker assemblages belonging to the B-group. After P. O. Nielsen 1994.

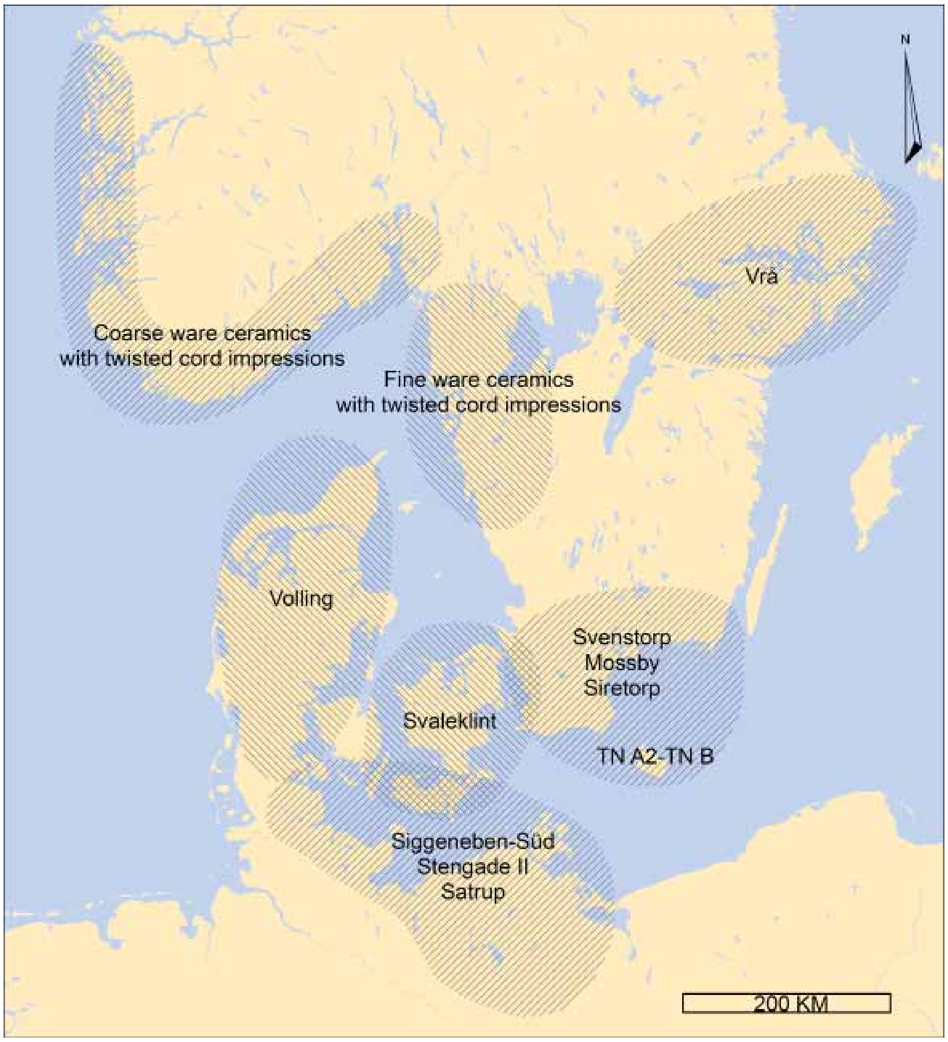


Fig. V. 46. Distribution of different regional ceramic groups during the late EN I. After Skaarup 1975; Madsen & Petersen 1984; Larsson 1984; Klassen 2004; Hallgren 2008; Nielsen 2009.

torp styles. However, these styles are as yet vaguely defined and are difficult to separate from one another, as they are all dominated by two-ply cord impressions. The Vrå style, on the other hand, is concentrated in East Central Sweden and is characterized by twisted cord impressions, cord stamps, tooth impressions and pit impressions (Bagge & Kjellmark 1939; Larsson 1984; 1992; Hallgren 2008) (Plate 3). In particular, the early appearance of pit impressions is a specific regional feature, which continues during the Pitted Ware culture (Strinnholm 2001; Larsson 2009). Other beaker groups displaying twisted cord impressions and stamps, and possibly influenced by the beakers of Vrå style, have been observed in western Sweden, as well as southern and south-western Norway (Hallgren 2008; Solheim 2012) (Fig. V.46). The earliest beakers from southern Norway are characterized by twisted cord impressions and appear to have been introduced during the late EN I phase. Later on, during the transition between the late EN I, EN II and MN, funnel beakers with corded stamp impressions are observed (Table 36). However, the ^{14}C dates of food residues on funnel beakers from Norway are especially debatable, as there may be problems associated with the reservoir effect, as discussed in section 6.2. In general, the Early Neolithic ceramics from southern and western Norway have a thickness of above 1 cm and contain tempering of

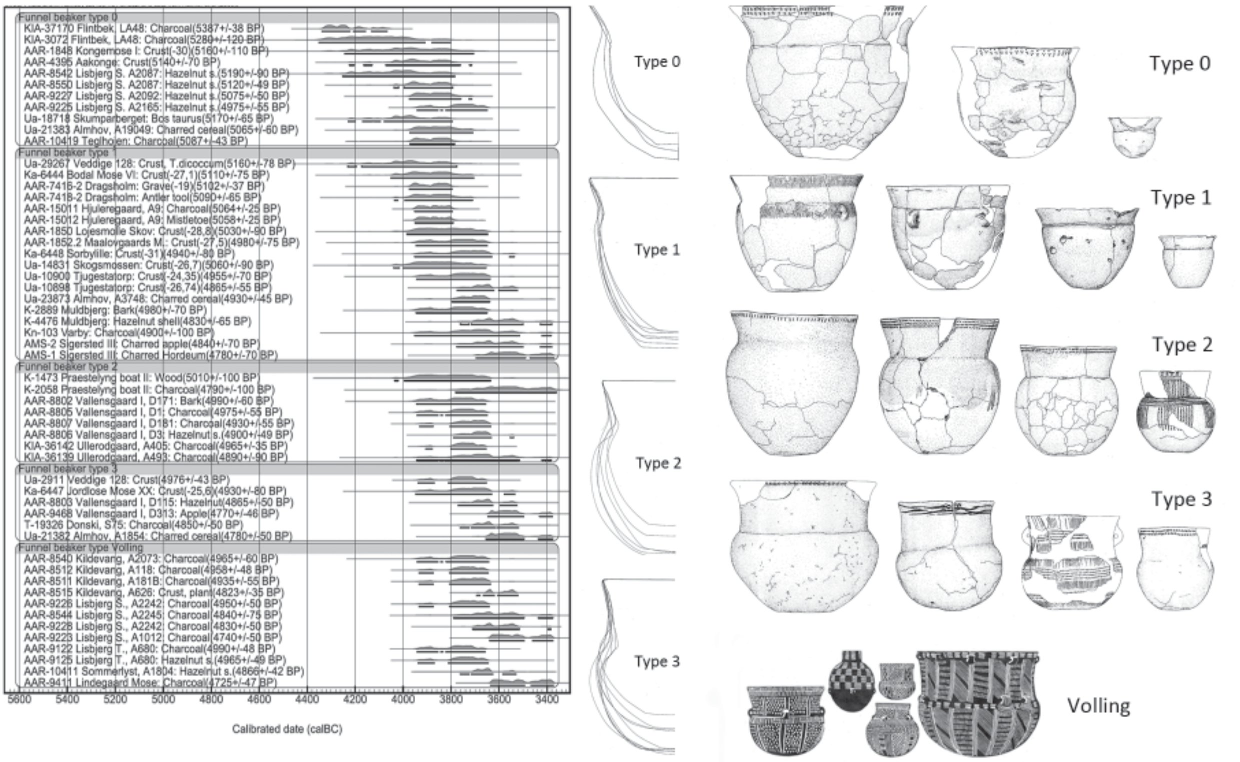


Fig. V. 47. [14]C dates of various types of funnel beakers (type 0, I, II, III and Volling vessels) in southern Scandinavia. After Koch 1998.

up to 1 cm in size (Skjølsvold 1977, 336; Nærøy 1987, 118; Olsen 1992; Åstveit 1999; Hallgren 2008; Åhrberg 2011). It therefore represents local production, which the indigenous population could have learnt through contacts with neighbouring agrarian societies. Contact with agrarian societies has been indicated by some rare finds of funnel beakers, which based on their shape, thickness, temper and ornamentation show similarities with the South Scandinavian B group. Such sherds have been found in small pits at sites like Dønski and Vøyenenga near Oslo, the enclosure-related site of Hamremoen, near Kristiansand, and at the site of Kotedalen in Hordaland, which is further discussed in section 12.8 (Olsen 1992; Østmo & Skogstrand 2006; Demuth & Simonsen 2010; Glørstad & Sundström 2014).

The B group is followed by the C group, which has been dated to approximately 3500 to 3300 cal BC, and can be regarded as a transitional style to the Middle Neolithic (Nielsen 1993; Koch 1998). The C group is characterized by vertical stripes on the belly of the vessels and rim ornamentation like whipped cord patterns, combined with different types of impressions. The C group has also been sub-divided into several groups, based on minor differences in the decoration. The Bellevuegård group can be identified in Scania, the Virum group is concentrated in eastern Denmark and the Fuchsberg group in the western part of Denmark (Ebbesen & Mahler 1980; Andersen & Madsen 1978, 142, Larsson 1984; Madsen 1994; Torfing 2013). Funnel beakers with vertical belly stripes and pits have also been observed from Central Sweden, thus pointing toward the emergence of Pitted Ware ceramics (Strinnholm 2001; Hallgren 2008; Larsson 2009). Funnel beakers belonging to the South Scandinavian C group have also been found in southern Norway at the megalith at Skjeltorp and two habitation sites, located at Børsebakke and Narestø (Østmo & Skogstrand 2006; Østmo 2007). During the EN II and MN phases many vessels in southern and western Norway display ornamentation characterized by corded stamp impressions, which could be interpreted as the emergence of a regional style (Ingstad 1970; Skjølsvold 1977; Olsen 1992; Amundsen 2000; Bergsvik 2002; Østmo 2007; Solheim 2012). Generally, the use of stamp impressions begins in the late EN I phase in South Scandinavia and becomes increasingly

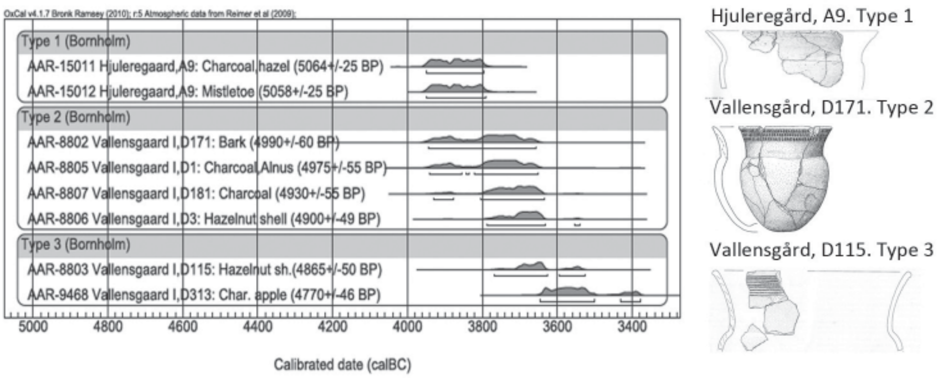


Fig. V. 48. ^{14}C dates of archaeological contexts containing funnel beakers of type I, II and III from Bornholm. After Nielsen 2009.

important during the EN II and MN (Andersen & Madsen 1978; Schwabedissen 1979, 150ff; Larsson 1984; Koch 1998; Klassen 2004).

There are many overlaps between the Early Neolithic ceramic groups based on ornamental trends (Becker 1947; Ebbesen & Mahler 1980; Larsson 1984; Madsen & Petersen 1984; P. O. Nielsen 1985; 1994). The problem has been solved by standardized measurement of vessel profiles, in which especially the length of the neck of the vessels is of typological importance (Salomonsson 1970; Koch 1998; Hallgren 2008; Nielsen 2009). Measuring the length of the neck of vessels as a percentage of the rim diameter produces a neck index, which reflects some typological trends. Vessels with the shortest necks are characterized as short-necked funnel beakers of types 0-I, which belong to the A group. Funnel beakers with a medium neck length belong to types II and III, which can be associated with the B group, whereas the C group corresponds to beakers with longer necks (types IV and V.1) (Koch 1998, 81ff). The typology proposed by Koch has been more or less confirmed by radiocarbon dating of the food residues present on different types of vessels, although some dates had to be discarded (Fischer 2002). These dates did not take into account the significance of reservoir effect, which could have meant that the radiocarbon dates were several hundred years earlier, depending on local variations (Bowman 1990).

8.3. Radiocarbon dates and ceramics from the Early Neolithic

A summary has been compiled of published radiocarbon dates from food residues on funnel beakers and contexts containing Early Neolithic beakers from all over southern Scandinavia (Fig. V.47 and Table 22). The dates of short-necked beakers of type 0 were concentrated from 4000 to 3800 cal BC, whereas type I was concentrated from 4000 to 3600 cal BC. Types 0 and I belong to the A group of short-necked funnel beakers.

Types II and III were dated from 3800 to 3500 cal BC. The results show an overlap between the A group/Oxie style of types 0-I and the B group/Volling/Svaleklint/Svenstorp styles of types II-III. Perhaps funnel beakers of type I, such as the one found in the male burial at Dragsholm, were in use for a longer period of time than type 0. However, a careful examination of the radiocarbon dates associated with type I funnel beakers reveals that the dates from Muldbjerg and Värby are old conventional dates. If these dates are discarded, then the majority of radiocarbon dates cluster around 4000 to 3800 cal BC. A general overview of the development of the funnel beakers emerges. But detailed typological studies, combined with a series of radiocarbon dates, might be able to help develop a more detailed local chronology. Such a study has been undertaken on the Early Funnel Beaker ceramics on Bornholm (Nielsen 2009). Here it was possible to distinguish between funnel beakers of types I, II and III (Fig. V.48). The research was based upon a series of radiocarbon dates from pits or postholes containing beakers. These results were combined with systematic recording of the neck index for each type of beaker. Type I was dated to 4000-3800 cal BC, whereas type II clustered around 3800 to 3700 cal BC and type III to approximately 3600 cal BC. In East Central Sweden several ^{14}C dates of contexts and food residues were also undertaken in relation to Vrå ceramics of types I, II, III and IV, which covered the whole EN I period (Hallgren 2008) (Plate

3). However, the typological classification of Vrå beakers of type 1 corresponded with Eva Koch's types I and II, which could explain why the ^{14}C dates covered the whole EN I phase. Generally, it is clear that the A group/Oxie ceramics can be characterized as short-necked funnel beakers of types 0 and I in the typology suggested by Koch (1998), Nielsen (2009) and partially Hallgren (2008). These short-necked funnel beakers may have been associated with the first agrarian societies in southern Scandinavia, appearing quite suddenly all over the region, whilst the pointed-based Ertebølle pottery vessels disappeared equally quickly (Plate 4).

8.4. Stratigraphy and development

The disappearance of the Late Ertebølle pottery has often been interpreted as an abrupt change, but very little is known about the development of the pointed-based vessels from 4800 to 4000 cal BC and in the transition to the production of funnel beakers (Brinch Petersen 2011). In many cases it has been impossible to observe any development of the Ertebølle pottery, because deposits at many of the sites are intermixed (Jennbert 1984; Koch 1998; Hartz 2011; Glykou 2011). However, at the Ertebølle site of Ringkloster, stratigraphic information was associated with the pottery found in the depositional layers (Andersen 1998a). Pottery sherds from the lower layers were dominated by H-built ware and had an average thickness of 1.2 cm, whereas the upper layers contained sherds dominated by N-built ware and had a thickness of around 1 cm (Fig. V.49). Furthermore, some small pointed- based cups were found in the upper layers, thus indicating a larger variety of vessel sizes in the latest part of the Ertebølle culture. In addition, narrow, rounded bases, described as a "transitional type" between Ertebølle and funnel beaker vessels, have been found in thin transitional horizons dated to around 4000 cal BC at Ertebølle, Bjørnsholm, Krabbesholm and Ringkloster (S. H. Andersen 1993; 2011) (Fig. V.50). Another possible transitional vessel has been proposed as type 0 in Koch's typology (1998). Nevertheless, it is important to acknowledge that neither Ertebølle nor funnel beaker vessels have been found together in the same layers at any kitchen midden sites with a well-defined stratigraphy (Andersen 2008a; 2011). Some coastal and lake shore sites have included layers with both funnel beakers and Ertebølle vessels. However, all these sites have been characterized as having an unclear or intermixed stratigraphy, due to water

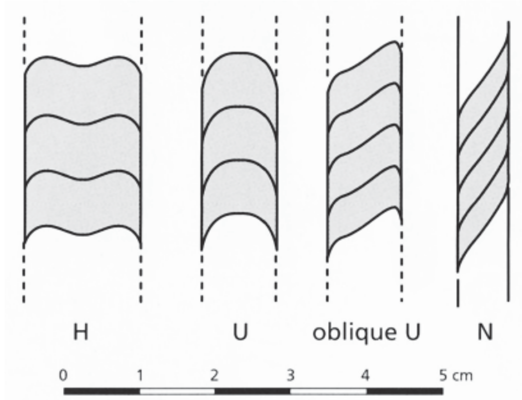


Fig. V. 49. Fabrication techniques of pointed based Ertebølle vessels (H, U, oblique U techniques) and funnel beakers (N technique). After Koch 1987.

transgressions or dynamic bog sedimentation (Bagge & Kjellmark 1939; Becker 1939; Mathiassen et al. 1942; Schindler 1955; Schwabedissen 1972; 1979; Meurers-Balke 1983; Jennbert 1984; Noe-Nygaard 1995; Hartz 1999a; 1999b; Fischer 2002; Lübke 2004; Hirsch et al. 2008; Terberger et al. 2009; Glykou 2011). How should we interpret these observations? Are we dealing with ongoing improvements in the Ertebølle ceramic technology, with no connection to the development of funnel beaker vessels, or a gradual change towards the emergence of funnel beaker vessels? In order to discuss these questions, it is necessary to investigate the technological, functional and symbolic characteristics of the pointed-based vessels and the flat-based funnel beakers.

8.5. Function and technology of ceramic vessels between the 5th and 4th millennium

The pointed-based Ertebølle vessels are characterized by an S-shaped or cylindrical profile and have no handles or knobs, whereas the flat-based funnel beakers are associated with a greater variety of forms and shapes, which beside beakers also include bowls and flasks. Other new forms, like clay spoons and discs, have also been observed in the earliest part of the Early Neolithic and are common amongst Central European agrarian societies at the transition between the 5th and 4th millennium (Klassen 2004). The clay discs have been interpreted as baking plates (Backteller) for making flat bread, thus connecting them with agrarian subsistence (Lüning 1968; Davidsen 1974). This interpretation is further supported by the

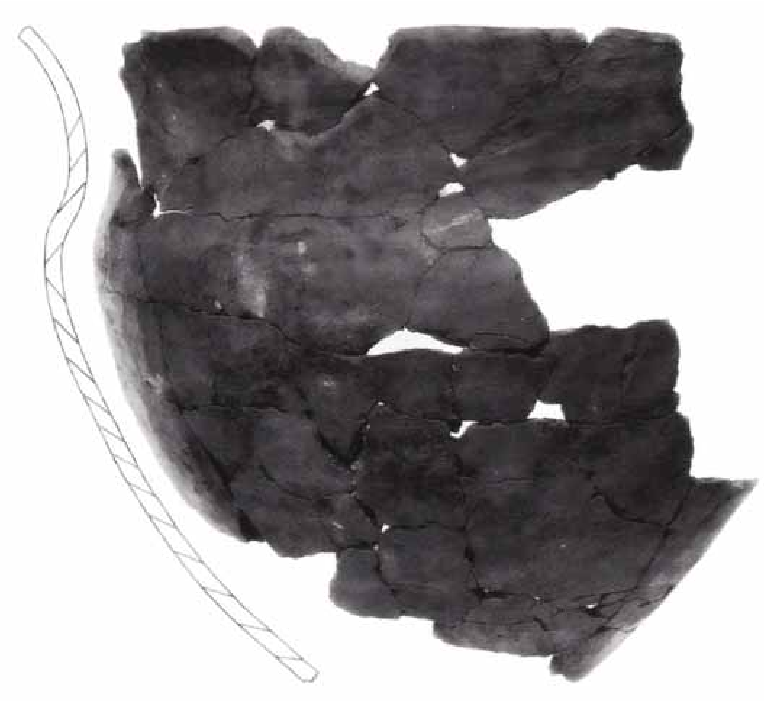


Fig. V. 50. A possible vessel of a "transitional type" from the kitchen midden of Bjørnsholm found in layers dated to around 4000 cal BC. After S. H. Andersen 1993; 2011.

straw-tempering present in the clay discs from St. Valby and Lisbjerg Skole (Becker 1954; Skousen 2008). However, the clay discs do not show any significant traces of sooting, thus questioning their function as baking plates. But experiments have shown that the clay discs could be placed near the fire, where the radiant heat could bake the flat bread without any sooting of the discs (Lüning 1968). Previously the clay discs have been interpreted as lids, but the diameters of the discs range from 15 to 20 cm, and they therefore show less variation than the rim diameters of the funnel beakers, which vary from small (5-6 cm) to medium (10-15 cm) and large (15-20 cm) vessels. It therefore seems likely that the clay discs were used as baking plates (Davidsen 1974).

Pointed-based vessels display similar sizes based on their rim diameter, but preliminary studies have shown that larger pots were preferred during the Ertebølle culture. The Funnel Beaker culture, on the other hand, favoured medium-sized beakers (Koch 1987). Whether these differences reflect what was cooked in the vessels is still unknown, although both Ertebølle vessels and funnel beakers have been used as cooking pots. Lipid studies of food residues from funnel beaker vessels show a continuation of the utilization of marine and freshwater resources during the Early Neolithic (Craig et al. 2011). However, these lipid investigations lack information from vessels found at inland sites located on easily workable arable soils, as argued in section 7.2. A recently published lipid analysis from the inland site of Skogsmossen in Västmanland confirms that cooking of milk may have taken place at these inland-oriented habitations (Isaksson & Hallgren 2012). These results have been interpreted as representing the introduction of dairy products from domesticated animals (cows, sheep or goats) during the Early Neolithic. However, as was argued in section 3.12, the isotopic values of milk fat seem to overlap with deer fatty acids (Evershed et al. 2002; Craig et al. 2005).

One of the major differences between the Ertebølle and funnel beaker vessels is the shape of the base, which may be connected with differing cooking methods. Hunter-gatherer societies seem to prefer pointed-based vessels, because experiments have shown that they can withstand being moved around a lot without breaking, thus corresponding with a more mobile lifestyle (Helton-Croll 2010). However, studies of replicas of large Ertebølle vessels have shown that they have a high fragmenta-

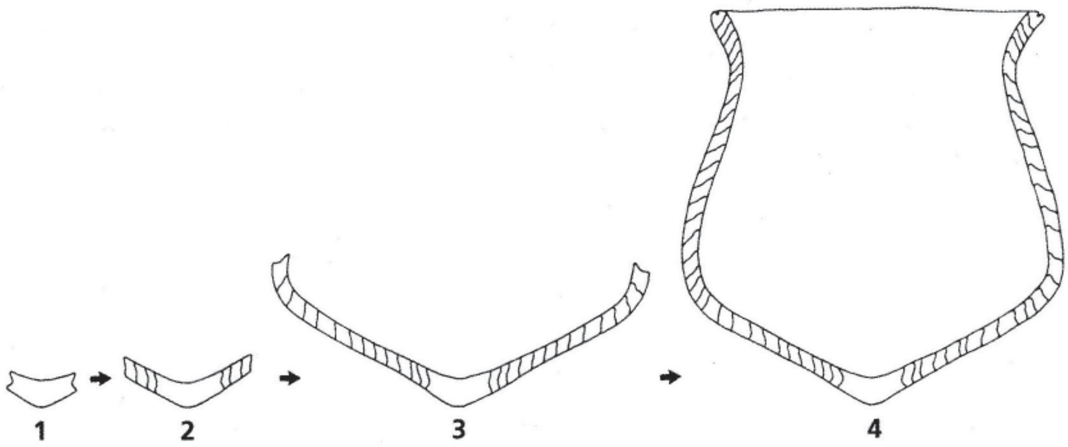


Fig. V. 51. Different coiling techniques observed on Ertebølle vessels. After Hulthén 1977; Koch 1987; Andersen 2011.

tion rate, because of their considerable weight, thickness above 1 cm and coarse tempering, thus suggesting that the larger vessels were used as stationary cooking pots (Inger Hildebrandt pers. comm.). In general, a close connection between past mobility and changes in ceramics has been investigated through ethnographic studies of the Protohistoric period (1450-1700 AD) in the southwestern United States. These studies confirm that the transition from pointed-based to flat-based vessels is synchronic with the transition to a more sedentary mobility pattern, as well as changes in subsistence and cooking methods (Linton 1944; Mills 1984). The pointed-based vessels can be put directly in the fire, thus indicating a different heating and perhaps cooking method compared to the funnel beaker vessels. One of the aims of the cooking method used during the Ertebølle culture could have been to shorten the boiling time, by placing the vessel directly in the fire. This observation is supported by the presence of food residues on the lower half of the pointed-based vessels from the Ertebølle culture (Koch 1987). Furthermore, investigations of Ertebølle vessels show that the base could be exposed to temperatures of up to 800 °C (Hulthén 1977). This strategy would result in limited variation in vessel form, with only a few preferred shapes and sizes used, which is a characteristic feature of Ertebølle ceramics (Andersen 2011).

The funnel beakers were not placed directly in the fire, but rather near to it or in its embers, as food residues are located on the upper parts of these vessels. The observations indicate a more prolonged boiling time and simmering of food, thus suggesting that a different cooking method can be associated with the Early Neolithic, as discussed in section 4.12 (Parker-Pearson 2003). The fact that vessels with narrow, rounded bases are found in Late Ertebølle layers dated to approximately 4000 cal BC points toward a gradual adoption of new cooking methods and funnel beakers by the indigenous population (Koch 1987; Raemaekers et al. 2013). However, the narrow, rounded bases of these vessels have been made in the same way as the pointed bases (Fig. V.51). The vessels with narrow, rounded bases could therefore represent an attempt by local Ertebølle hunter-gatherers to imitate the shape of the funnel beakers, but without grasping the exact technology behind making them (Andersen 2011). The base of a typical funnel beaker is made out of two discs, with clay coils in between them. In certain cases the direction of the clay coils of the funnel beakers changes, either at the midpoint or at the transition to the neck, which is a trait not observed in any pointed-based vessels (Fig. V.52). All these traits enable the pottery maker to have a better control of standardizing the shape of the vessel, which makes it possible to produce a wider range of various vessels, such as flasks, jars, jugs and bowls. The beakers must have stood on a movable surface whilst they were being made. The surface may have been made from interwoven plant materials, as it is not unusual to find impressions of chaff or grass on base sherds (Koch 1998).

The Ertebølle vessels, on the other hand, seem to have been built up either on the lap of the potter or around

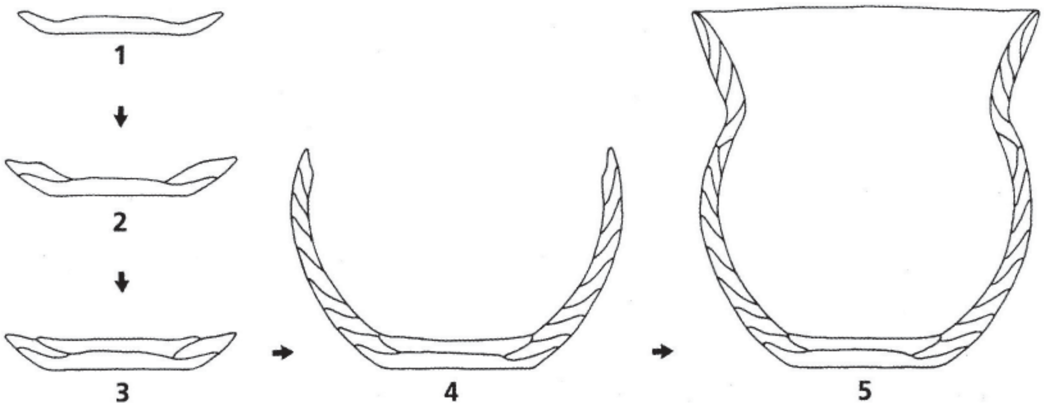


Fig. V. 52. Different coiling techniques observed on funnel beakers. After Hulthén 1977; Koch 1987; Andersen 2011.

a wooden basket, thus resulting in rather variable and sometimes irregular vessel shapes (Tranekjer 2013; Inger Hildebrandt pers. comm.). The pointed-based vessels were begun by shaping a lump of clay into a cone. Then clay coils were placed on top of the cone, and the coils were pressed onto those underneath, often with the potter's fingertips, resulting in either an H-built or U-built ware. The typical H-technique is observed on many pointed-based vessels, but not any funnel beakers, thus indicating an important technological difference between the two types of vessels (Fig. V.53). Nevertheless, the N-technique has been observed on some Ertebølle vessels, which could be interpreted as a gradual technological change towards the making of funnel beakers. However, the N-technique is often seen on certain sloping parts of the Ertebølle vessels. Furthermore, the clay coils of N-built Ertebølle vessels show finger impressions, which are unknown on N-built funnel beaker vessels (Koch 1998; Tranekjer 2013). The N-technique on Ertebølle vessels therefore seems to represent a practical solution and improvement in pottery techniques. Other technological observations have, however, shown considerable overlaps in the size and material of the tempering, and the thickness and sizes of the pointed-based and funnel beaker vessels (Hulthén 1977; Koch 1987; 1998). But pit A 2087 at Lisbjerg Skole, dated from 4000 to 3800 cal BC, included sherds containing a different tempering material, of either fine sand or smaller pieces of granite (Fig. V.54). In particular, the use of fine sand as a tempering material makes it possible to produce very thin-walled ceramic vessels. This observation is confirmed, as funnel beakers tend to be thin-walled and contain a more regular and higher density of tempering. This allows the beakers to withstand thermal shock better, thus prolonging their usage compared to the pointed-based vessels. Moreover, some funnel beakers from Early Neolithic sites only contain tempering of fine sand, which makes it easier to produce very thin-walled beakers and detailed decoration without breaking the vessels (Nielsen 1985; Koch 2004; Skousen 2008). Early Neolithic funnel beakers are characterized by simple ornamentation just below or upon the rim, which may suggest that some vessels also were used for symbolic purposes (Koch 1998). One of the major differences between the vessels of the Ertebølle culture and the Funnel Beaker culture also relates to their symbolic meaning.

8.6. Domestic and symbolic usage of ceramics in Ertebølle and Early Funnel Beaker contexts

Currently there are only a few interpretations connecting the Ertebølle vessels to symbolic usage (Koch 1998; Asingh 2000). One of the more convincing finds comes from the lake shore site of Maglelyng XL, where two Ertebølle vessels were found placed upright against a post, thus suggesting they were an offering. But the unique character of this find does not point towards a standardized tradition of depositing ceramics in wetland areas during the Ertebølle culture. The smaller pointed-based vessels that appeared during the later parts of the Ertebølle culture have also been interpreted as ceremonial drinking vessels, similar to the smaller funnel beakers (Fischer 2002). But again the interpretation is based on a very limited

Chracteristic features observed on ertebølle ceramics	Characteristic features observed on short necked funnel beakers	References
Pointed base made out of a lump of clay	Rounded or flat base made out of two discs with clay coils in between them	Koch 1987; 1998; Lagergren-Olsson 2003; Andersen 2011
Forming vessels by using H or U techniques	Forming vessels by using the N technique	Koch 1987; 1998
Finger impressions between the clay coils	No visible finger impressions between the clay coils	Tranekjer 2013
No change in the direction of clay coils	Change in the direction of clay coils at the transition between neck and belly	Koch 1987; 1998; Lagergren-Olsson 2003; Andersen 2011
Thickness of vessels often above 1 cm	Thickness of vessels often below 1 cm	Hulthén 1977; Koch 1987; 1998
Uneven distribution of coarse tempering inclusions of up to 1 cm in size	Evenly distributed tempering inclusions often below 0,5 cm in sizes	Hulthén 1977; Koch 1987; 1998
More fragile type of ceramic	More compact type of ceramic	Koch 1987; 1998; Lagergren-Olsson 2003; Andersen 2011
Impressions from fingers or nails upon the rim of vessels	Smoothed rims	Hulthén 1977; Koch 1987; 1998
Ornamentation not common: fish net pattern, series of small dots or small shallow marks	Ornamentation common below or upon the rim: nail, finger or stick impressions	Koch 1987; 1998; Lagergren-Olsson 2003; Andersen 2011
Impressions from a wodden basket inside of the vessels at the base and sides	Impressions of braided plant/organic materials on the outside of the vessels	Koch 1987; 1998; Tranekjer 2013
Smooth transition between rim, neck and belly of the vessels	Most often a sharpe transition between neck and belly	Koch 1987; 1998; Lagergren-Olsson 2003; Andersen 2011
Food crusts located within the lower half of the vessels (pots have been standing in the fireplace)	Food crusts located within the upper half of the vessels (pots have been standing near the fireplace	Koch 1987; 1998; Lagergren-Olsson 2003; Andersen 2011
Lower variability in shapes and sizes of pots	Higher variability in shapes and sizes of pots	Koch 1987; 1998; Lagergren-Olsson 2003; Andersen 2011
Intentional depositions of ertebølle vessels occurs rarely	Intentional depositions of funnel beakers occurs frequently in wetland areas or pits	Koch 1998; Andersen 2011; Müller 2011a

Fig. V. 53. Chracteristic features observed on Ertebølle vessels and short necked funnel beakers. After Hulthén 1977; Koch 1987; 1998; Lagergren-Olsson 2003; Andersen 2011; Müller 2011a; Tranekjer 2013.

amount of material (Andersen 2011). Other rare finds of Ertebølle vessels display various types of ornamentation (fish net patterns, a series of small dots and small shallow marks), which suggest that these pottery vessels may have had a symbolic meaning. But if this symbolic meaning was significant within Ertebølle society, then one would expect a greater number of ornamented vessels, as is characteristic of funnel beaker ceramics (Koch 1998). Similar ornamental patterns have also been observed on other Ertebølle artefacts of bone, antler and amber (Andersen 2011). The decorated artefacts of the Late Ertebølle culture have all been found in common "depositional layers", which besides flint flakes, blades and tools also contained ceramics, antler axes, amber beads and stray finds of human bones (Brinch Petersen 2001; S. H. Andersen 2009). Some of these layers may have contained intentionally deposited artefacts. However, it is currently very difficult to separate the intentionally deposited artefacts from normal settlement refuse (Sørensen 2012a). Some artefacts probably had a symbolic meaning within the Ertebølle society, but the pointed-based vessels are likely to represent general domestic usage (Fig. V.53).

The emergence of the funnel beakers around 4000 cal BC, on the other hand, can be associated with the emergence of a new and more formalized symbolic tradition of depositing ceramics and unused pointed-butted flint axes in wetland areas (Koch 1998; Hallgren 2008; Sørensen 2012a). The changes in ceremonial practices have been associated with offerings, which might have been part of a cycle of social gatherings within agrarian societies. Funnel beakers have also been found in burials, such as that of the Dragsholm man (Brinch Petersen 1974; Price et al. 2007). The changed ceremonial practices around 4000 cal BC also resulted in new depositional practices in areas of dry land, where complete funnel beakers have been found in pits near or inside possible house structures (Nielsen 2009). Furthermore, some large ceramic assemblages of funnel beakers, bowls and flasks, as well as discs and spoons, have been found in larger pits. The ceramic assemblages from these sites belong to the A group. The introduction of beakers also resulted in new methods of storing food or liquids, or other practical ways of deposing of refuse from 4000 cal BC onwards (Mathiassen 1940; Becker 1954; Salomonsson 1970; An-

Fig. V. 54. Two funnel beaker sherds from pit A 2087 on Lisbjerg Skole dated from 4000 to 3800 cal BC. The sherds are showing different tempering material of either fine sand or smaller pieces of granite. After Skousen 2004.

dersen 1977; Larsson 1984; Nielsen 1985; Skousen 2008; Rudebeck 2010). Overall, the depositions of ceramic assemblages in pits represent new patterns of behaviour, primarily associated with Early Neolithic sites located on easily worked arable soils. The pits contained various types of vessels, as well as discs and spoons (Plate 4). Similar ceramic assemblages have been found in pits at Earlier Neolithic sites in Central Europe. It is still debatable whether the contents of the pits can be interpreted as intentional depositions connected with large offerings at various social events. However, it is difficult to separate ordinary waste from ritual depositions in these pits, especially if destruction of artefacts was a part of the symbolic behaviour (N.H. Andersen 2000; Andersson 2003).

8.7. Distribution of Ertebølle and funnel beaker vessels

Ertebølle vessels have been found at coastal and lake shore sites. Most of the short-necked funnel beakers have also been found at coastal or lake shore sites in southern Scandinavia, but not beyond the boreonemoral vegetation zone in Central Sweden and southern Norway, thus corresponding to the distribution of primary agrarian evidence during the Early Neolithic (Moen 1999) (Plate 4). The continued habitation near the coastal and lake shore sites indicates a high degree of continuity from the Ertebølle culture. However, signs of change can be observed around 4000 cal BC, with the emergence of a new type of inland site, located on easily worked arable soils. The artefact assemblages from these sites have often been found in pits, thus pointing towards new depositional practices, which are paralleled in the agrarian societies of Central Europe (Lüning 1968; Kirsch 1993; Biel et al. 1998; Klassen 2004; Jeunesse 2011).Unfortunately, the archaeological visibility of these inland sites located on workable arable soils is relatively low, as they are both difficult to find and badly preserved. They often consist of insubstantial cultural layers and some shallow pits just below the subsoil, which makes them vulnerable to modern disturbance. These inland sites are clearly underrepresented in the archaeological material, compared to the easy detectable coastal and lake shore sites, which suggests that the current distribution of short-necked funnel beakers is biased. The interpretation is supported by the results of large-scale rescue excavations, that have revealed previously unknown Early Neolithic inland sites located on easily worked arable soils, which have produced short-necked funnel beakers, near Århus in Jutland (Skousen 2008), in Malmö in Scania (Hadevik 2009) and Mälardalen in East Central Sweden (Hallgren 2008).

The investigations of the Early Funnel Beaker ceramics have also revealed some differences, such as a lack of spoons and discs from the coastal and lake shore sites belonging to the early part of EN I (Plate 4). Currently, Siggeneben-Süd LA 12, Wangels and Norsminde are the only coastal sites from the early EN I at which clay discs have been found (Meurers-Balke 1983; Andersen 1991; Hartz 1999a). The early radiocarbon dates for domesticated animals from Wangels and Siggeneben-Süd indicate early contact with neighbouring agrarian societies, which may explain why clay discs were found at these sites. However, both sites are intermixed with later occupation, from which the clay discs could originate. The same situation can be observed at Norsminde, where the clay disc may be associated with the Volling horizon (Table 52). In addition, many of the inland sites have produced charred cereal grains, evidence of crop processing and quern stones, which do not appear as often at the coastal and lake shore sites (Sørensen & Karg 2012). These differences demonstrate that activities relating to crop processing were of minor importance at the coastal and lake shore sites. The difficulties in learning cultivation practices, as argued in section 4.8, could be one of the reasons why evidence for the processing cereals is so rare at coastal or lake shore sites during the early EN I. These observations could support a scenario of pioneering farmers settling on easily worked arable soils, whereas the coastal and lake shore sites were inhabited by either commuting farmers or indigenous hunter-gatherers. The few domesticated animals at the coastal and lake shore sites could be interpreted as initial herding activities by indigenous communities, who still lived as hunters, gatherers and fishermen in an intermediate phase of transition. These pioneering farmers, who settled on easily worked arable soils, can be interpreted as the prime movers of agrarian ideas. They brought with them a new set of pottery, of various sizes and shapes that could be used for new functional and symbolic purposes, which was quickly adapted as a new trait by the indigenous population, thus supporting the idea of migrationism and integrationism.

8.8. Impulses and contacts based on the ceramic assemblages from the Early Funnel Beaker culture

It has previously been suggested that the funnel beaker of type 0 may represent a transitional shape of vessel between the Ertebølle culture and Funnel Beaker culture, thus indicating an independent evolvement of the funnel beakers (Koch 1998; Andersen 2008a). But type 0 has parallels with short-necked funnel beakers from the early stages of the Michelsberg culture dated to 4400 to 4000 cal BC (Fig. V.55). It is therefore probable that funnel beakers came to southern Scandinavia through direct or indirect contacts with agrarian groups around 4000 cal BC (Lüning 1968). The new practice of disposing of ceramics in pits points towards direct contact, associated with pioneering farmers who were linked to people from the Michelsberg culture (Becker 1954; Biel et al. 1998; Jeunesse 2011) (Fig. V.56). The interpretation is supported by finds of type 0 funnel beakers, discs and spoons in a pit from the site Flintbek LA 48, where pieces of charcoal from the fill were ^{14}C dated to 5387±38 BP (4337-4068 cal BC, KIA-37170) and 5280±120 BP (4351-3803 cal BC, KIA-3072) (Zich 1993, 20; Jansen et al. 2013). Flintbek is one of only inland sites located on easily worked arable soils in Schleswig-Holstein. The ceramic material from Flintbek displays parallels with vessels from the Michelsberg culture (phase II-III), which could have been the place of origin for these pioneering farmers in Schleswig-Holstein (Lüning 1968; Schwabedissen 1979; Laux 1986; Zich 1993; Höhn 1998; Klassen 2004; Jansen et al. 2013). The radiocarbon dates from the pit at Flintbek LA 48 are approximately 100 years earlier than the first funnel beakers in southern Scandinavia, thus supporting the idea of an early impulse from pioneering farmers in Schleswig-Holstein (Table 22). The early impulse is also supported by the domesticated animals, which also arrived around 100 years earlier in Schleswig-Holstein, as discussed in section 7.2 (Hartz et al. 2007; Sørensen & Karg 2012). Contacts with or influences from the Michelsberg culture phase III/IV can also be seen with the appearance of tulip-shaped beakers, which were found at the site Brunn 17 in Mecklenburg-Vorpommern (Vogt 2009) (Fig. V.57). But very few classic tulip-shaped beakers have been found in South Scandinavia. At present, only one has been reported from Zealand, which was found at Øgaarde 19, Åmosen (Koch 1998) (Fig. V.58). The reason for the lack of tulip-shaped beakers could be connected to the aspect of migration theories, which Anthony (1990) has described as the founders' effect. If the first migrating farmers came with a material culture, which did not include the tulip-shaped beakers, then this might explain the lack of certain artefacts. But the few found in South Scandinavia could alternatively have resulted from scouting expeditions, which occurred just before an actual migration (Anthony 1990). Other impulses from the Michelsberg culture have also been reported from the early EN I site of Lisbjerg Skole in eastern Jutland, where a clay disc from pit A

Fig. V. 55. Comparisons between ceramic assemblages from the Michelsberg site of Rübeland-Baumannshöhle in Harzen (left) and the Early Funnel Beaker site of Muldbjerg I on Zealand (right). After Troels-Smith 1957; 1982; Richter 2002.

2087 displayed impressions of a rush mat, thus showing similarities with clay discs from the Michelsberg site of Rübeland-Baumannshöhle in Harzen (Klassen 2004; Skousen 2008) (Fig. V.59). In the same pit (A2087) several funnel beaker sherds contained a tempering material of fine sand, which is a feature of Michelsberg ceramics (Fig. V.54). All these observations indicate that the sudden appearance of short-necked funnel beakers, clay discs, spoons, bowls and flasks should be connected to the expansion of pioneering immigrating groups consisting of men and women, who came from or had close social relations with the people of the Michelsberg culture.

It was previously believed that the origins of the Funnel Beaker culture could be found on the Polish Plain, based upon the numerous sites that have produced typical Funnel Beaker ceramics, especially in the Kujavia region (Becker 1947; Lichardus 1976; Midgley 1992; Persson 1999). The interpretation was supported by a single radiocarbon date (5570±60 BP, 4531-4331 cal BC, GrN-5035), which was derived from a piece of charcoal found in a pit containing short-necked funnel beakers, below a long barrow at the site of Sarnowo (Gabałówna 1970; Wilak 1982) (Table 66). However, several new radiocarbon dates of charcoal from pits that contained funnel beakers, jars, flasks, discs and spoons from the Sarnowo phase at the site of Redecz Krukowy 20 are concentrated around 4000 to 3800 cal BC (Wstępne 2012, 216). These results support the argument for a large-scale synchronous introduction of funnel beakers by people connected with the Michelsberg societies. The appearance of a new material culture is also often contemporary with the earliest agrarian evidence in many parts of Northern Europe,

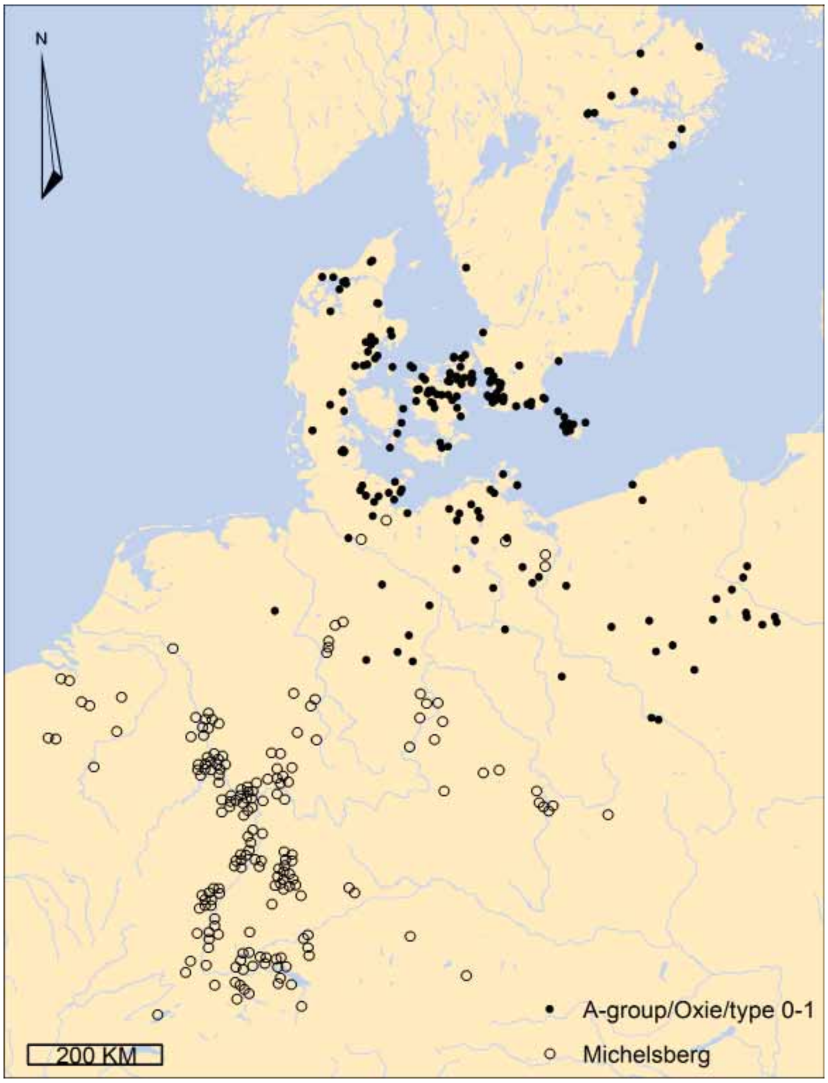


Fig. V. 56. Map of Michelsberg sites in central Europe and localities containing short necked funnel beakers in southern Scandinavia, northern Germany and northern Poland. After Lüning 1968 and data from Plate 4.

thus perhaps suggesting immigration from agrarian societies in Central Europe (Höhn 2002; Klassen 2004; Sheridan 2010).

9. AXES FROM CENTRAL EUROPEAN AGRARIAN SOCIETIES AND THEIR IMITATIONS IN SOUTH SCANDINAVIA

In the ongoing discussion regarding the adoption and expansion of agrarian societies, flint and stone axes have always played a crucial role in each of the proposed hypotheses supporting migrationism, indigenism and integrationism (see section 3.13). In particular, the exchange of foreign axes from agrarian societies in Central Europe with hunter gatherers in South Scandinavia has been interpreted as a movement of mediators of agrarian ideas and ideology, which makes the axes particularly important in the discussion of the Neolithisation process in Northern Europe (Sørensen 2012a).

The purpose of this section is to discuss whether there are functional or more ideological motives behind

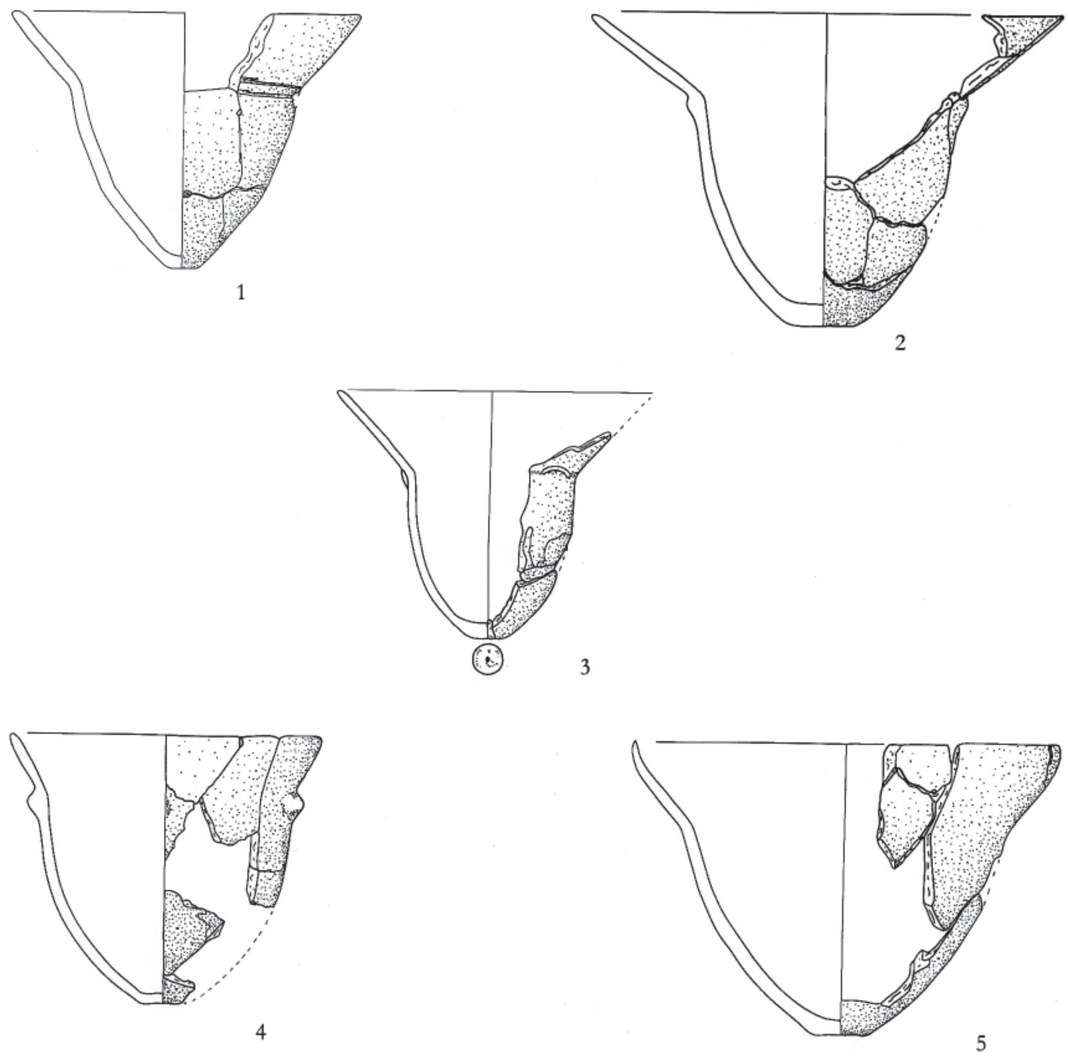


Fig. V. 57. Tulip-shaped funnel beakers from the site Brunn 17 in Mecklenburg-Vorpommern. After Vogt 2009.

the exchange of axes originating from Central European agrarian societies (shoe-last, jade and copper axes) and the South Scandinavia production of axes (Limhamn, Oringe, pointed- and thin-butted axes of flint, and stone and core axes with specialized edges) during the late 5th and early 4th millennium BC. The appearance of local South Scandinavian imitations of axes from Central European agrarian societies is especially significant, as these axes may have functioned as mediators of a meaning, which had been transferred to these local objects. This is an important aspect of the discussion of the emergence of large-scale agrarian networks.

9.1. Shoe-last axes

Provenance studies of shoe-last axes of amphibolite showed that they were thought to have originated from unknown quarries in the Balkans or the West Carpathian area, but recent research points towards outcrops located in the Czech Republic or the Slovakian Republic (Schwarz-Mackensen & Schneider 1983; 1986; Illásová & Hovorka 1995; Raemaekers et al. 2010; Bernardini et al. 2013). During the Ertebølle culture (4900-4000 cal BC) an increasing importation of shoe-last axes can be observed in southern Scandinavia, which reached its peak during the period 4300-4000 cal BC (Klassen 2004, 24ff)

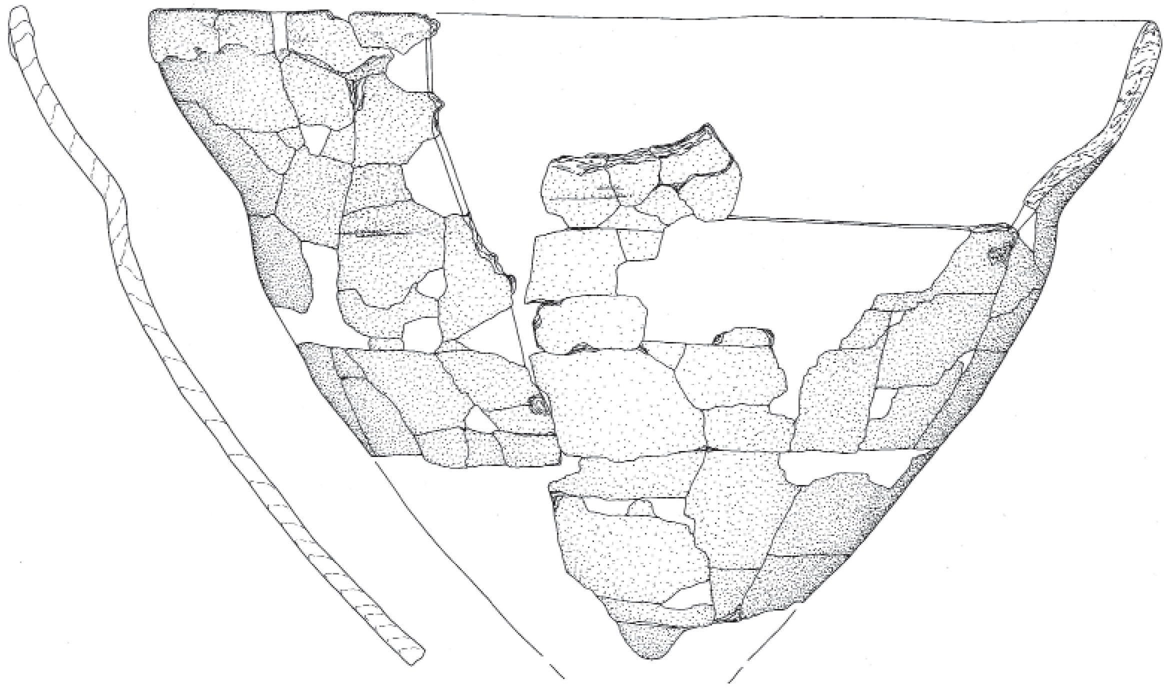


Fig. V. 58. A tulip-shaped beaker from Øgårde 19 on Zealand. After Koch 1998.

Fig. V. 59. Clay disc from pit A 2087 at Lisbjerg Skole contained impressions from a rush mat similar to clay disc from the Michelsberg site of Rübeland-Baumannshöhle in Harzen. After Klassen 2004; Skousen 2004; 2008.

(Fig. V.60). The distribution of shoe-last axes indicates that they probably came to southern Scandinavia via the major Central European rivers, such as the Elbe, Saale and Oder (Fig. V.61). The shoe-last axes had an important symbolic meaning to some of the earliest Central European agrarian cultures, as they have been found in burials and at settlements belonging to the Rössen culture (5500-4400 cal BC) (Klassen 2004). Inspired by many ethnographic parallels, shoe-last axes have been interpreted as prestigious objects, which were exchanged between Central European agrarian societies and Ertebølle hunter-gatherers (Sahlins 1968; Højlund 1979; Fischer 1982; 2002, 376f; Jennbert 1984; Larsson 1988; Laux 1993). The possession of such exotic objects would, according to the theories proposed, create an increased status for the local Ertebølle hunter-gatherers who owned the axes. The systematic exchange of shoe-last axes with Ertebølle hunter-gatherers has thus been interpreted as the movement of mediators of a gradual transfer of agrarian ideas, ideology and hierarchical structures.

However, shoe-last axes have only been found in ordinary refuse layers in South Scandinavia, thus making an interpretation of the axes as prestigious objects seem less plausible (Klassen 2004, 409ff). Although many of the ordinary waste deposits could be reinterpreted, as besides the shoe-last axes these layers also contained decorated antler axes and scattered fragments of human bones (Brinch Petersen 2001, 43ff; S. H. Andersen 2009, 187). Currently, there is no consensus over or clear distinction between the interpretations of normal refuse, as opposed to deliberately destroyed objects or symbolic deposits (N. H. Andersen 2000, 14; Holten 2000, 291; Andersson 2003; Hansson & Celin 2006, 121). It is therefore difficult to separate ordinary waste from symbolic deposits (Rech 1979; Karsten 1994; N. H. Andersen 2000). Moreover, there are only a few burials from the later phase of the Ertebølle culture (4400-4000 cal BC), which might confirm whether or not these shoe-last axes were prestigious objects (Brinch Petersen 2001, 49ff). On the other hand, a deposit has been recorded at Udstolpe on Lolland, which consisted of two shoe-last axes and one pointed-butted stone axe of amphibolite (Lomborg 1962, 20f) (Fig. V.62). The deposition of axes in hoards is characteristic of Central European agrarian societies, but an unknown phenomenon in the Late Ertebølle culture. The shoe-last axes from Udstolpe probably originated from southern Lower Saxony or Thuringia. Furthermore, the deposit

Fig. V. 60. A complete shoe-last axe from Store Åmose on Zealand. Photo. John Lee, the National Museum of Denmark.

from Udstolpe is one of the earliest axe hoards found in southern Scandinavia, as the shape of the shoe-last axes suggests a typological date around 4300-4000 cal BC (Klassen 2004). In addition, the pointed-butted amphibolite axe had a four-sided cross-section, thus showing similarities with copper axes of the Kaka type, which are dated to transition between the 5th and 4th millennium BC (Pétrequin et al. 2012e). The Udstolpe hoard could represent the emergence of new forms of rituals within the Ertebølle culture, which had their origins amongst the contemporary agrarian communities of Central Europe (Fischer 1982; Jennbert 1984). However, during this period there were increased social contacts between Central European agrarian societies and southern Scandinavian hunter-gatherers, which is shown by bone rings, combs and T-shaped antler axes (Vang Petersen 1984; Klassen 2000, 341ff; 2004, 64f; Klassen & Nielsen 2010, 37f; Klassen et al. 2012, 1288f). Therefore, it cannot be ruled out that the deposition at Udstolpe may have taken place right at the transition between the Mesolithic and Neolithic, and was a deliberate symbolic act by the first farmers or the result of a scouting expedition, as discussed in section 5.6 (Anthony 1990).

Another problem associated with the interpretation of shoe-last axes as prestigious objects is the lack of local imitations of these axes, except for a possible example found at the site of Ringkloster (Andersen 1998a, 34). If the ownership of such axes was associated with increased status and the objects functioned as powerful mediators of certain ideas, then local imitations would be expected. The Ertebølle hunter-gatherers had the necessary technological skills to make imitations of shoe-last axes using local raw materials, as they had knapped and polished stone axes and made shaft holes in antler axes since the Early Mesolithic (Nicolaisen 2003; Sørensen 2007; Sørensen & Casati 2010). Many of the local copies

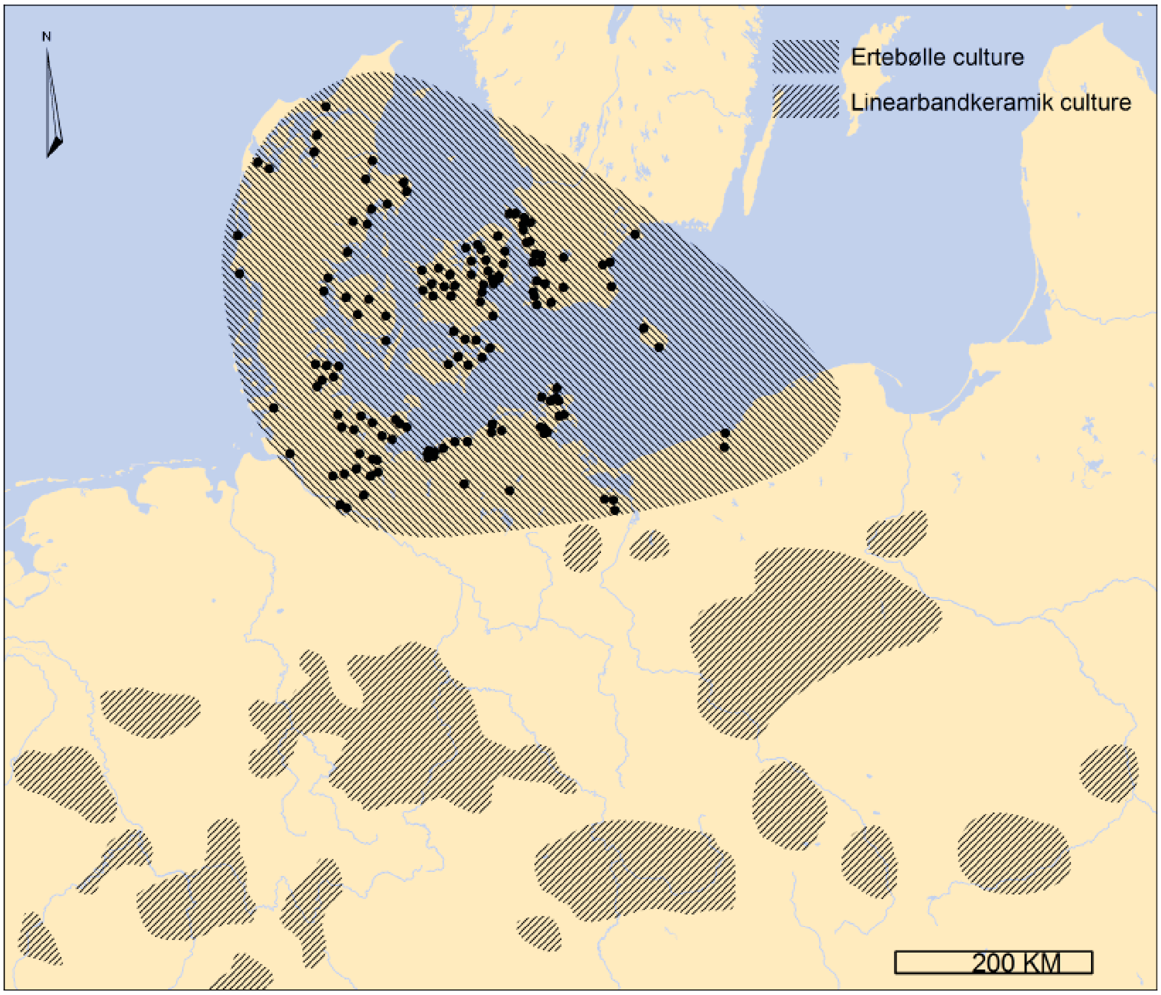


Fig. V. 61. The distribution of the Linearbandkeramik culture and the Ertebølle culture. After Hartz et al. 2007.

of jade and copper axes from the Early Neolithic appear to imitate foreign axes made from local raw materials, which was presumably linked to power and status (Klassen 2000; 2004; Andersen & Johansen 1992, 38; Ebbesen 1984, 113ff). However, some shoe-last axes have been recycled and converted into pointed-butted amphibolite axes, thus suggesting that some of these axes may have had their meaning and symbolic value altered in the centuries before and after 4000 cal BC (Fischer 2002). The transformation from one type of axe to another could also reflect the transition from a hunter-gatherer to an agrarian society between the 5th and 4th millennium BC in South Scandinavia.

9.2. The loss of agrarian ideas in a Mesolithic network

Generally, the lack of imitations of the shoe-last axes could indicate that the ideas behind the axes as items of prestige and status may have been lost in a Mesolithic network of contacts. If an artefact is exchanged indirectly several times and reaches marginal regions of a network, then the original meaning behind the object can be lost and change to something different, as discussed in section 5.4 (Latour 1996a) (Fig. III.18).

The distribution of the shoe-last axes in Northern Europe becomes less dense in South Scandinavia and can therefore be interpreted as a classic "down-the-line" exchange, which implies a more indirect contact between farmers and hunter-gatherer groups (Renfrew 1975,

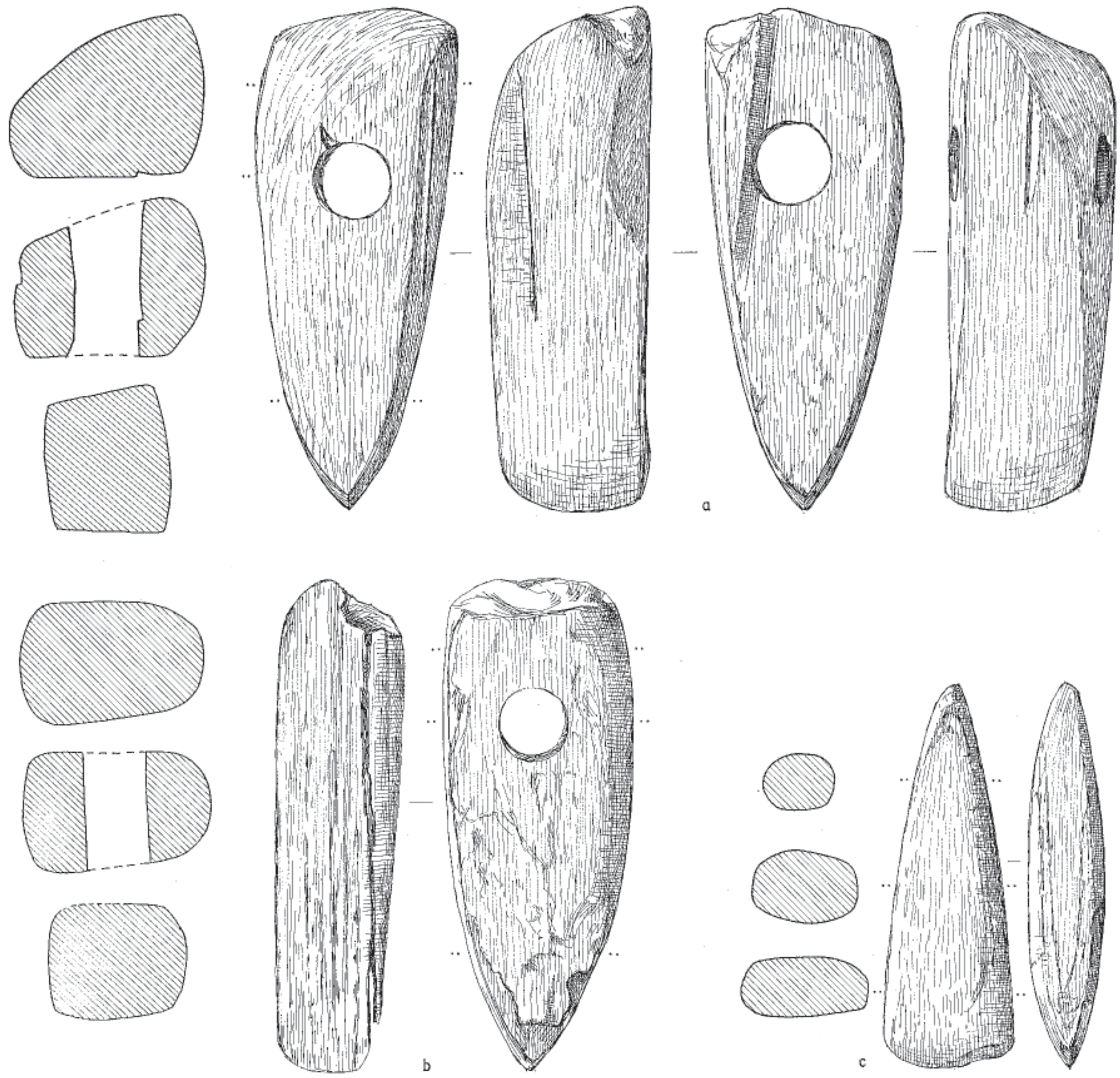


Fig. V. 62. Deposition of two shoe-last axes (a & b) and one pointed-butted stone axe of amphibolite (c) from Udstolpe, Lolland. After Lomborg 1962.

Klassen 2004; Brinch Petersen & Egeberg 2009) (Fig. V.63). This argument is also supported by the very limited evidence of domesticated animals and charred cereals grains that is found at Ertebølle sites, as discussed in section 7.1 (Jennbert 1984; Sørensen 2005; Price & Gebauer 2005). The Ertebølle hunter-gatherers probably had their own preferences regarding when and why certain objects could be associated with prestige and status, which could be the same as or different to the perceptions within agrarian societies in Central Europe (Vang Petersen 1984, 14f; Klassen 2004, 129; Pétrequin et al. 2012a; 2012c, 632ff; Klassen et al. 2012, 1287). The shoe-last axes seem to be an example of selective importation of amphibolite axes, which were used for specific functional purposes, such the preparation of dugout canoes and large hut constructions (Christensen 1990; Grøn 2003). The purely functional use of these shoe-last axes could explain why many of them show signifcant use-wear and fragmentation on the neck (Klassen 2004; Raemaekers et al. 2010, 19). However, this does rule out the possibility that some of the unused shoe-last axes could have been associated with prestige. The personal circumstances and preferences of

Fig. V. 63. Distribution of shoe-last axes in South Scandinavia. After Klassen 2004.

hunter-gatherers probably played an important role in defining what were perceived as objects of power and status during the Ertebølle culture (Sørensen 2012a).

9.3. The Limhamn axes and adzes

The Limhamn axe can be distinguished as a local type distributed in eastern Denmark, Scania and western Sweden, which were produced from a large flake or an oval-shaped nodule of diabase or basalt (Table 53). The cross-section of the Limhamn axes and adzes is two-sided and the polishing is more intensive at the edges than on the sides, which often display knapping scars (Kjellmark 1904, 187ff; Jennbert 1984, 102; Lindgren & Nordqvist 1997, 58). Some Limhamn axes have a pointed butt, which makes it difficult to distinguish them from pointed-butted stone axes from the Early Neolithic (Fig. V.64). Based on their morphological features, some of Limhamn axes could be interpreted as local imitations of jade axes, thus indicating contact with agrarian societies. Archaeological contexts containing Limhamn axes belong to the Late Ertebølle Culture, with dates concentrated from 4600 to 4000 cal BC, which makes them contemporary with the jade axes (Becker 1939, 238; Skaarup 1973, 81ff; Malmros 1975, 107; Pétrequin et al. 2012a) (Fig. V.65 and Table 23). However, one of the differences can be observed in the knapping scars on the sides of the Limhamn axes; the pointed-butted jade or stone axes from the Early Neolithic differ in that they were produced using the knapping and pecking technique, which minimizes the amount of scars on the axes. Furthermore, the polishing of the Early Neolithic stone axes was more pronounced. Moreover, all the axes have been found as stray finds and none have come from hoards, thus indicating that their role in the hunter-gatherer society was of a more functional character.

Perhaps the Limhamn axes that suddenly appeared in South Scandinavia should be interpreted as a local hybrid of the jade axes, resulting from indirect functional rather than symbolic impulses from the Central European farming communities. This hypothesis is supported by the fact that the Limhamn axes represent a new type of axe, which is functionally different, as some of them have been hafted as axes and not adzes. All the previous stone axes in the Mesolithic were adzes and not axes, as their edges were either U-shaped or asymmetrical (Nicolaisen 2003). Adding shafts to axes makes them an ideal tool for cutting down trees and for large-scale logging work, and during the Late Ertebølle culture it can be observed that such axes were used for the building of large dugout canoes, huts and stationary fish structures (Christensen 1990, 119ff; Pedersen 1997; Grøn 2003; Price & Gebauer 2005, 84ff; S. H. Andersen 2009). A study of the Danish Limhamn axes indicates that the majority of them (75%) have symmetrical to slightly asymmetrical edges, and could have been shafted as axes. The remaining 25% have a U-shaped edge, and thus were shafted as adzes (Nicolaisen 2003; 2009, 854) (Fig. V.66). At present, only one shafted Limhamn axe with a symmetrical edge has been found, at Bålkåkra in Scania (Montelius 1917, 16) (Fig. V.67). In this case the Limhamn axe had been inserted as an axe into a piece of red deer antler. The antler has been ^{14}C dated to 5276±38 BP (4240-3980 cal BC, Ua-44079), and thus belongs to the latest part of the Ertebølle culture (Plate 5). It is possible that a new hafting method may have emerged locally, as some pecked axes from Central Sweden do show symmetrical edges (Lindgren & Nordqvist 1997; Hallgren 2008). However, in Denmark and Scania most pecked axes have either U-shaped or asymmetrical edges (Nicolaisen 2003). The innovation of the hafted axe could also have originated

Fig. V. 64. Limhamn axe with a pointed butt from the Ertebølle site of Vejlebro in North Zealand. Fokemuseet in Hillerød (FHM 3362).

from Central Europe, where the axes of Dechseln type from the Rössen Culture (5500-4400 cal BC) may be amongst the possibilities (Klassen 2004, 57ff). A few axes of this type have been found on Zealand (Henriksholm-Bøgebakken) and in Scania (Bökeberg III and Skateholm II / grave 2) (Larsson 1988; Karsten 2001). Dechseln axes are often D-shaped in cross section, which is similar to some of Limhamn axes. Furthermore, the edges of the Dechseln axes are both symmetrical and U-shaped, thus suggesting that they may have been hafted as both axes and adzes, like the Limhamn axes. Another explanation of the hafting method may be associated with the jade axes, as they all have symmetrical edges. Moreover, they have been depicted as hafted axes in rock carvings in several burials from northern France, which have been dated to 4900-4700 cal BC (Bailoud et al. 1995). The spreading of a particular technology, which in this case is the hafted axe, may have taken place very quickly in prehistoric times, which could have resulted in the appearance of the Limhamn axe in southern Scandinavia. There are several other examples from the Mesolithic period, which show that new types of arrowheads, along with new hafting methods, could have spread throughout Europe over a few hundred years (Kozłowski 2009). Such expansions of new technological trends, however, did not necessarily also result in the spread of new ideological trends that changed whole societies.

There was systematic production of Limhamn axes concentrated around the quarry sites of Kullens Fyr, Sjöholmen and Jonstorp in Scania. However, local production also occurred, as preforms of Limhamn axes have been reported from Hammeren on Bornholm, Sølager, Nivågård, Ordrup Næs, Birgittehøj, Torpe and Maglelyng on Zealand (Madsen et al. 1900; Nordman 1918; Nicolaisen 2003, 30f) (Fig. V.68). Up until now, about 400 Limhamn adzes and axes have been found in Denmark, and a recent excavation at Lollikhuse produced 40 Limhamn axes and adzes, thus representing 10% of the all known Limhamn axes and adzes in Denmark. However, at Lollikhuse no flakes of diabase or basalt were found, despite the large number of Limhamn axes, whereas many flakes were recovered from the production centres for Limhamn axes at the sites in Scania. It is therefore possible that some small-scale exchange patterns could have emerged between neighbouring hunter-gatherers on Zealand and in Scania at the time of the Ertebølle culture, which may have laid the foundations for the large-scale exchanges of flint axes during the Early Neolithic (Lidén 1938; Althin 1954; Sørensen 2007; Sørensen 2012a). But during the Late Ertebølle culture most axe production was local, and some of the characteristic types were core axes with specialized edges and Oringe axes.

9.4. Core axes with specialized edges and Oringe axes

Core axes with specialized edges were previously interpreted as the predecessors of pointed-butted flint axes (Åberg 1912, 29). The interpretation is supported by the shape of the preforms, where both types have a two-sided cross section. But core axes with specialized edges often display cortex on the broader sides/body and a U-shaped edge, thus proving that they were shafted as adzes, whereas the pointed-butted axes were axes (Vang Petersen 1993; Stafford 1999) (Fig. V.69). Generally, the two axe types show identical measurements in terms of length and thickness, which has caused some identification problems, as discussed in section 6.8 (Fig. V.70).

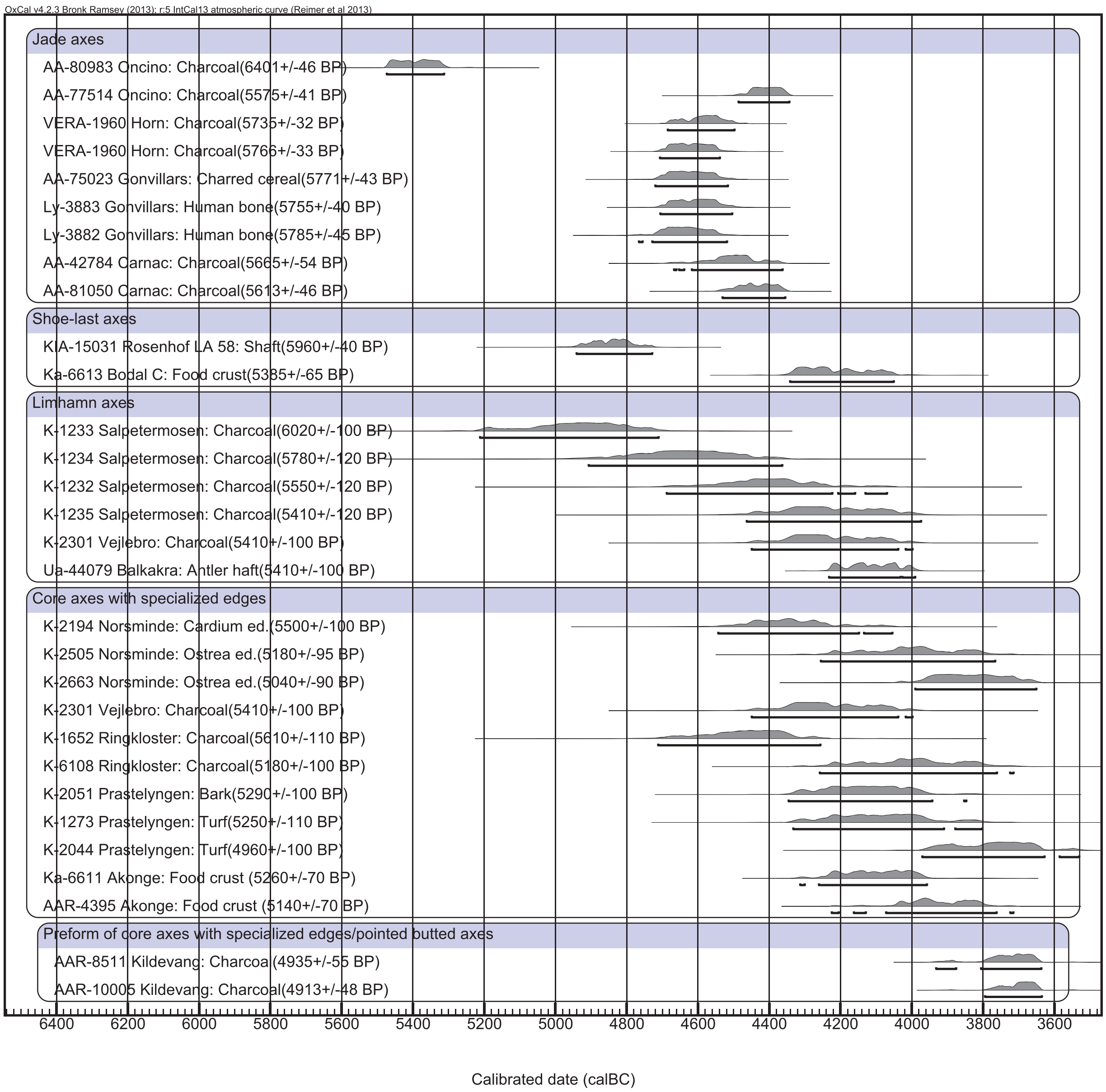


Fig. V. 65. ^{14}C dates of contexts containing jade axes, shoe-last axes, Limhamn axes, core axes with specialized edges and preforms of either core axes or pointed-butted axes. After Troels-Smith 1957; Salomonsson 1970; Tauber 1971; Malmros 1975; Andersen 1991; Kristensen 1991; 2000; Andersen & Johansen 1992; Liversage 1992; Nilsson 1996; Koch 1998; Rasmussen 1998; Stafford 1999; Nielsen 2000; Andreasen 2002; Fischer 2002; Hartz 2004, 67; Hartz & Lübke 2004; Lübke & Terberger 2004; Hallgren 2008; Hirsch et al. 2008; Skousen 2008; Lübke et al. 2009; Rudebeck 2010; Mischka 2011a; Pétrequin et al. 2012c, 633; Ravn 2012; Beck 2013; Esben Aasleff pers. comm. Data after Table 23.

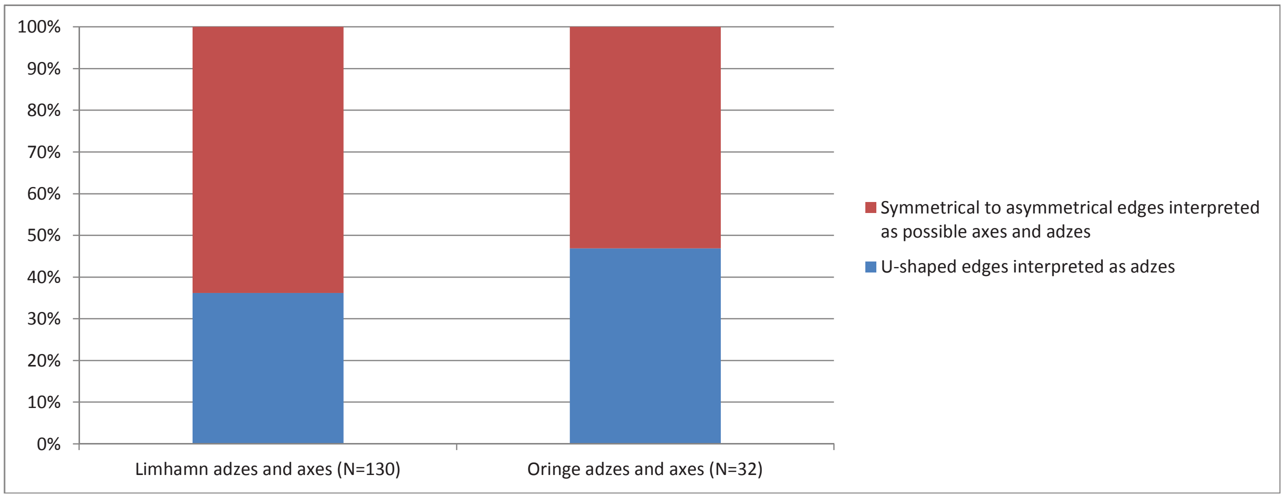


Fig. V. 66. Limhamn and Oringe axes or adzes which contain a symmetrical/asymmetrical edge (interpreted as axes) or an U-shaped edge (interpreted as adzes). After Madsen et al. 1900; Nordman 1918; Mathiassen 1943; Vang Petersen 1979; Andersen 1983; Nicolaisen 2003; Sørensen 2007. Data after Table 53.

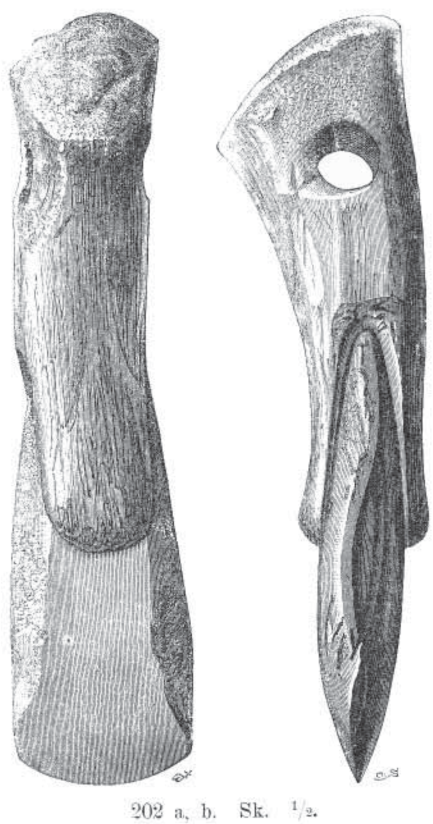


Fig. V. 67. Shafted Limhamn axe from Bålkåkra, Scania. After Montelius 1917, 16.

However, measurements of the edges indicate that the pointed-butted axes have an average edge width of between five and seven cm, whilst core axes with specialized edges have an edge width of between four and five cm (Fig. V.71 and Table 55). The differences in the width and shape of the edges have in the later production stages resulted in the use of different knapping approaches. The aim in the production of pointed-butted axes was to create a triangular or teardrop- shaped preform with a symmetrical cross section, while a more pointed oval shape with a rhombic cross section was made when knapping a core axe with specialized edges. The core axe with specialized edges has been interpreted as an important type in the Late Ertebølle culture, as it is commonly found in layers that have been ^{14}C dated between 4500 and 4000 cal BC (Brinch Petersen 1971; S. H. Andersen 1991; 1993; 1998a; Andersen & Johansen 1987; Malmros 1975; Andreasen 2002) (Fig. V.65 and Table 54).

Core axes are almost exclusively found at coastal or lake shore Ertebølle sites. However, recently the type has also been recovered from some potentially Early Neolithic contexts at sites like Åkonge in Åmosen and Helenelyst near Brabrand (Fischer 2002; Skriver 2003). But it is difficult to separate the Ertebølle and Early Funnel Beaker layers from one another at these settlements. Nevertheless, at the site of Kildevang near Aarhus several core axes with specialized edges have been found in pits that also contained Volling ceramics, thus placing the type within the late EN I (Ravn 2012) (Fig. V.72).

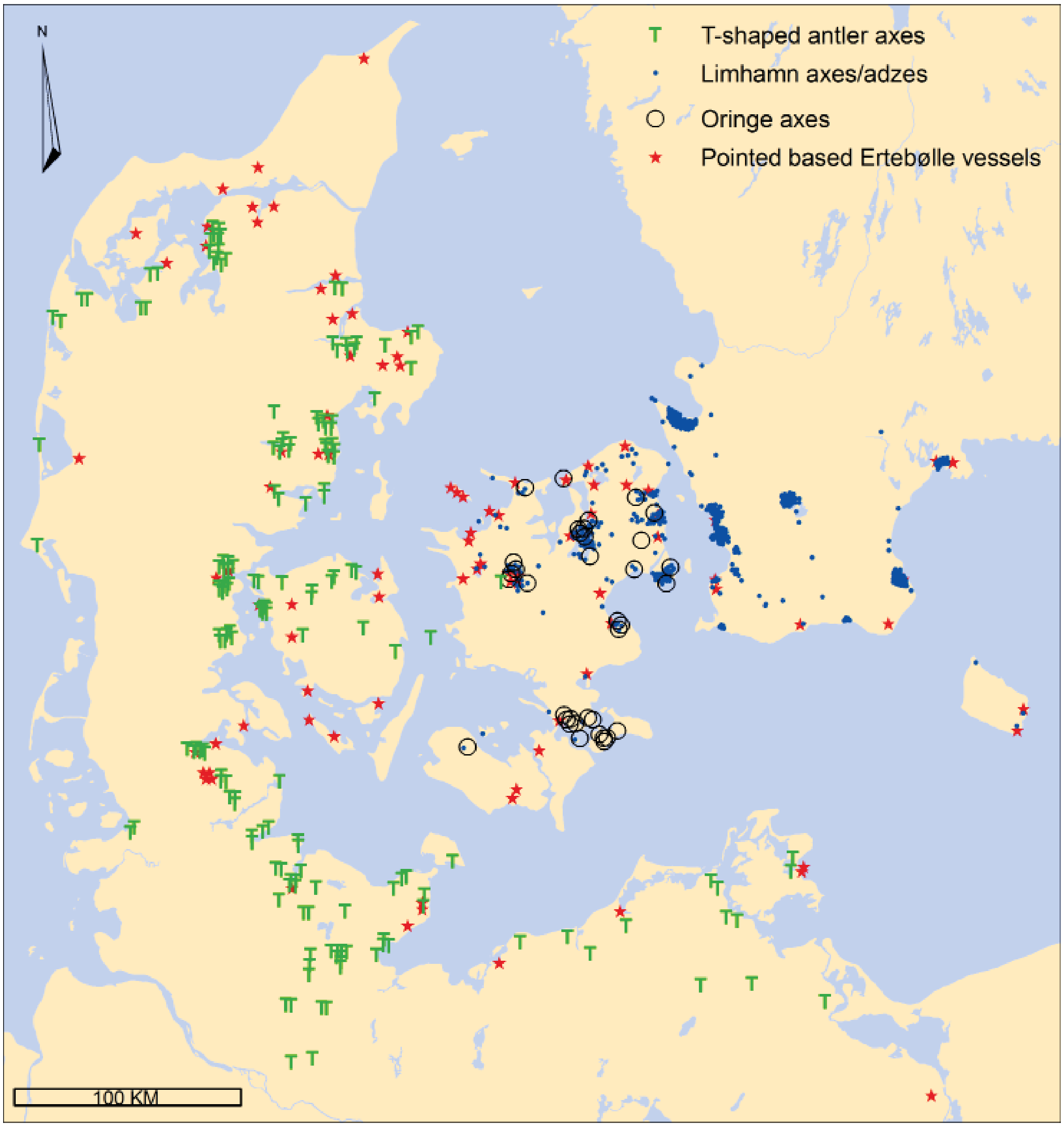


Fig. V. 68. Distribution of T-shaped antler axes, Limhamn axes and adzes, Oringe axes and pointed based Ertebølle vessels in southern Scandinavia. After Vang Petersen 1979; 1984; Andersen 1998a; Nicolaisen 2009; Sönke Hartz pers. comm..

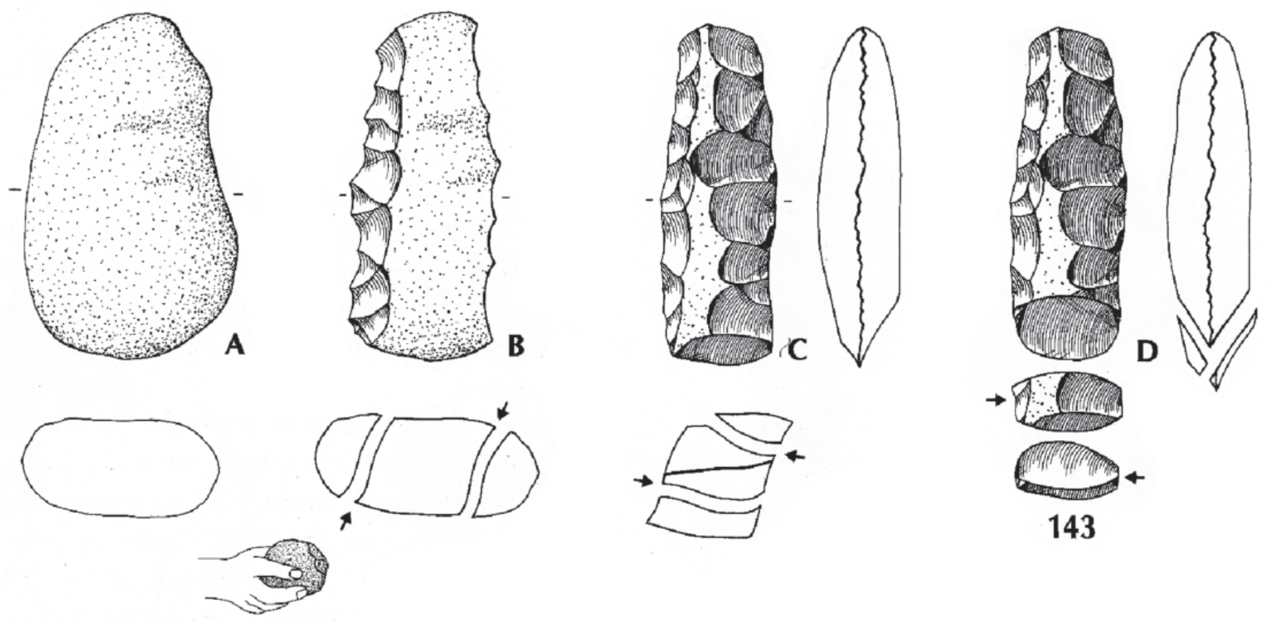


Fig. V. 69. Different stages in producing a core axe with specialized edges. A) Procurement of an oval shaped nodule. B) Bifacial knapping along the side of the nodule. C) Knapping of the broader sides of the preform in order to make it thinner and to make an edge. D) Resharpening the axe by knapping a rejuvenation flake, thus making the edge sharper. After Vang Petersen 1993. Drawing, Lykke Johansen.

The continuous use of the core axes with specialized edges may therefore demonstrate a more gradual adoption of technologies and ideas from agrarian societies in certain regions. Unfortunately, it is difficult to separate these presumed core axes with specialized edges from preforms of pointed-butted axes (Salomonsen 1970, 64; Sørensen 2012a). These problems of identification may be the reason why some researchers support the theory of the continued use of the core axes with specialized edges into the Early Neolithic. Furthermore, core axes with specialized edges have not been found in Early Funnel Beaker layers at any of the kitchen midden sites of North Jutland, thus refuting the argument for their presence in the Early Neolithic period in South Scandinavia. In addition, core axes with specialized edges are not present in hoards and the majority of the axes show signs of use, thus indicating that they belong to a Mesolithic tradition (Fig. V.73). Pointed-butted axes have, on the other hand, been found in hoards, in which at least 50% of them are unused, thus indicating that these axes also had a symbolic importance in the agrarian societies, just like the short-necked funnel beakers, as discussed in section 8.6. However, it is clear that the core axes with specialized edges display evidence of new trends from the agrarian societies, as some of them have been polished (Johansson 1999, 26) (Fig. V.74). The distribution of the polished core axes with specialized edges covers most of South Scandinavia, and they also have been found in Central Sweden, thus indicating that the indigenous hunter-gatherer populations also played an important role in spreading new ideas in the transition from the Mesolithic to the Neolithic period (Fig. V.75).

Unfortunately, all the polished core axes with specialized edges are stray finds, which makes it impossible to investigate when the polishing of these flint axes took place. But the dense concentration of polished core axes with specialized edges in South Zealand at the site of Oringe may indicate that this phenomenon occurred right at the transition between the Late Ertebølle and Early Funnel Beaker cultures. In the same region several pointed-butted stone axes with symmetrical edges of the Oringe type have been found as stray finds at the Late Ertebølle sites at Klintsø, Oringe, Sølager and Maglelyng (Nicolaisen 2003) (Fig. V.76). The Oringe axes may represent some of the earliest local imitations of jade axes, thus indicating that Lolland, Falster and South Zealand could be one of the regions where the Neolithisation process began in South Scandinavia. The hypothesis is further supported by the earliest axe hoard found at Udstolpe on Lolland,

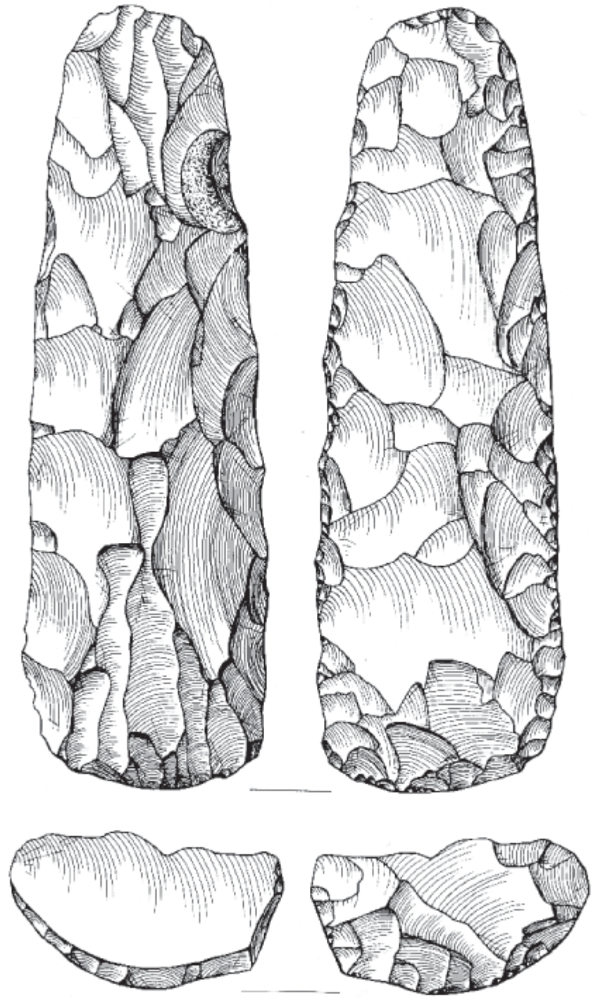


Fig. V. 70. Core axe with specialized edges. After Vang Petersen 1993. Drawing, Lykke Johansen.

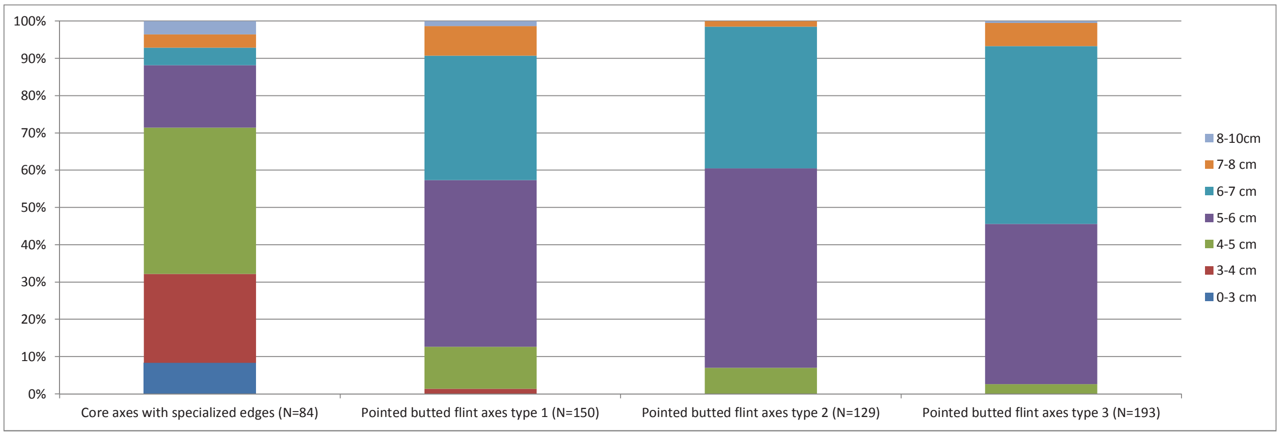


Fig. V. 71. Comparisons of the edge width between core axes with specialized edges and pointed-butted flint axes. Data after Tables Tables 54, 55 and 59.

Fig. V. 72. A preform of a pointed-butted axe, which have been interpreted as a core axe with specialized edges from Kildevang (FHM 4092, x1122) in Jutland. After Ravn 2004.

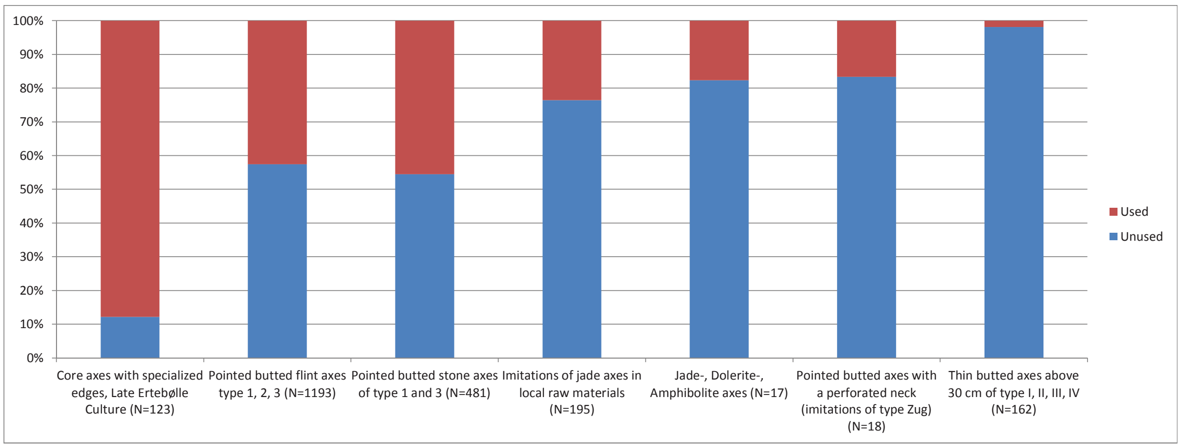


Fig. V. 73. Comparisons of used and unused core axes with specialized edges, pointed-butted flint axes, jade axes and thin-butted flint axes. Data after Tables 54, 55, 56, 59 and 60.

Fig. V. 74. Polished core axes with specialized edges from Oringe, South Zealand based on data from Tables 54 and 55.

as discussed in section 9.1 (Lomborg 1962; Nicolaisen 2003, Klassen 2004).

9.5. Towards a unified material culture and the emergence of larger networks

The foreign shoe-last axes and local imitations, such as the Oringe axes, indicate that there was either direct or indirect contact between Ertebølle hunters and gatherers and Central European agrarian societies. However, the impulses were sporadic and different from region to region, which, according to the primary evidence of agriculture, did not lead to the emergence of an agrarian society during the Late Ertebølle culture. Instead, several regional differences within the material culture emerged during the Late Ertebølle culture: T-shaped antler axes, bone rings and bone combs are concentrated in Jutland and Schleswig-Holstein, whereas Limhamn greenstone axes and curved harpoons are found on Zealand and in Scania. Smaller regional groups on Zealand have also been suggested, based on differences within the flake axe assemblages (Vang Petersen 1984). The differences between Jutland, Zealand and Scania are clearly connected to the fact that these regions are separated by large straits of water, with the Great Belt (Storebælt) and the Sound (Øresund) serving as natural borders in prehistoric times. The fact that Zealand became an island during the continuous Boreal and Atlantic transgressions created differences in the faunal assemblages, which explains the lack of bone rings made of aurochs scapulae and T-shaped antler axes on Zealand. The aurochs became extinct after the Boreal phase and the red deer became so reduced in size that their antlers were unsuitable for making antler axes on Zealand, which could explain the emergence of Limhamn axes in this region. The lack of stone axes from the Late Ertebølle culture in Jutland may be explained by the presence of the T-shaped axes, which were used for working wood (Jensen 1991) (Fig. V.77). In general, the T-shaped antler axes, bone combs, hour shaped buttons of oyster shell (dobbleknöpfe) and the bone rings from Jutland clearly reflect continental impulses, thus show-

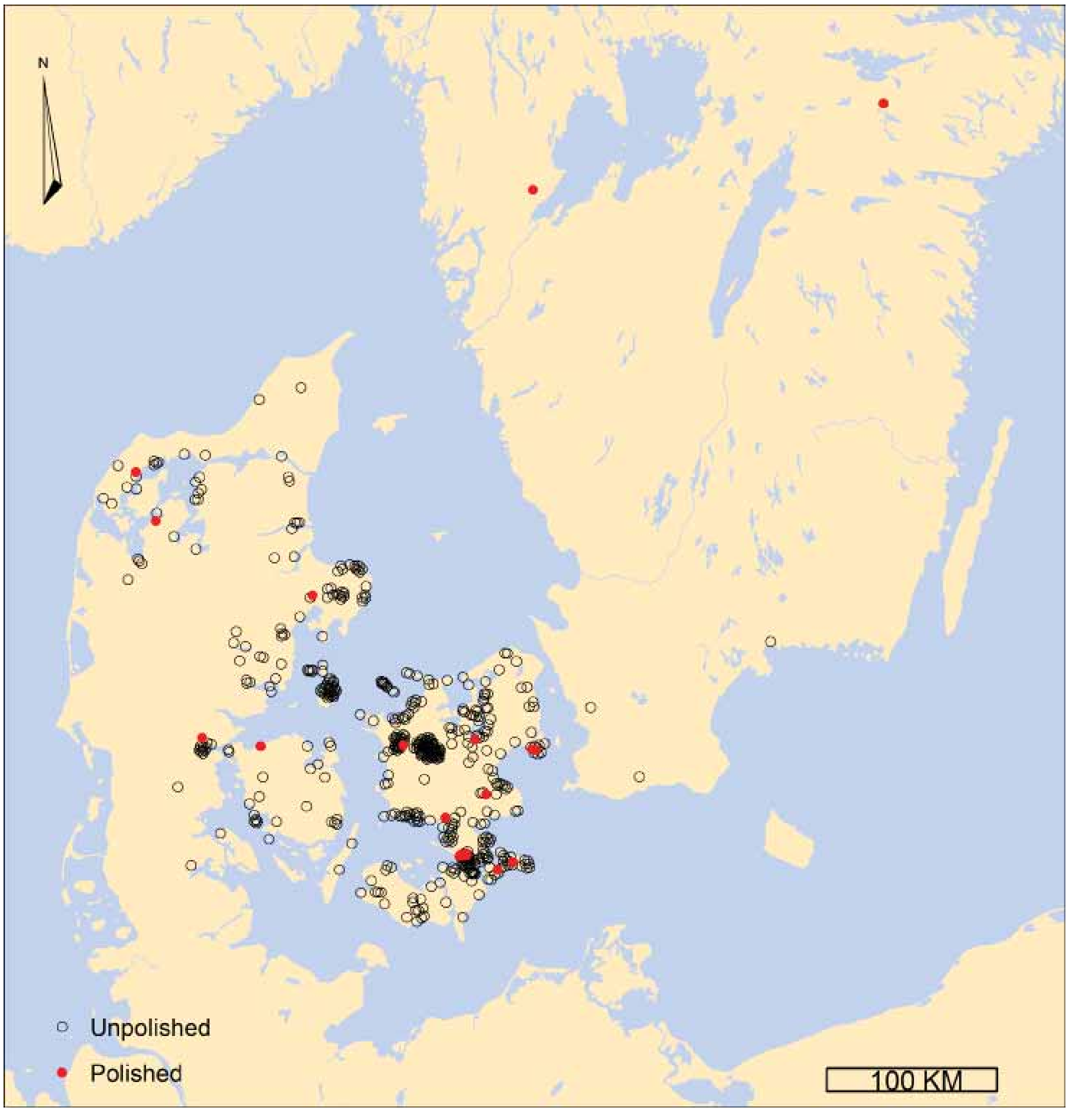


Fig. V. 75. Distribution of core axes with specialized edges in South Scandinavia based on data from Tables 54 and 55.

ing that the hunter-gatherers of the Ertebølle culture were either directly or indirectly linked to agrarian societies in Central Europe (Vang Petersen 1984; Andersen 2008b; Heumüller 2012). Some of these impulses could have originated from scouting expeditions, whilst others may have resulted from more indirect relations with agrarian societies.

The fact that there are regional differences in the distribution of certain artefacts indicates that the Ertebølle hunter-gatherers probably consisted of several small groups, which were interconnected with one another. However, these regional differences within the Ertebølle culture disappeared quite quickly and were replaced by a more unified material culture associated with the Funnel Beaker culture from around 4000 cal BC, which covered all regions of South Scandinavia, as already documented by the appearance of the short-necked funnel beakers in section 8.7. The distribution patterns of the typical Ertebølle objects also shows that habitation was concentrated in the coastal and lake shore areas (Fig. V.68). However, this settlement pattern was expanded during the Early Funnel Beaker culture, with a new type of inland-orien-

Fig. V. 76. Oringe axes from Oringe (A9636), South Zealand. Photo. The National Museum of Denmark.

tated settlement located on easily worked arable soils, as documented by the distribution of pointed-butted jade, flint and stone axes, which will be discussed in the following sections.

9.6. Jade axes

Southern Scandinavian jade axes have been interpreted as prestigious items of exchange, illustrating contact with the agrarian societies of Central Europe and reflecting agrarian ideas and ideology (Klassen 2004; 2014a; Klassen et al. 2012; Pétrequin et al. 2012a). Many of the jade axes that reached South Scandinavia could potentially have had a long circulation period of up to several hundred years, as many of the types have a wide chronology covering a timespan from the first half of the 5th millennium to the early 4th millennium BC (Fig. V.78). Despite the long circulation period, it seems as if the carriers of these axes had the power to penetrate important cultural and linguistic barriers. The jade axes have been interpreted as sacred objects and mediators of powerful myths, thus contributing to the spread of new rituals, ideas and knowledge, as well as the creation of networks (Fig. V.80). They are therefore important in the discussion concerning the process of Neolithisation in Northern Europe. However, the difficulties in differentiating between Neolithic axes of alpine jade and axes imported from other continents has attracted some attention, as discussed in section 6.8. Furthermore, some of the jade axes found in South Scandinavian collections originate from private collectors, many of whom had contacts all over Europe. The jade axes therefore lack secure archaeological contexts and may not have been found in Scandinavia (Sørensen 2013a) (Table 56). For many years it was believed that Danish jade axes came from former European colonies and this is one of the main reasons why some jade axes are found in ethnographic collections. At least one jade axe (ODIg 53; Klassen 2004, 88) was 'rediscovered' in the ethnographic collection of the National Museum of Denmark. It was believed to have originated from one of the Caribbean islands (Randsborg 2001). Another axe from Lolland or Falster (LFS3527; Klassen 2004, 88) was thought to have originated from Asia (Plate 6). The

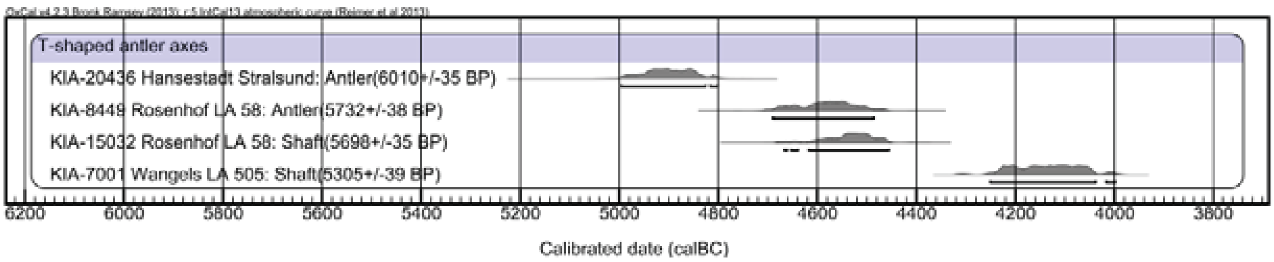


Fig. V. 77. [14]C dates of T-shaped antler axes. After Hartz & Lübke 2004; Hartz 2004; Lübke & Terberger 2004.

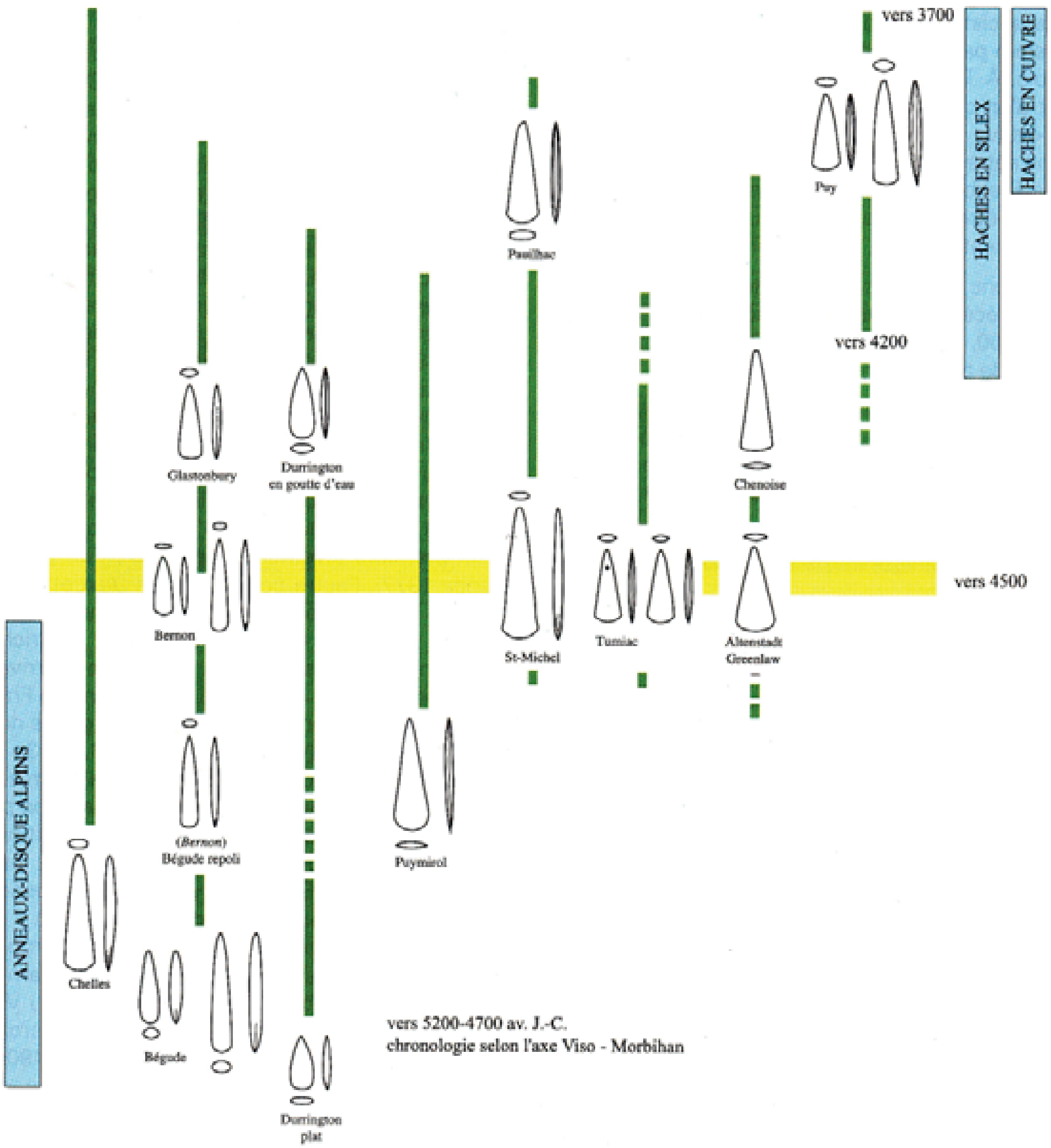


Fig. V. 78. Chronology of the different types of jade axes. After Pétrequin et al. 2012c, 627.

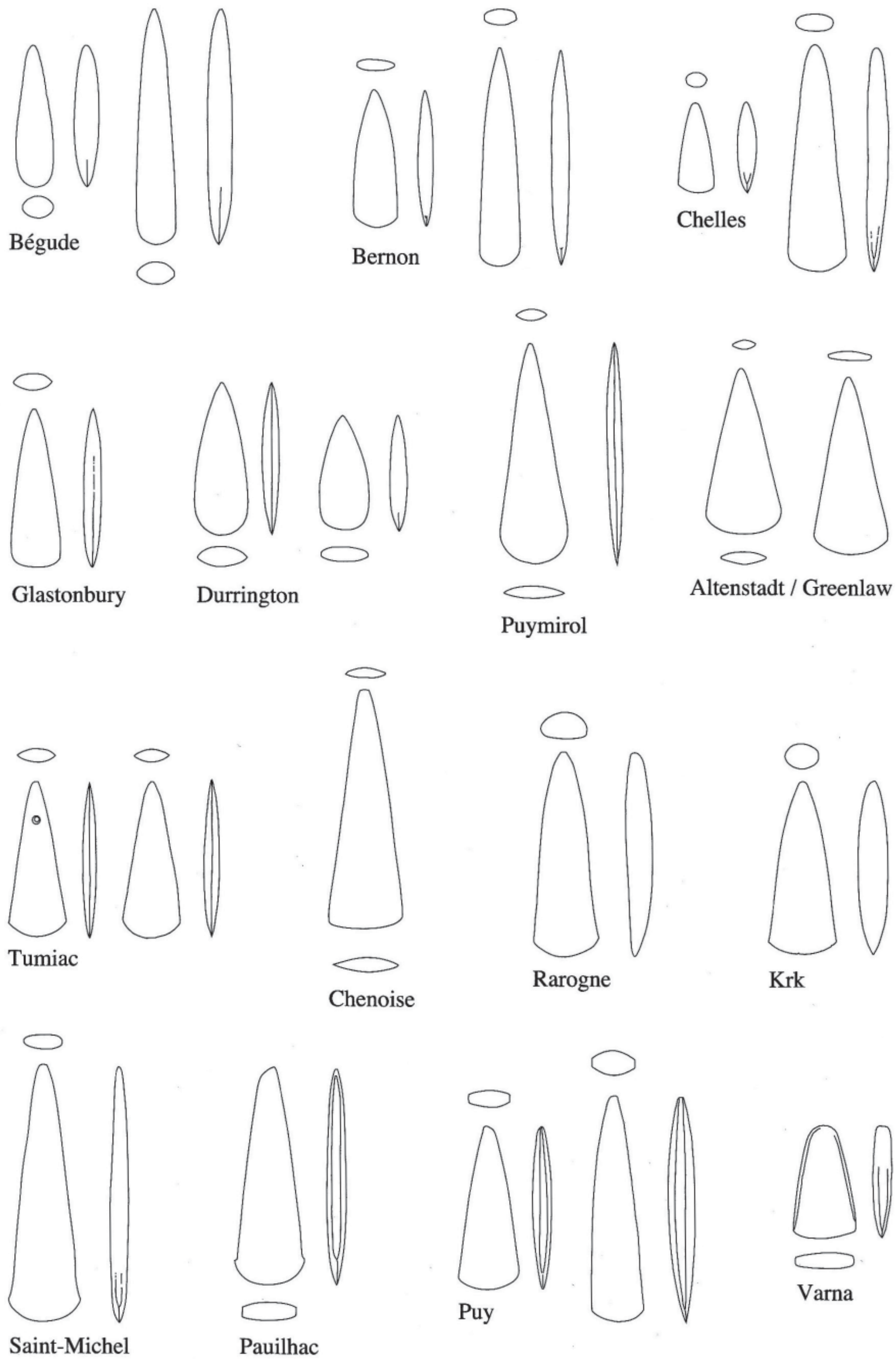


Fig. V. 79. Various types of jade axes. After Pétrequin et al. 2012c, 596.

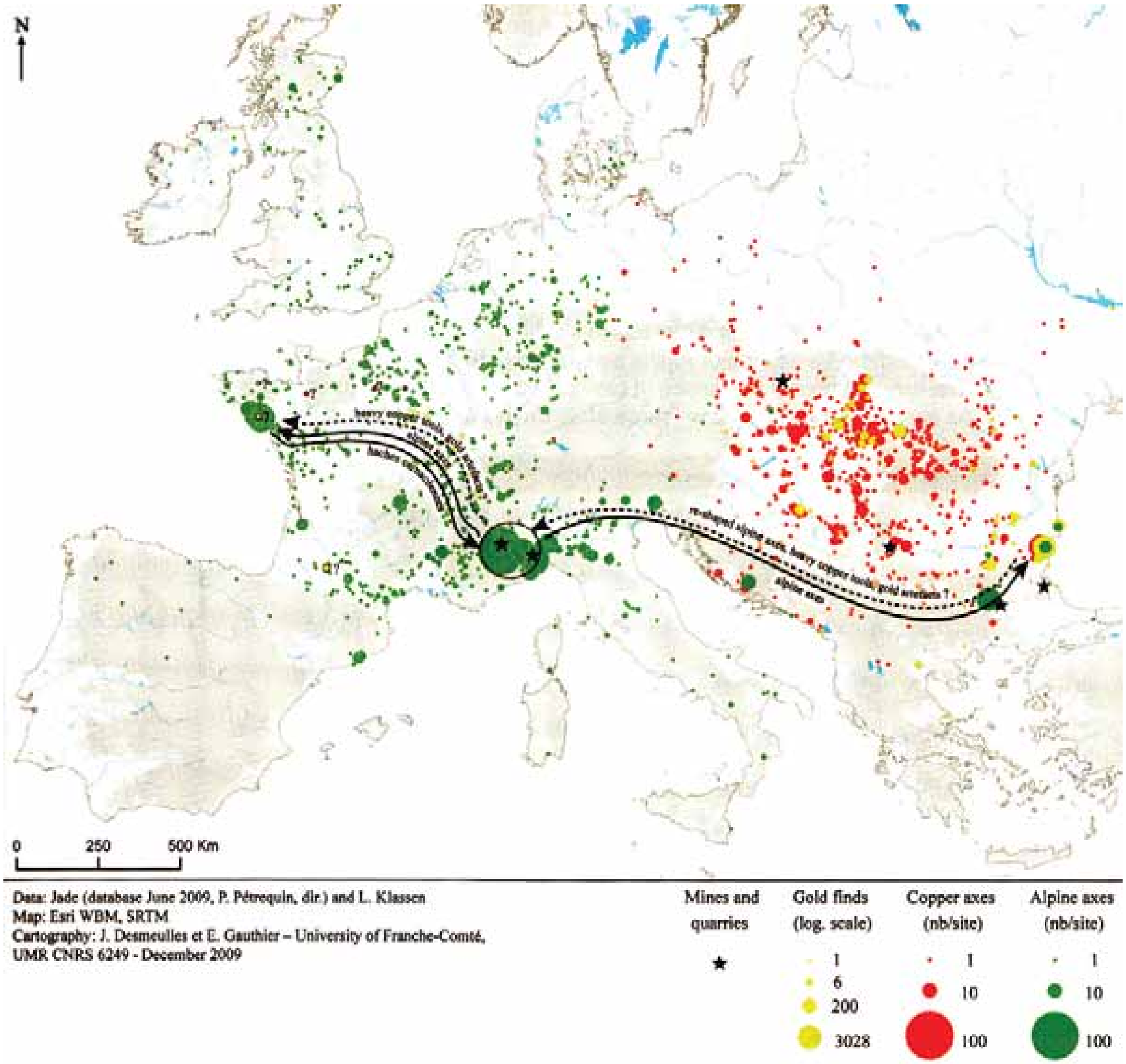


Fig. V. 80. Distribution of jade axes and copper objects from the 5th and early 4th millennium BC. After Klassen et al. 2012, 1301.

'ethnographic' interpretation of these axes was due to the fact that jade quarries were not known of in Europe until Pierre and Anne-Marie Pétrequin identified jadeite quarries in the Italian Alps and the northern Apennines (Pétrequin et al. 2012a). Based on petrographic studies, it was concluded that the two above-mentioned jade axes from Denmark (ODIg 53 and LFS3527) were made of jadeite procured at Mount Beigua. Another two axes from Denmark (OBM A258; Klassen 2004, 84f) were made of jade from Mount Viso (D'Amico 2012, 439). The European jade project also suggested a typological classification of the jade axes, based on axes found in dated contexts. The dominant jade axe in southern Scandinavia belongs to the Durrington type, which is almond shaped, with a pointed oval cross section (Fig. V.79). According to Klassen's *Jade und Kupfer* publication from 2004, a total of 13 jade axes are accepted as having been imported to southern Scandinavia during the Stone Age (Fig. V.81). Three of the 13 jade axes are from private collections and lack any information about their origin. They can be regarded as stray finds without a secure context. These three axes (Klassen 2004, 427: finds list 9. Nos. 3, 4, 9) could have been exchanged and traded by antique dealers, who had contacts all over Europe

Fig. V. 81. Axes of Alpine jade from South Scandinavia. 1, 2. Zealand, unknown find location, 3. Højgård, Tulstrup parish, eastern Jutland, 4. Danmark, unknown find location, 5. Lolland-Falster, unknown find location, 6. South Funen, unknown find location, 7. possibly south-western Scania, unknown find location. 1, 2, 6, 7 are jadeitite; 3 and 6 are eclogite; 4 is amphibolite. 1. Belongs to type Chelles. 2 and 6 is associated with type Puy. 3, 4, 5 and 7 belong to type Durrington. Photo. Louise Hilmar, Moesgård Museum. Aarhus University. After Klassen 2013, 87.

during the 19th and 20th centuries. The context of these axes within southern Scandinavia remains an open question. However, it was possible to determine a parish or region for the remaining ten axes (Klassen 2004, 427: finds list 9. Nos. 1, 2, 5, 6, 7, 8, 10, 11, 12 and 13). The main problem with all jade axes is that it is difficult to visually distinguish between Neolithic axes of alpine jadeite and imported ethnographic axes from, for instance, the Caribbean islands, as discussed in section 6.8. However, the many imitations of jade axes produced in local raw materials clearly indicate that the ideas behind these axes were so powerful, that they may reflect the advent of agrarian ideas and ideology during the Mesolithic and Neolithic transition in South Scandinavia (Fig. V.82). Imitations of jade axes have not only been found in South Scandinavia, but also in the British Isles (Sheridan 2010; Sheridan & Pailler 2012, 1046ff), as well as at several causewayed enclosures and sites of the Michelsberg Culture in Germany (Brandt 1967; Anding 1968; Lüning 1968; Rehbein 1970; Wilhelmi 1971; Raddatz 1972; Boeliche 1978; Willms 1982; Simon 1989; Wallbrecht 2000).

Jade axes reached southern Scandinavia during the Early Neolithic (4000-3500 cal BC), which is supported by imitations found in ^{14}C-dated contexts, thus making their introduction synchronic with the introduction of agriculture (Fig. V.83 and Table 57). A pointed-butted flint axe imitating a jade axe of the Durrington type was found at Lisbjerg Skole in pit A2247, together with Oxie ceramics and threshing waste from cereals, which was dated to the early EN I (Skousen 2008, 131). Other local imitations of jade axes from South Scandinavia include the Durrington, Chelles, Bègude, Bernon, Saint Michel, Rarogne, Altenstadt and Chenoise types, which were made in local raw materials, such as flint, diabase, basalt, porphyry and slate (Fig. V.84). The typological classification can of course be debated, but some of the imitations of jade axes with splayed edges (Saint-Michel and Rarogne) clearly suggest imitations of specific jade

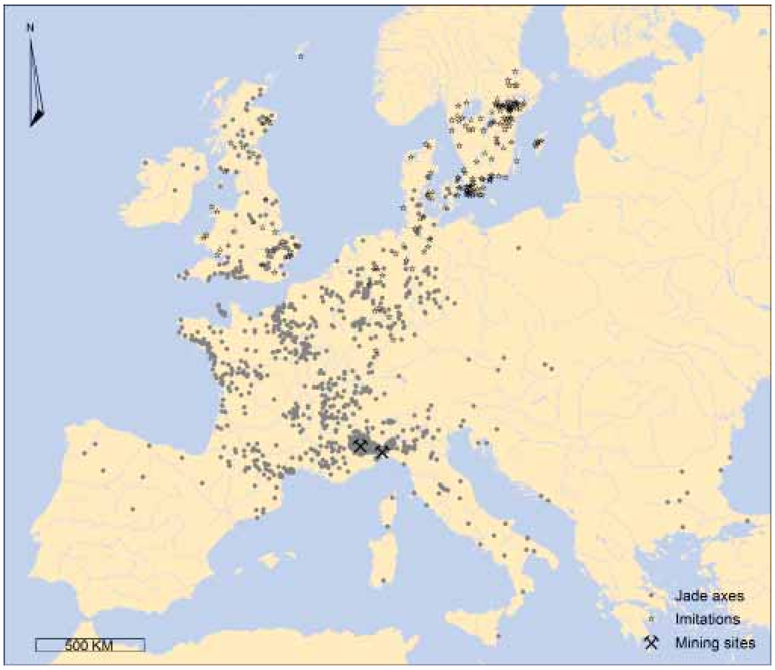


Fig. V. 82. Distribution of jade axes and their imitations in Northern Europe. After Kersten & La Baume 1958; Ahrens 1966; Brandt 1967, 84ff; Anding 1968, 117ff; Lüning 1968, 74; Rehbein 1970, 238ff; Wilhelmi 1971, 33; Raddatz 1972, 1ff; Boelicke 1978, 111; Willms 1982, 38; Simon 1989, 130; Wallbrecht 2000, 92; Pétrequin et al. 2012c, 584; Klassen et al. 2012; Sheridan & Pailler 2012, 1046ff.

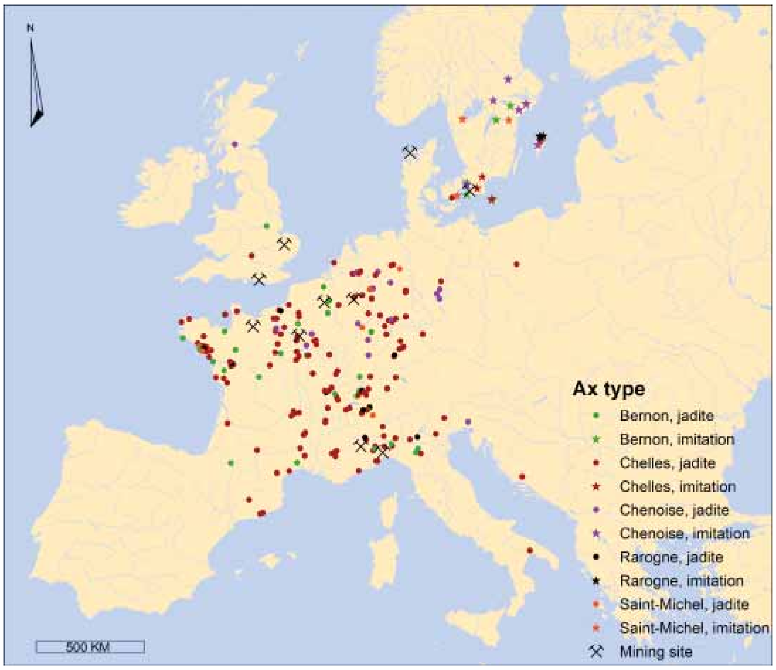


Fig. V. 83. Distribution of jade axes, jadeite quarries and imitations of jade axes made in local raw materials such as flint, slate, diabase or porphyry. After Klassen et al. 2012, 1301; Pétrequin et al. 2012c, 584; Sheridan & Pailler 2012, 1048.

axes found in Central Europe. Furthermore, the imitations of Chenoise jade axes show a connection with the Michelsberg culture, which may have been the place of origin for the first farmers who came to South Scandinavia, as the individuals who made these imitations must have seen such axes. A hoard from Amalienslund in Scania consisted of a pointed-butted flint axe of type III and a pointed-butted axe of diabase with a perforation in the butt, thus dating the hoard to the late EN I phase. In general, the pointed-butted axes with a perforation in the butt show similarities with the contemporary Zug type, which is concentrated in Switzerland (Pétrequin et al. 2012d, 1029) (Fig. V.85). The axes of the Zug type were often made of serpentine and have been interpreted as regional imitations of the jade axes of the Tumiac type (Klassen 2014a). The Tumiac type has been dated to around the late 5th millennium, whereas the Zug type is believed to date to around 3800 cal BC, which is supported by the hoard from Amalienslund (Fig. V.86). Several stray finds of the type Zug have been found in South Scandinavie as stray finds, thus showing impulses from Switzerland (Klassen 2014a) (Figs. V.87-88 and Table 58). Connections to Switzerland are also shown by a thin adze of a non-local, nephrite material, which was found at Växjö in Småland (Montelius 1917, 12) (Fig. V.89). The thin adze from Växjö is identical in material and shape to an adze of nephrite from Hallwillersee in Switzerland (Pétrequin et al. 2012b, 193). According to Bahnson (1889), nephrite flakes from the production of such adzes have been found at sites located near Maurach in Bodensee and at Forel, near Lake Neuchatel. Petrographic studies are, however, required in order to clarify the exact origin of the nephrite used to make the Växjö adze.

Numerous imitations of jade axes have been found especially in Scania, Gotland, Närke and Södermanland, which are regions where some of the earliest evidence of agrarian practices has been identified (Figs. V.90-93). Such regions could be interpreted as containing small colonies of immigrating pioneering farmers, based on the migration patterns discussed in section 5.5 (Fig. V.94). Furthermore, several pointed-butted flint and greenstone axes from Early Neolithic contexts in southern Scandinavia are unused and some are over 25 cm long (Fig. V.95). Locally-produced axes apparently had a non-utilitarian function similar to the Alpine jade axes. Imitations were not only made in local materials, as some rare examples of copper flat axes, like the ones from Pilegård on Zealand and Vester Bedegadegård on Bornholm, can also be interpreted as copies of jade axes (Klassen 2000; Klassen et al. 2012, 1285) (Fig. V.96). According to Klassen (2004), these axes are made of eastern Alpine Mondsee copper, which was imported to South Scandinavia during the late EN I and EN II phases (Fig. V.97). However, the imitations of jade axes in copper have a wide distribution, covering most of Eastern Europe (Todorova 1981; Zachos 2007; Klassen 2000; Klassen et al. 2012; Turck 2010) (Fig. V.98). It is therefore possible that the pointed-butted copper axes may also have originated from copper mines in Eastern Europe, such as Aibunar, Rudna Glava and Jarmovac (Davies 1937; Chernykh 1978; Jovanović 1980; Pernicka et al. 1993; 1997; Radivojević et al. 2010). The region of Mondsee could, however, have played an important role as a satellite centre in such exchange systems for copper artefacts from the south-east of Eastern Europe (Fig. V.99). The continuous exchanges may later on, during the transition between 5th and 4th millennium, have resulted in the exploitation of copper in the Mondsee region. The fact that jade axes were imitated in copper demonstrates that the ideas behind these axes were widely spread in a large-scale European agrarian network involving a "big men society", concentrated at Morbihan in northern France and at Varna in Bulgaria from the mid-5th to the early 4th millennium BC (Pétrequin et al. 2012a) (Fig. V.80). A direct connection between the Morbihan region and South Scandinavia may be indicated by a stray find of a fibrolite axe, which presumably was found by a local farmer in Hov parish in southern Jutland (Pailler 2012, 1168) (Fig. V.100). However, the exact provenance of this axe is uncertain, as it has been sold to various antique dealers, thus making it difficult to identify the original finder and confirm its provenance. Such a situation is unfortunately typical in relation to many of these very exotic axes. Nevertheless, the distribution pattern of the jade axes in Northern Europe could easily be interpreted as a classic down the line exchange pattern, in which limited interaction between the centres of power and more distant regions would have occurred. However, it is more likely that the distribution of jade axes reflects an exchange pattern between more dominant societies in Europe, in which ideas and knowledge relating to agriculture could spread alongside these axes. The fact that imitations were made of the jade axes suggests that the meaning behind these jade axes was not lost, but maintained and incorporated into the local communities. It can

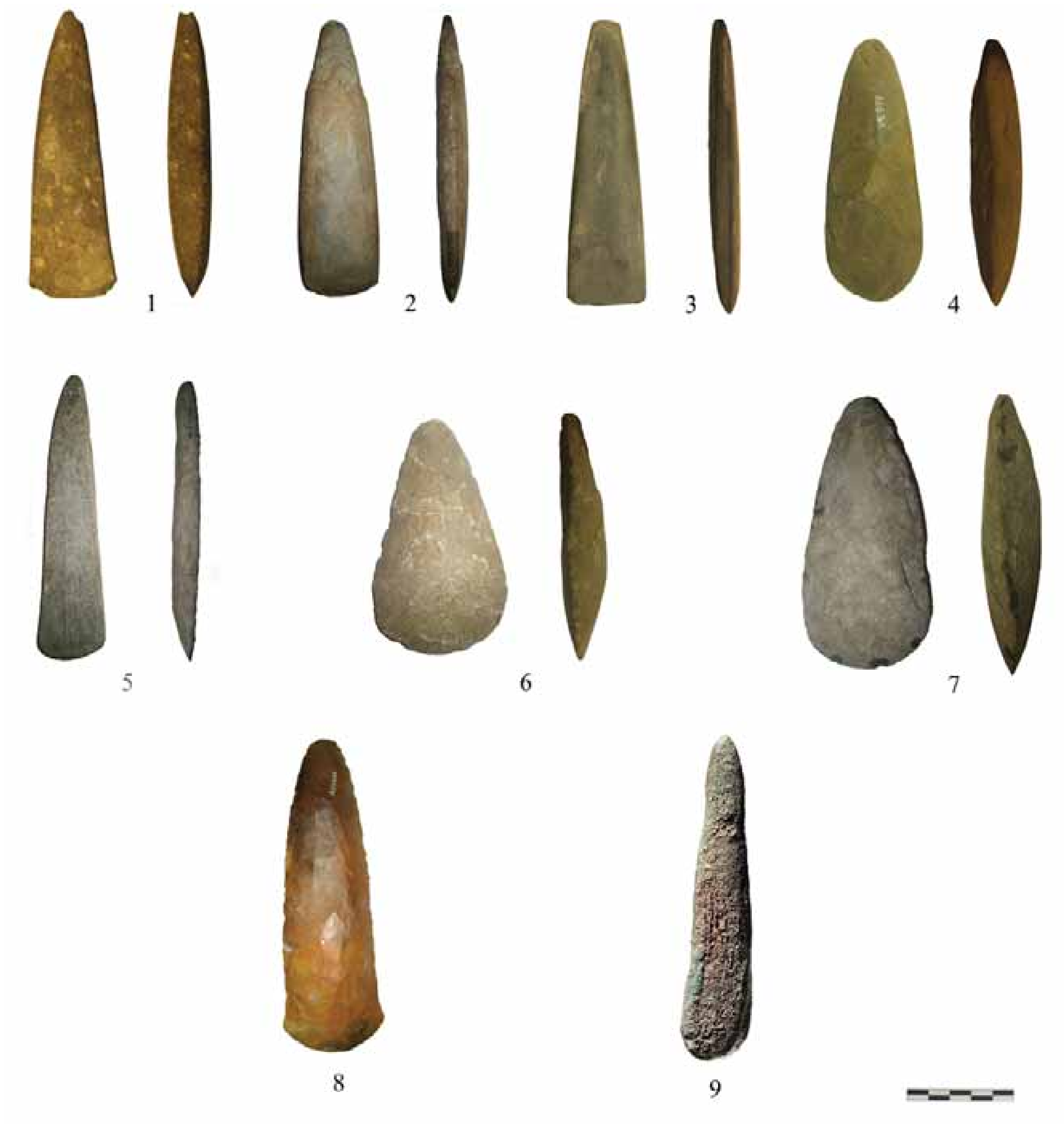


Fig. V. 84. Pointed-butted axes of diabase, basalt or copper from southern Scandinavia, which have been interpreted as imitations of different jade axe types (Pétrequin et al. 2012c, 596; 2012d, 1029). 1. Imitation of jade axe type St. Michel or Krk (Stockholms Hist. Mus. 6643.1, Lokrume, Gotland), 2. Imitation of jade axe type Chelles (Stockholms Hist. Mus. 11495.287, Aska, Östergötland), 3. Imitation of jade axe type Chenoise (Stockholms Hist. Mus. 13376.5, Tysslinge, Närke), 4. Imitation of jade axe type Durrington (Lunds Hist. Mus. 22999, Västra Karup, Scania), 5. Imitation of jade axe type St. Michel or Rarogne (Stockholms Hist. Mus. 17573.3 V. Husby, Östergötland), 6. Imitation of jade axe type Altenstadt (Lunds Hist. Mus. 24736, Mjällby, Scania), 7. Imitation of jade axe type Durrington (Lunds Hist. Mus. 25174, Mjällby, Scania), 8. Imitation of jade axe type St. Michel (The National Mus. of Denmark, A24306, Varpelev, Stevns, Zealand) and 9. (The National Museum of Denmark, A52087, Vester Bedegadegård, Bornholm).

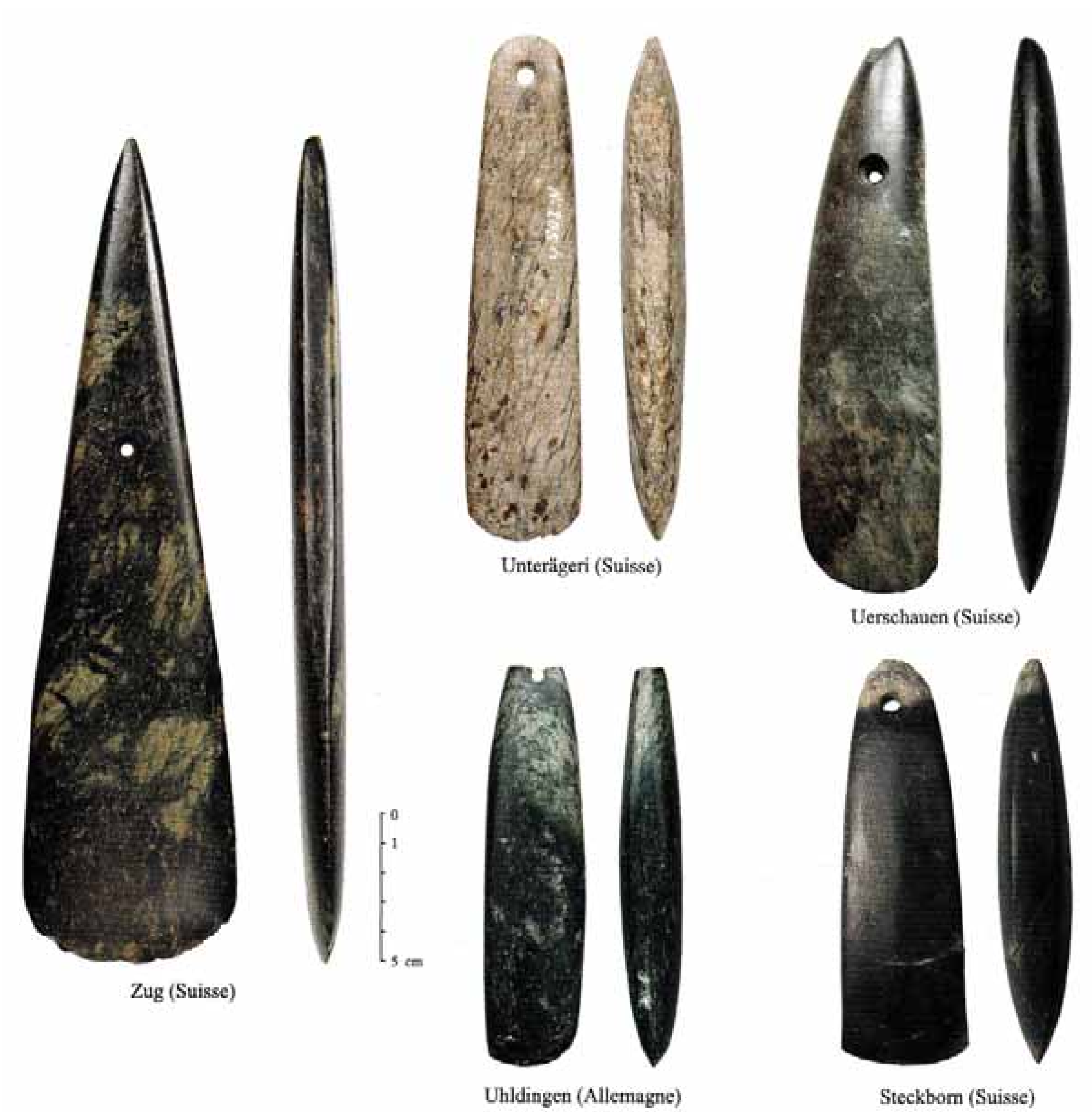


Fig. V. 85. Pointed-butted stone axes of type Zug having a perforation through the butt found in Switzerland. After Pétrequin et al. 2012d, 1015.

Fig. V. 86. Hoad from Amalielunds Gård (Lunds Hist. Mus. LUHM25491) consisting of a pointed-butted flint axe of type 3 (right) and a pointed-butted stone axe of type Zug, which had a perforation through the butt (left).

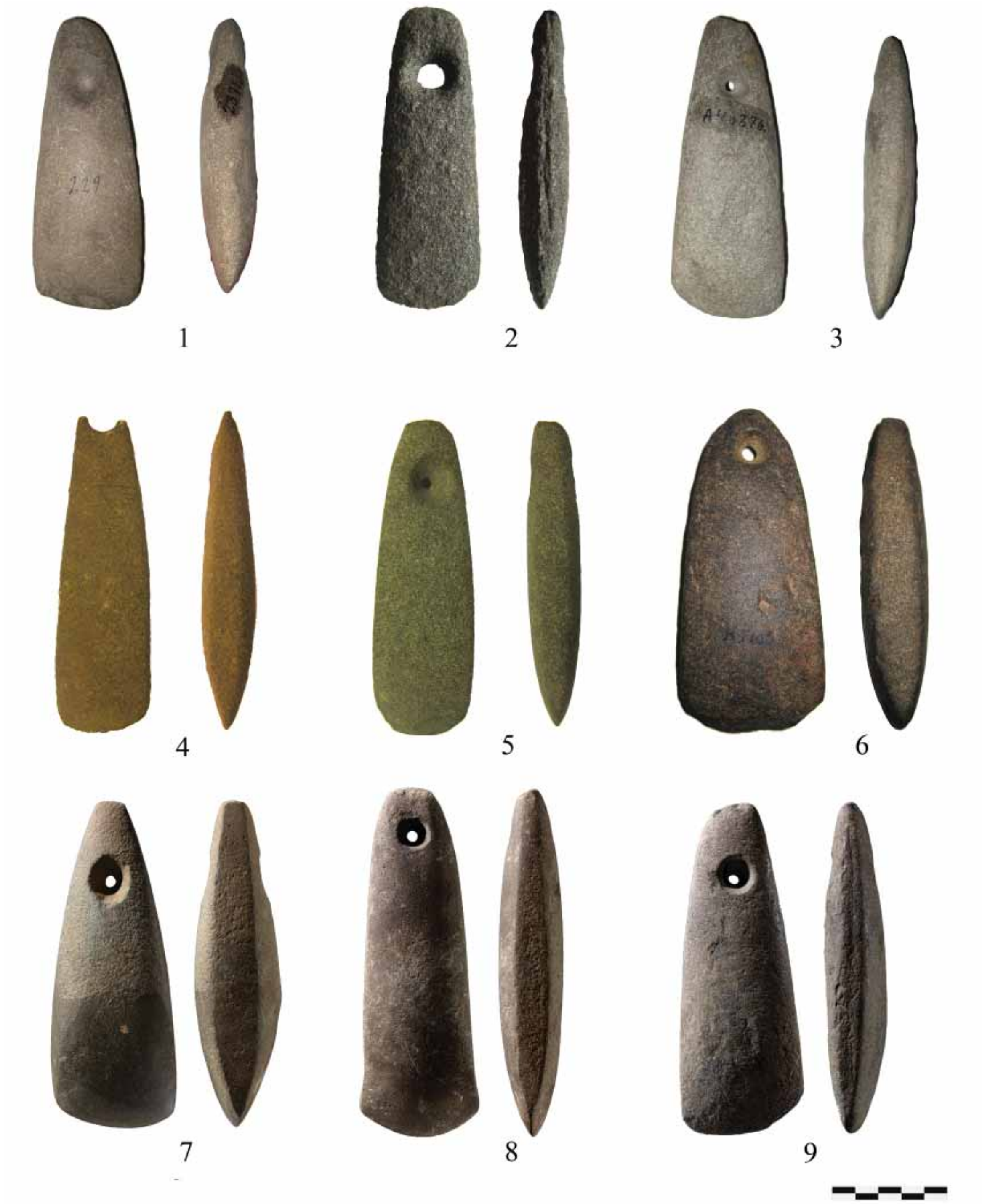


Fig. V. 87. Pointed-butted axes with a perforation in the butt of diabase or basalt from Denmark and Scania, Sweden, which have been interpreted as imitating type Zug (Pétrequin et al. 2012d, 1029). 1. Højbjerg, Zealand (Odsherred Mus., 2371), 2. Holbæk, Zealand (Holbæk Mus., 3149), 3. Kirkerup, Zealand (The National Mus. of Denmark, A40876), 4. stray find, Scania (Lunds Hist. Mus., 5049), 5. Amalielunds Gård Sövde, Scania. Found together with a pointed-butted flint axe of type 3 (Lunds Hist. Mus., LUHM 25491), 6. Tolstrup, North Jutland (Moesgård Mus., 2694), 7. Attrup (Museum Østjylland, DJM2461x1), 8. Rude Eskilstrup (Nationalmuseet, A39162) and 9. Østrup Holme (Nationalmuseet, A40876).

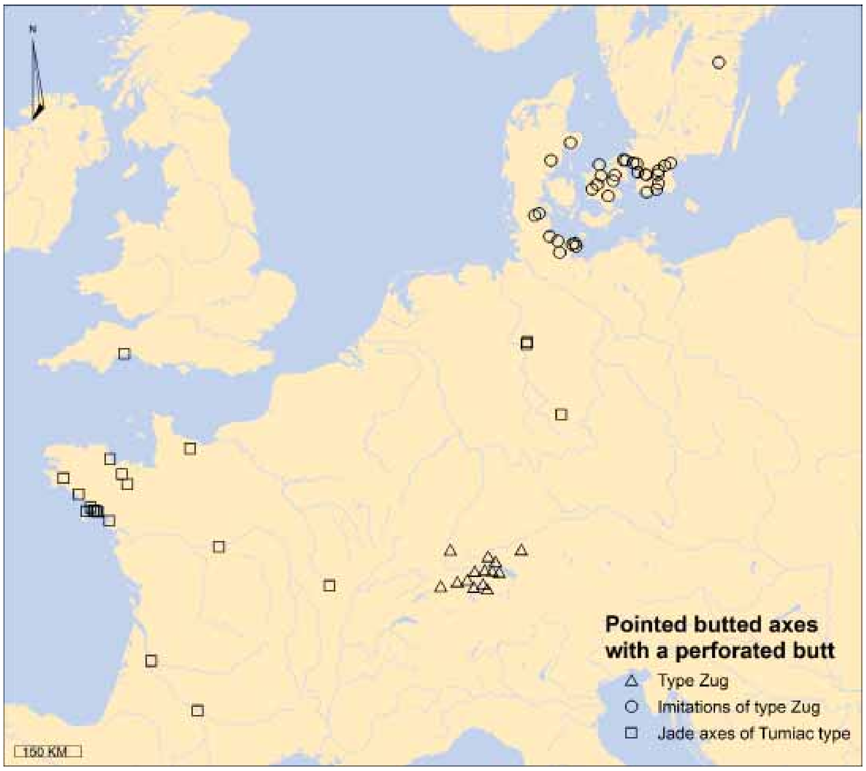


Fig. V. 88. Distribution of pointed-butted stone axes with a perforated butt of the types Tumiac, Zug and imitations of type Zug. After Brandt 1967; Pétrequin et al. 2012d, 1015; Klassen 2014a.

Fig. V. 89. Chissel of nephrite from Växjö in Småland. Stockholms Hist. Museum (SHM 12628). After Montelius 1917, 12, no. 146.

Fig. V. 90. Pointed-butted axes of flint, diabase or basalt from Denmark and Scania, which have been interpreted as imitations of jade axes (Klassen 2004; Skousen 2008; Pétrequin et al. 2012c). 1. Lisbjerg Skole (Moesgård Mus. A2247, Early Neolithic site, Jutland), 2. Gislöv, Scania (Lunds Hist. Mus. 2549), 3. Håstad, Scania (Stockholms Hist. Mus. 2918), 4. Ingelstorp, Scania (Stockholms Hist. Mus. 3414.36), 5. Stray find, Scania (Stockholms Hist. Mus. 7577.319,), 6. stray find, Zealand (The National Mus. of Denmark, A4476), 7. Torna, Scania (Lunds Hist. Mus. 6226), 8. Räng, Scania (Lunds Hist. Mus. 18011), 9. Västra Karup, Scania (Lunds Hist. Mus. 22999), 10. Mjällby, Scania (Lunds Hist. Mus. 24736), 11. Mors, Jutland. Photo. Morslands Mus. MHM 1046-2.

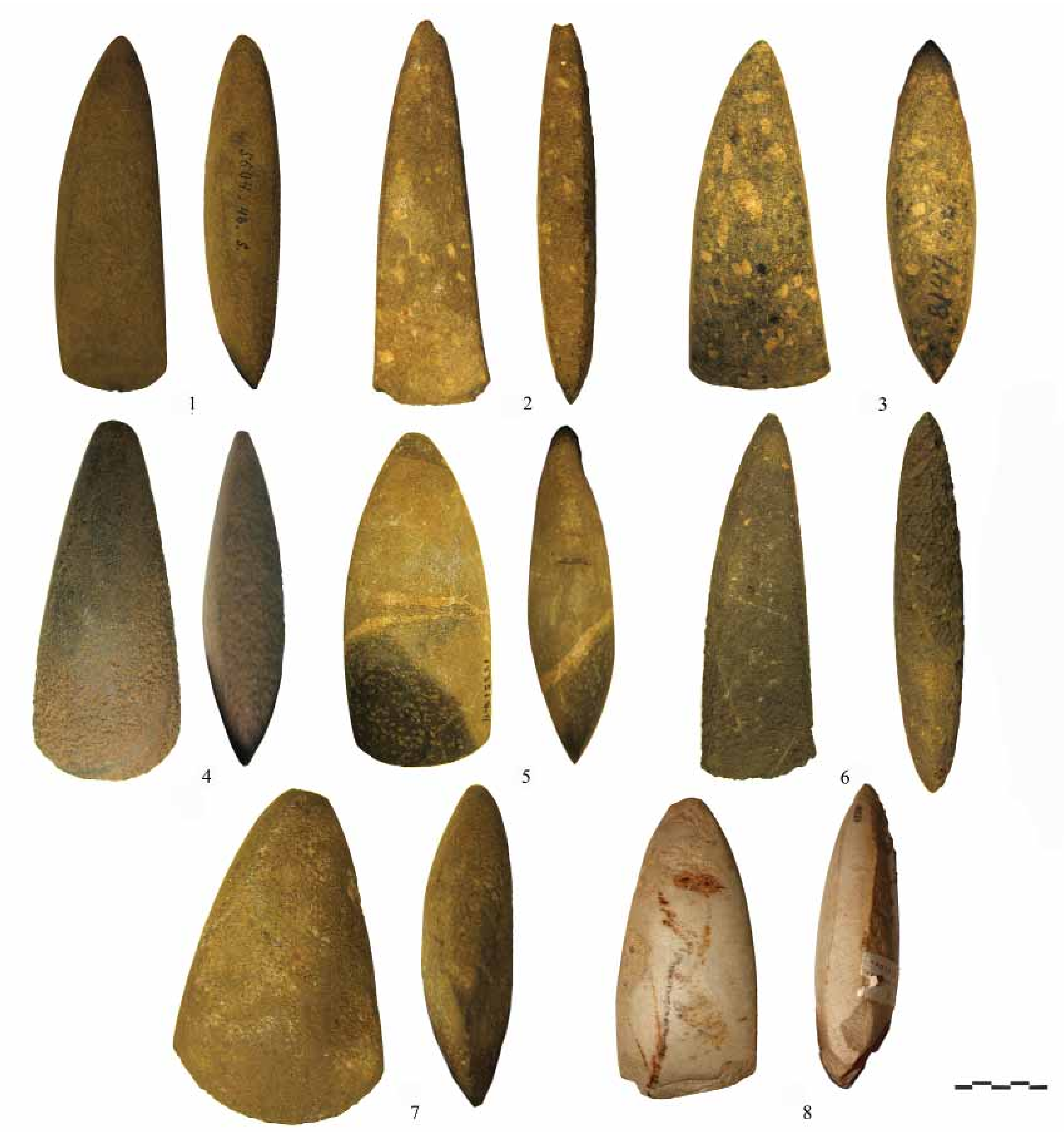


Fig. V. 91. Pointed-butted axes of diabase, basalt, porphyry or quartzite from Gotland, Öland (all from Stockholms Hist. Mus.) and Bornholm (The National Museum of Denmark), which have been interpreted as imitations of jade axes (Pétrequin et al. 2012c). Some of the axes from Gotland is also depicted in Montelius (1917, 10ff). 1. Ekeby, Gotland (Stockholms Hist. Mus. 5604.48), 2. Lokrume, Gotland (Stockholms Hist. Mus. 6643.1), 3. Stenkyrka, Gotland (Stockholms Hist. Mus. 8147), 4. Gårdløsa, Öland (Stockholms Hist. Mus. 12326.2), 5. Roma, Gotland (Stockholms Hist. Mus. 12351), 6. Tingstäde, Gotland (Stockholms Hist. Mus. 14778), 7. Eskelhem, Gotland (Stockholms Hist. Mus. 16486), 8. Åker, Bornholm (The National Mus. of Denmark A53361).

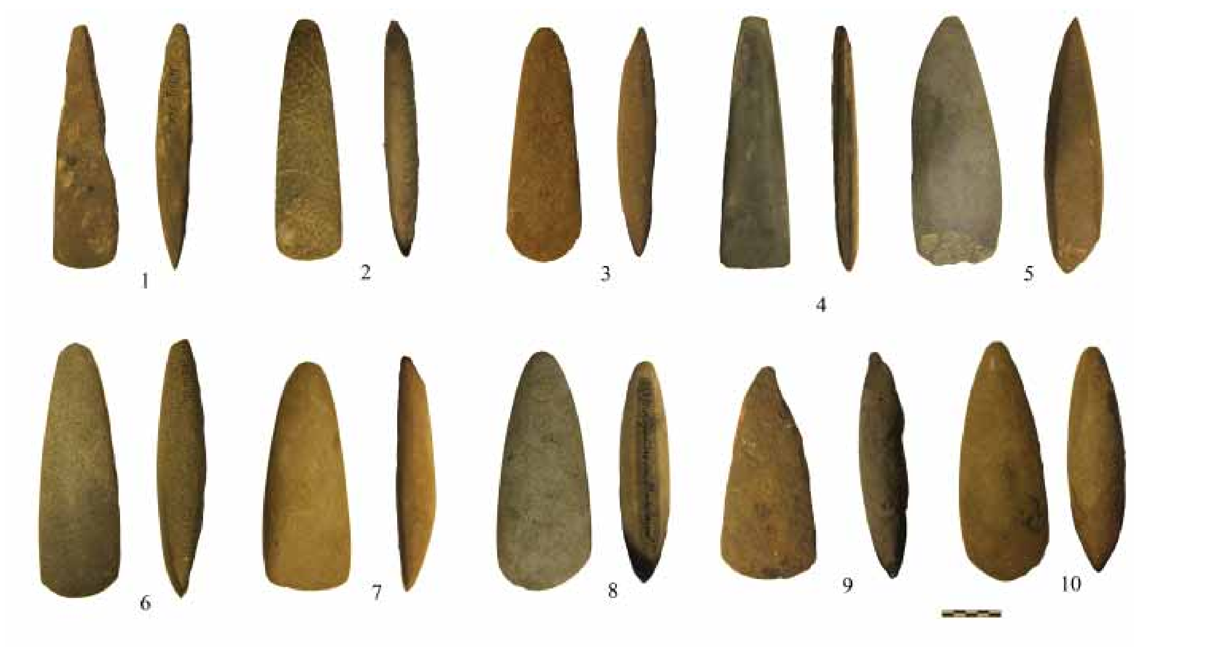


Fig. V. 92. Pointed-butted axes of diabase or basalt from central parts of Sweden (Södermanland, Dalsland, Närke, Uppland, Gästrikland and Värmland), which have been interpreted as imitations of jade axes or pointed-butted flint axes (Klassen 2004; Pétrequin et al. 2012c). All axes are from Stockholms Hist. Museum: 1. Lid, Södermanland (5631.3), 2. Frandefors, Dalsland (8646.1011), 3. Skollersta, Närke (13233.6), 4. Tysslinge, Närke (13376.5), 5. Dunker, Södermanland (13404.2), 6. Floda, Södermanland (15260.2), 7. Västerlövsta, Uppland (16862.3), 8. Högsatar, Dalsland (17343.842), 9. Arsunda, Gästrikland (18252), 10. Kila, Värmland (20149).

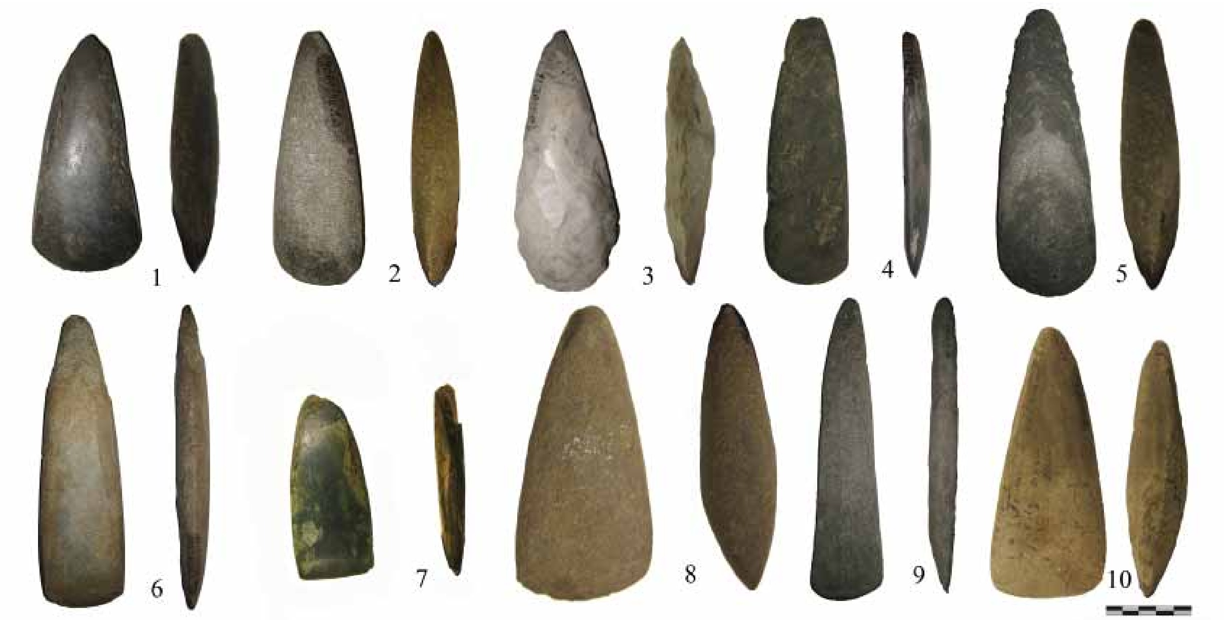


Fig. V. 93. Pointed-butted axes of diabase, basalt, nephrite or flint from southwest and southeastern parts of Sweden (Västergötland, Östergötland, Bohuslän, Blekinge and Småland), which have been interpreted as imitations of jade axes or pointed-butted flint axes (Klassen 2004; Pétrequin et al. 2012c). All axes are from Stockholms Hist. Museum: 1. Yxnarum, Östergötland (6013.78), 2. Foss, Bohuslän (9000.42), 3. Tollstad, Östergötland (9170.1, V), 4. Ronneby, Blekinge (10869.26), 5. Vikingstad, Östergötland (11362.18A), 6. Aska, Östergötland (11495.287), 7. Växjö, Småland. Nephrite axe/chissel possibly import from Switzerland as a parallel has been found in Hallwillersee (12628 (Montelius 1917, 12, no. 146; Pétrequin et al. 2012b, 193)), 8. Folby, Västergötland (13130.1), 9. Vester Husby, Östergötland (17573.3), 10. Gårdved, Småland (21001).

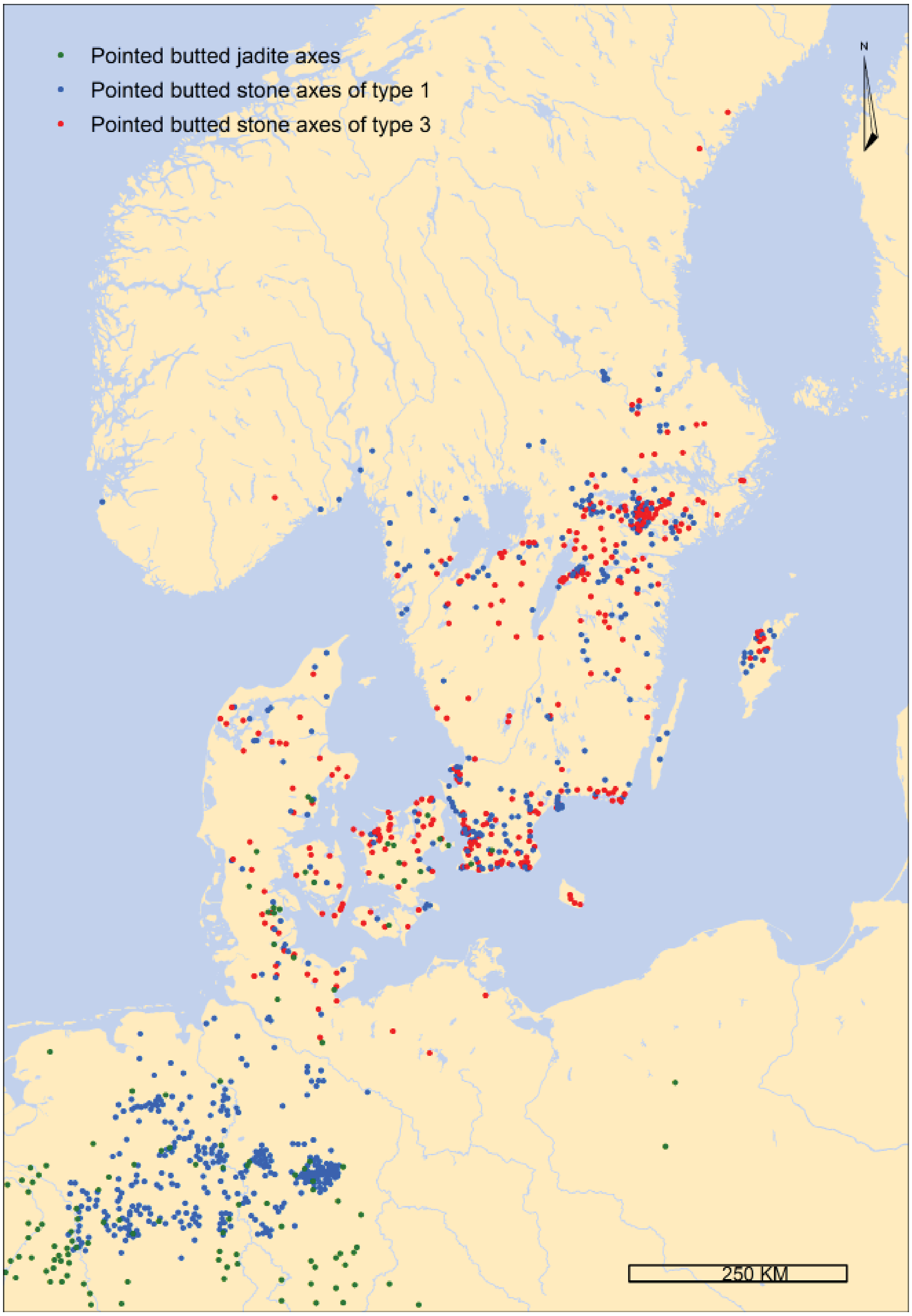


Fig. V. 94. Distribution of pointed-butted jade and pointed-butted stone axes in Northern Europe. After Brøgger 1906; Åberg 1937; Kersten 1939; 1951; S. Florin 1958; Hingst 1959; Lomborg 1962; Röschmann 1963; Ahrens 1966; Brandt 1967; Skaarup 1975; 1985; Ebbesen 1984; Klassen 2004; Gustafsson 2005; Hallgren 2008; Lübke et al. 2009; Klassen et al. 2012; Peter Vang Petersen pers. comm. Data after Table 56.

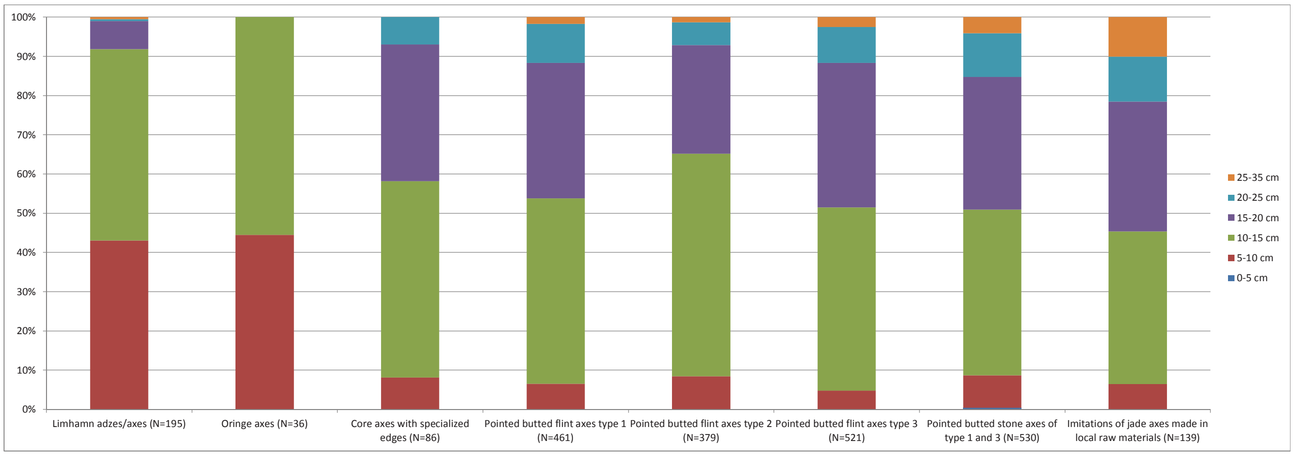


Fig. V. 95. Length of Limhamn axes/adzes, Oringe axes, core axes with specialized edges, pointed-butted flint, stone and jade axes. Data after Tables 53, 55, 56, 57, 58 and 59.

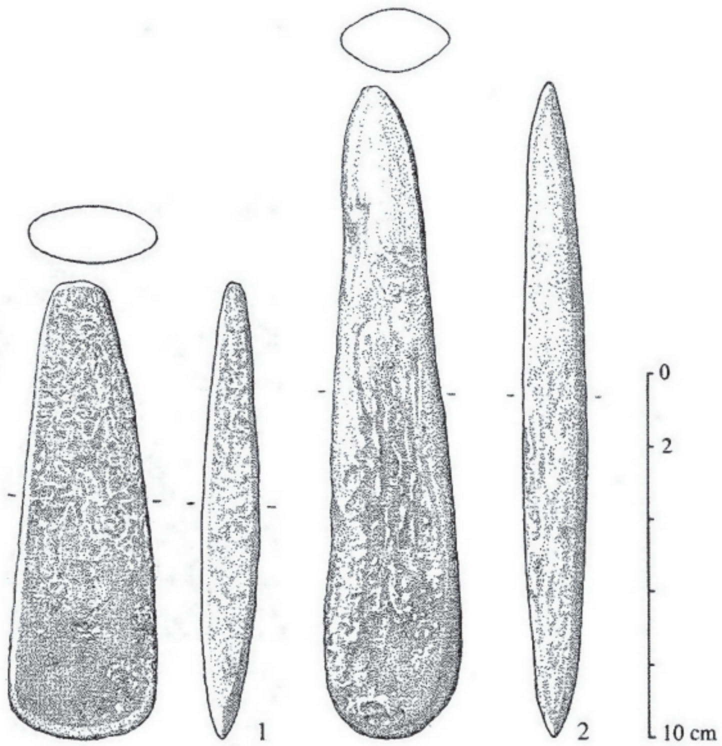


Fig. V. 96. Pointed-butted copper axes from Pilegård on Zealand (1) and Vester Bedegadegård on Bornholm (2). After Klassen 2000.

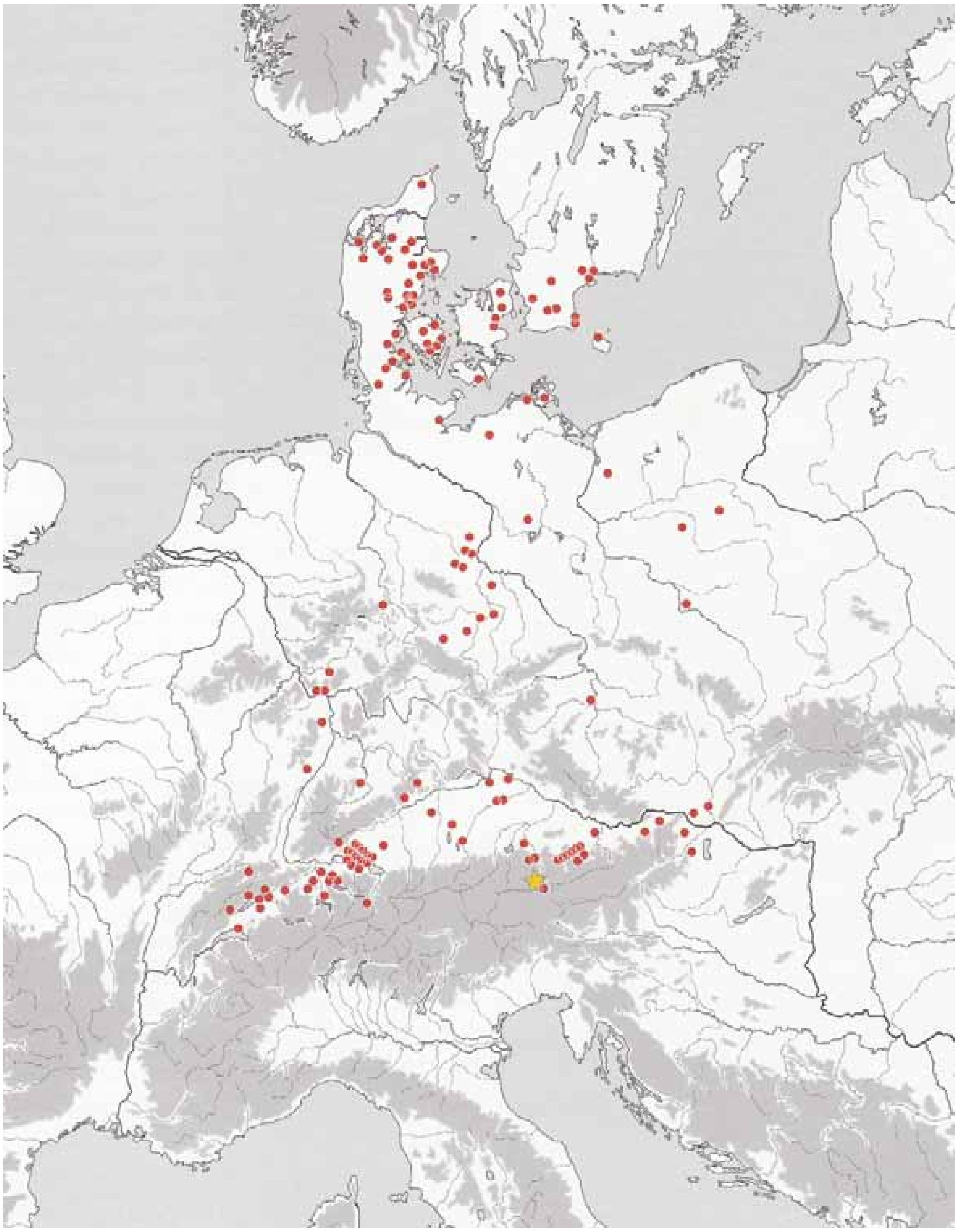


Fig. V. 97. Distribution of copper objects made of Mondsee copper. After Klassen 2000; 2004; Klassen & Nielsen 2010.

Fig. V. 98. Distribution of pointed-butted copper axes having an oval and four-sided cross-section together with known copper mines (Aibunar, Rudna Glava, Jarmovac and Mondsee) from the fifth and fourth millennium BC. Pointed-butted copper axes after Todorova 1981; Zachos 2007; Klassen 2000; Turck 2010; Klassen et al. 2012. Copper mines after Davies 1937; Chernykh 1978; Jovanović 1980; Pernicka et al. 1993; 1997; Radivojević et al. 2010. Data after Table 56.

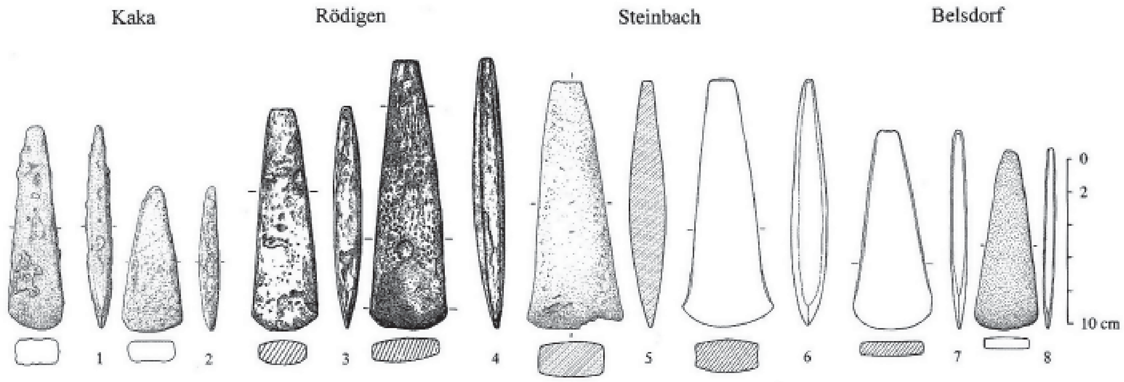


Fig. V. 99. Different types of pointed-butted copper axes (Kaka, Rödigen, Steinbach, Belsdorf) from the late 5th and early 4th millennium BC. 1. Vantore, 2. Schwabstedt, 3. Komořany, 4. Nechranice, 5. Rastenberg, 6. Steinbach, 7. Belsdorf and 8. Jedovnice. After Klassen et al. 2012, 1289.

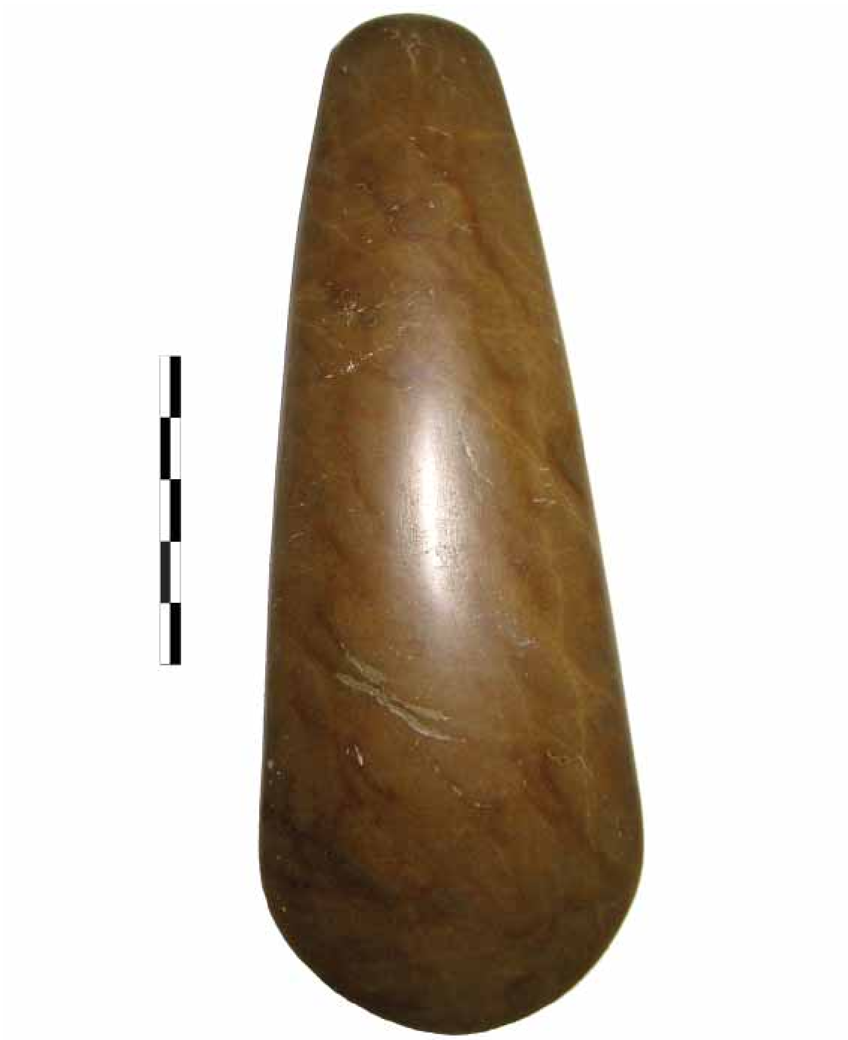


Fig. V. 100. A possible fibrolite axe presumably from Hov parish in southern Jutland? Museum Sønderjylland.

be argued that the carriers of these jade axes were in fact the first pioneering farmers in South Scandinavia, as their appearance is contemporary with the introduction of domesticated animals and cereal cultivation during the period 4000-3700 cal BC. Particularly important to this line of argument, is the emergence of pointed-butted flint axes in South Scandinavia.

9.7. Pointed-butted flint axes

Jade axes were already being imitated in flint in the Michelsberg culture during the period from 4300 to 4000 cal BC, which is shown by the emergence of the Glis-Weisweil type (Gallay 1977; Pétrequin et al. 2006; 2010, 237ff) (Fig. V.101). Pointed-butted flint axes of the Glis-Weisweil type have their main distribution in Alsace, South Germany and Switzerland, which is similar to the concentrations of pointed-butted stone axes with a perforated butt of the Zug type (Klassen 2014a). The pointed-butted axes of the Glis-Weisweil type clearly show the same shape, sizes and proportions as the jade axes of the Durrington, Puymirol and Tumiac types. These types of jade axe belong to the mid- and second half of the 5th millennium, when the jadeite was obtained from the production centres at Piémont and Liguria (Pétrequin et al. 2012a). Their distribution is widespread and they have been found as far north as South Scandinavia and Scotland (Klassen 2004; Sheridan & Pailler 2012). However, the jade axes of the Durrington and Tumiac types are very rare in the area where the pointed-butted flint axes of type Glis-Weisweil are concentrated, as here local production imitating jade axes may have occurred. But the imitations so closely resemble the original jade axes, that there must have been some contact with regions where the jade axes were more densely distributed. Where the flint came from that was used to make the pointed-butted axes of the Glis-Weisweil type is still unclear. But flint mines have been reported at Kleinkems and Löwenburg, near Basel, in the region where many of these Glis-Weisweil axe types were found (Diethelm 1997, 63f; Engel & Siegmund 2005; Pétrequin et al. 2010, 247). ^{14}C dates of charcoal from the mine shafts at both Kleinkems and Löwenburg date the extraction of flint to between 4250 and 3800 cal BC, thus indicating that these mining activities were contemporary with the establishment of mines in other parts of Western Europe (Diethelm 1997; Engel & Siegmund 2005; Sørensen 2012a). Unfortunately, no roughouts or blanks were found in the mineshafts, which makes it difficult to determine exactly which axe types were produced in the mines (Fig. V.102). Around 50% of the 66 pointed-butted axes of the Glis-Weisweil type were stray finds from wetland areas or bogs, thus pointing towards a direct parallel with depositional behaviour associated with pointed-butted axes in South Scandinavia (Pétrequin et al. 2010, 239; Sørensen 2012a). In South Scandinavia it is clear that the depositional practices associated with pointed-butted axes found in hoards are linked with their use as symbolic offerings in an agrarian society (Sørensen 2012a). In Central Europe there are many examples of hoards containing jade axes during the late 5th millennium BC (Fig. V.103). However, such depositional practices would have created an increasing demand for jade axes, if several agrarian societies had participated in these networks. But if it was impossible to obtain the actual jade axes, then local production could have been stimulated, with jade axes imitated in other available materials, such as flint. A corresponding demand would arise if the production of jade axes decreased, as seems to have occurred in the early 4th millennium. Such a phenomenon may explain the emergence of flint mines and the systematic production of pointed-butted flint axes (Fig. V.104).

Unfortunately, only limited regional studies of the distribution of pointed-butted flint axes in Europe have been undertaken, thus making it difficult to investigate possible social relations between the agrarian societies (Åberg 1912; Brandt 1967; Schut 1991, 28ff; Watté 2007, 65). Such advanced networks have been documented and confirmed by the distribution pattern of pointed-butted axes in southern Scandinavia (Brøndsted 1938; Hinz 1954; Hingst 1959; Röschmann 1963; Østmo 1986; Hernek 1988; Blomqvist 1990; Hallgren 2008; Hirsch et al. 2008; Nielsen 2009; Sørensen 2012a; Vogt 2009) (Table 59). A huge production has been observed in regions rich in flint sources on Zealand and in Scania during the Early Funnel Beaker culture, which resulted in major exchanges of flint axes to areas lacking flint in Central Sweden and southern Norway (Fig. V.105). A similar contemporary phenomenon can be observed in England, where the areas rich in flint (South England and Yorkshire) were characterized by major production of flint axes, which supported neighbouring regions without flint (Åberg 1912; Manby 1979; Moore 1979; Bradley & Edmonds 1993; Edmonds 1995; Pitts 1996; Barber et al. 1999). Perhaps the abundance of and easy access to flint sources is one of the more important pull factors, which could explain why some of the

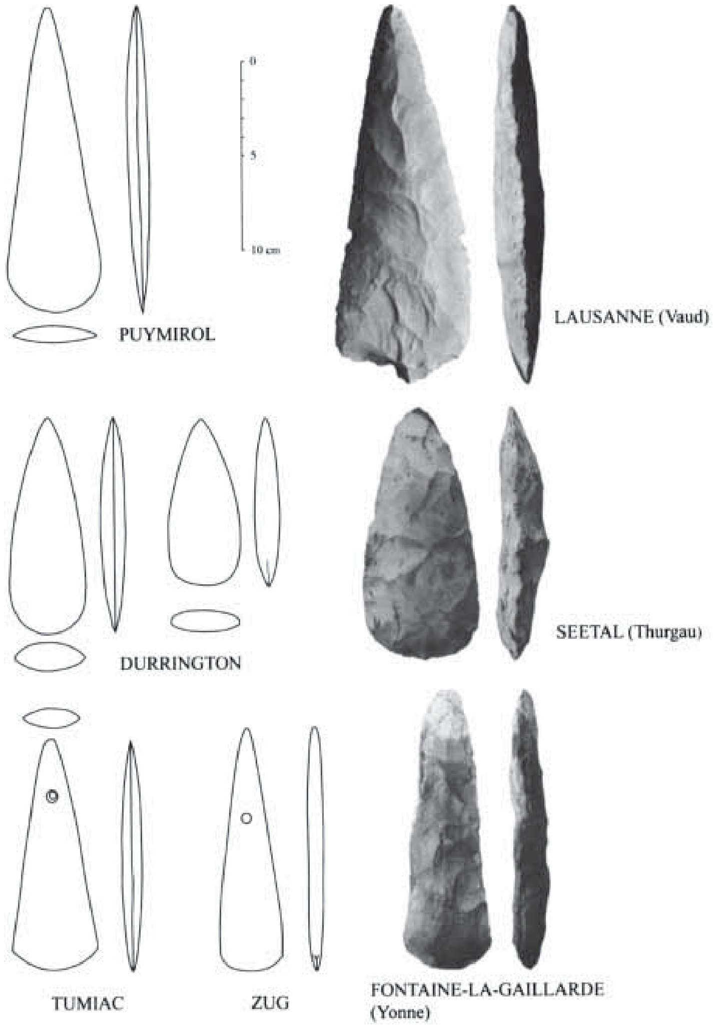


Fig. V. 101. Pointed-butted flint axes of type Glis-Weisweil imitating different types of jade axes. After Pétrequin et al. 2010.

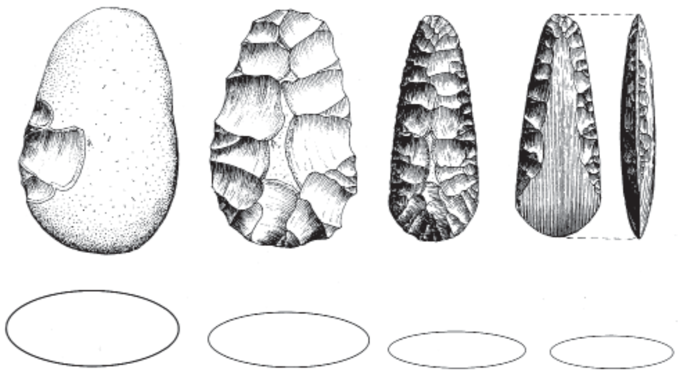


Fig. V. 102. Different production stages in making a pointed-butted flint axe. After Stafford 1999.

first immigrating farmers wanted to settle near places rich in flint sources in both South Scandinavia and Britain. This would be especially applicable if the axes were used by the pioneering farmers as agents to create and maintain larger agrarian networks in newly settled regions. The participants in these networks would have generated a constant demand, which is supported by the fact that at least 50% of the pointed-butted axes in South Scandinavia were deposited in an unused state in wetland areas (Fig. V.106). This is indicated by the yellow, blue, red or brown patina that is found on the flint axes (Fig. V.107). It is therefore clear that large-scale depositional practices continued in South Scandinavia after the arrival of the first agrarian societies. The demand for axes increased further, as flint axes were needed to clear the forest and open up the landscape, thus paving the way for agrarian subsistence.

Pointed-butted axes are associated with the first farmers in southern Scandinavia, as they have been found in contexts that have been ^{14}C dated to between 4000 and 3600 cal BC, which also contained short-necked funnel beakers and the first evidence of agrarian activities (Nielsen 1985; Andersen 2001; Rosenberg 2006; Hallgren 2008; Skousen 2008; Rudebeck 2010; Sørensen & Karg 2012) (Fig. V.108 and Table 24). The pointed-butted flint axes also go through a typological and technological development in southern Scandinavia, which is of some chronological importance. Type 1 is characterized by a two-sided cross section, whilst types 2 and 3 have respectively three- and four-sided cross sections (Nielsen 1977) (Fig. V.109). The typology is partly supported by ^{14}C dates of several contexts that contained different types of pointed-butted axes (Sørensen 2012a). However, there are considerable overlaps between pointed-butted axes of types 2 and 3, as well as the contextual ^{14}C dates of the thin-butted axes of types I, II, III and IV (Fig. V.135). Nevertheless, the original typology is confirmed when investigating the flint hoards, because type 1 is never found together with type 3 or any of the thin-butted axes. But types 2 and 3 have been found in hoards with thin-butted axes (Rydbeck 1918; Nielsen 1977; Karsten 1994) (Figs. V.110-111). It is therefore clear that pointed-butted axes of type 1 belong to the early EN I phase (4000-3800 cal BC), whereas types 2 and 3 have a wider use period covering most of the EN I phase (4000-3500 cal BC) (Salomonsson 1970; Liversage 1992; Stafford 1999; Hallgren 2008; Hirsch et al. 2008; Rudebeck 2010). The thin-butted axes of types I, II, III and IV confirm the overlapping chronology, as their contexts have been ^{14}C dated from 3800 to 3400 cal BC (Kristensen 1991; Andersen & Johansen 1992; Nilsson 1996; Nielsen 2000; Skousen 2008; Mischka 2011b; Beck 2013).

The distribution of the stray finds of pointed-butted axes in southern Scandinavia clearly demonstrates the limit of the Early Funnel Beaker expansion, which corresponds to the boundary between the boreonemoral and southern/middle boreal vegetation zones (Figs. V.112-113). The distribution of the short-necked funnel beakers and other agrarian evidence reached the same boundary, as discussed in section 8.7. Nevertheless, a few pointed-butted flint axes have been found as far north as Nordland in Norway, thus showing the wide distribution of these axes to hunter-gatherers in North Scandinavia (Valen 2007; 2012). The distribution of these axes also reveals trends of continuity and significant changes in settlement patterns in the period 4000-3600 cal BC in South Scandinavia. Continuity can be observed through the pointed-butted axes which have been found in the coastal and lake shore areas. Changes are shown by the concentrations of pointed-butted flint axes in the interiors of regions, such as Falbygden in Västergötland, Östergötland, Närke, Södermanland, Scania, Bornholm, North Funen and Vendsyssel. Small concentrations of pointed-butted axes in the inland zone can especially be identified in regions which were characterized by very limited and scattered habitation during the Late Mesolithic, such as Vendsyssel, Bornholm, Gotland and Central Sweden (see section 12). In some of these regions, the excavated Early Funnel Beaker inland sites are often located on light sandy soils, which are optimal for initiating cultivation practices. However, in other regions, like Vendsyssel, Västergötland and Götland, almost no Early Funnel Beaker inland sites have been excavated or recognized, as these can be extremely difficult to find. Mostly these sites have only been revealed by individual pits or small cultural layers of a limited depth (Salomonsson 1970; Larsson 1984; Rosenberg 2006; Hallgren 2008; Skousen 2008; Hadevik & Steinke 2009; Nielsen 2009; Rudebeck 2010, 85ff). A few of the inland sites that have produced pointed-butted flint axes have been found stratigraphically below long barrows, such as at Tolstrup and Barkær (Madsen 1975, 124ff; Liversage 1992, 59). The tendency of placing a long barrow on top of an Early Funnel Beaker site has also been confirmed at other localities, which have pro-

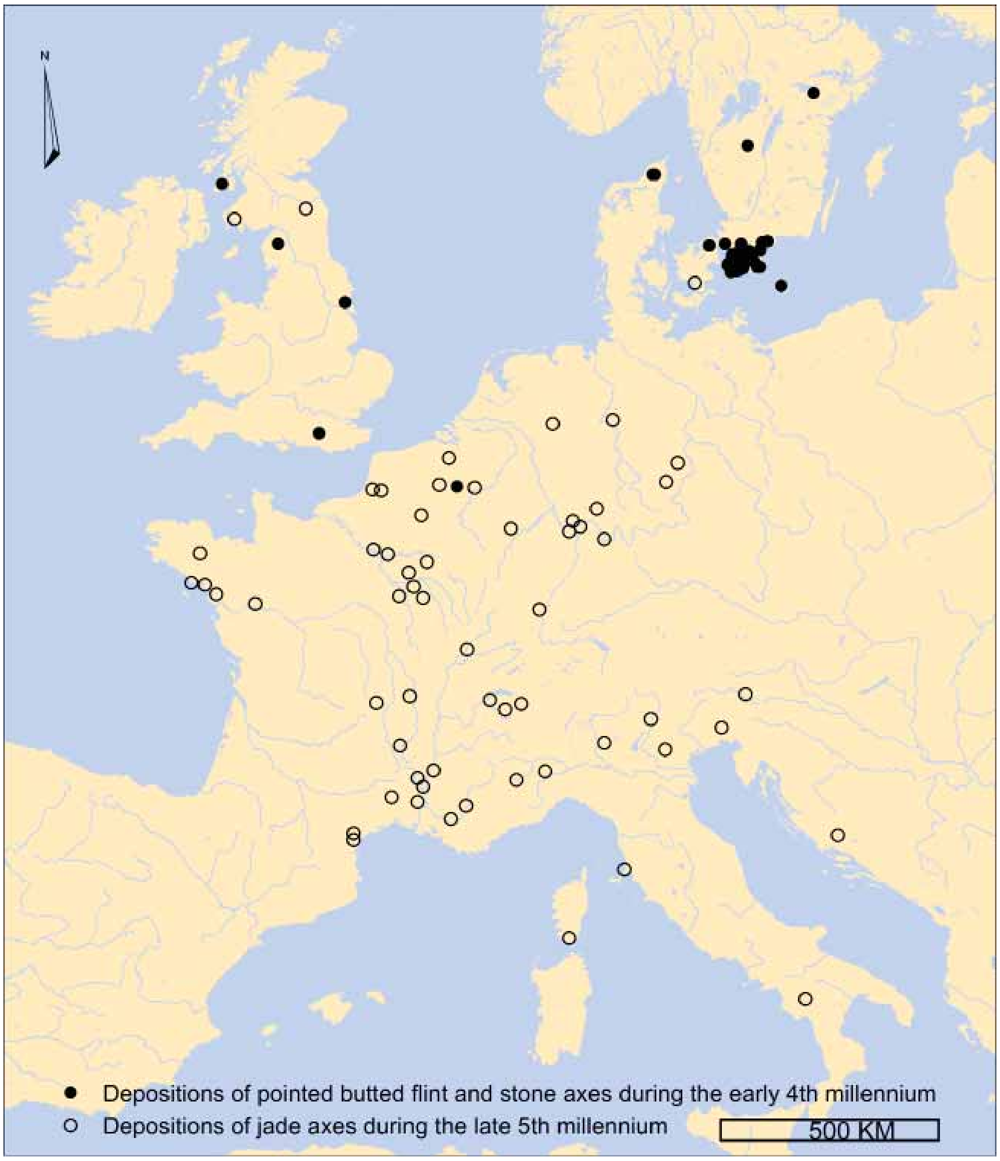


Fig. V. 103. Distribution of pointed-butted flint and stone axe hoards in Northern Europe from the early 4th mellinium shown together with hoards of jade axes from mid 5th to the early 4th mellinium BC. After Rydbeck 1918; Nielsen 1977; Manby 1979, 81; Bradley & Edmonds 1993, 147; Karsten 1994; Edmonds 1995, 57; Barber et al. 1999, 15; Klassen 2004; Gustafsson 2005; Rosenberg 2006; Collet et al. 2008, 60; Rudebeck 2010; Pétrequin et al. 2012e, 1390; Sørensen 2013c.

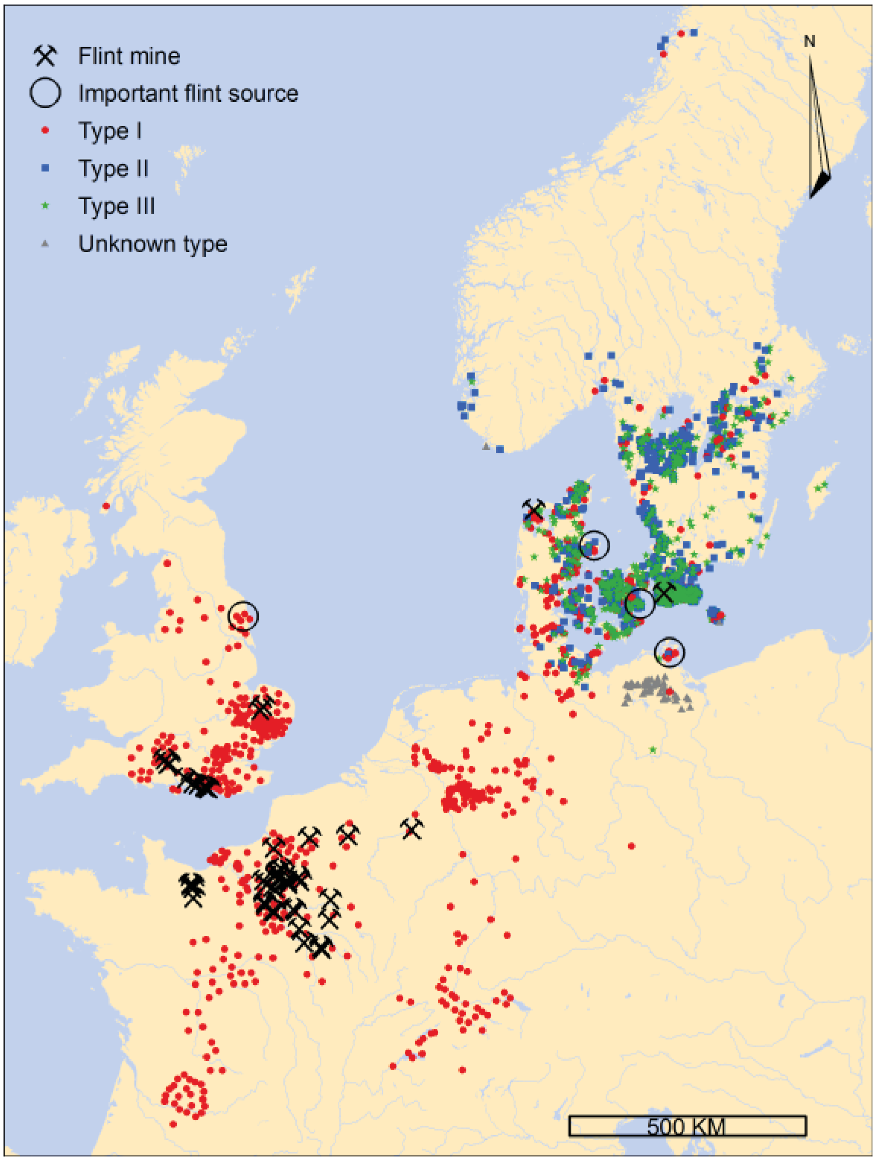


Fig. V. 104. Distribution of pointed-butted flint axes, flint mines and important flint ressources in western Europe. After Åberg 1912; Brøndsted 1938; Sprockhoff 1938; Kersten 1939; 1951; Hinz 1954; Schindler 1955; Kersten & La Baume 1958; Hingst 1959; Röschmann 1963; Brandt 1967; Lüning 1968, 74; Wilhelmi 1971, 33; Boelicke 1978, 111; Manby 1979; Moore 1979; Willms 1982; Østmo 1986; Hernek 1988; Blomqvist 1990; Schut 1991; Bostyn & Lanchon 1992; Bradley & Edmonds 1993, 147; Edmonds 1995, 57; Barber et al. 1999; Brauer 1999; Wallbrecht 2000, 92; Richter 2002; Collet et al. 2004: 151ff; Collet et al. 2008; Ungerath & Cziesla 2006; Hirsch et al. 2008; Watté 2007; Hallgren 2008; Nielsen 2009; Pétrequin et al. 2010; Bergsvik & Østmo 2011; Grooth et al. 2011: 77ff; Giligny et al. 2012: 1167; Sørensen 2012a; Valen 2012.

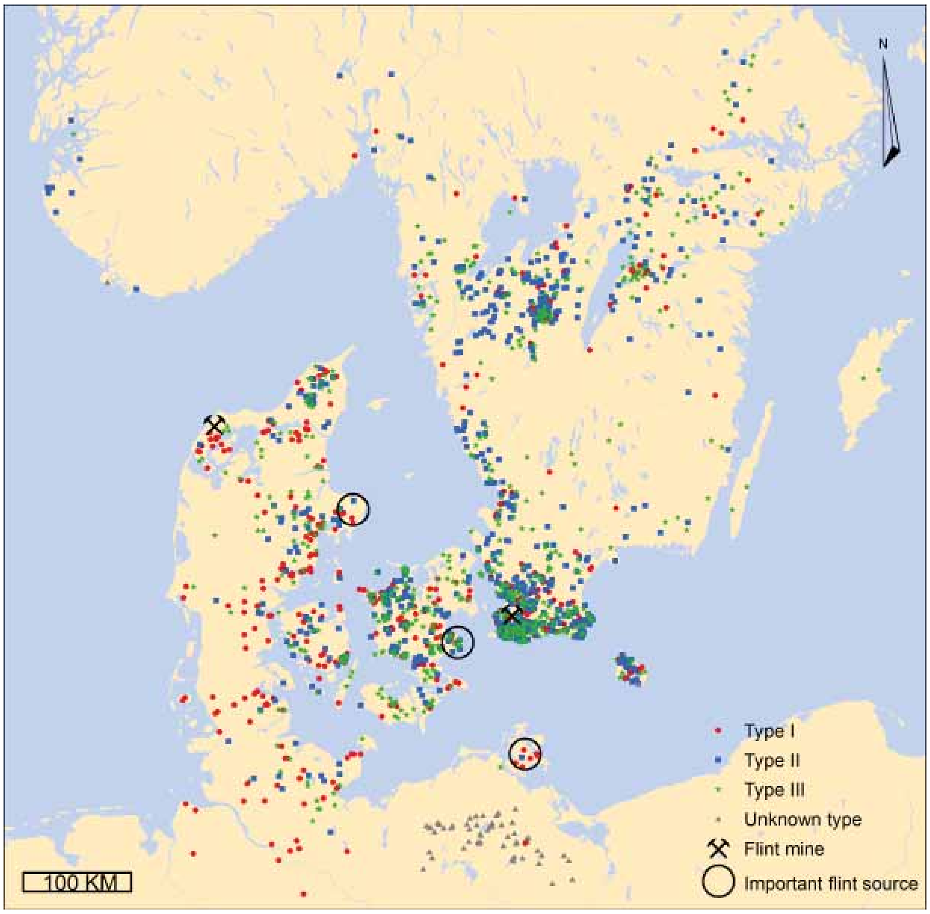


Fig. V. 105. Distribution of pointed-butted flint axes, flint mines and important flint ressources in southern Scandinavia and northern Germany. After Westerby 1920; Sprockhoff 1938; Kersten 1939; 1951; Mathiassen et al. 1942; Hinz 1954; Schindler 1955; Troels-Smith 1957; Kersten & La Baume 1958; S. Florin 1958; Hingst 1959; Röschmann 1963; Salomonsson 1970; Madsen 1975; Thomsen 1977; Larsson 1984; Skaarup 1985; Østmo 1986; Hernek 1988; Blomqvist 1990; Andersen 1991; Liversage 1992; Loewe 1998; Brauer 1999; Ravn 2004; 2012; Staal 2005; Kveiborg 2006; Rosenberg 2006; Hallgren 2008; Hirsch et al. 2008; Skousen 2008; Nielsen 2009; Vogt 2009; Rudebeck 2010; Bergsvik & Østmo 2011; Sørensen 2012a; Valen 2012; Anne Rosenberg pers. comm; Poul Erik Lindelof pers. comm; Poul Otto Nielsen pers. comm; Robert Hernek pers. comm; Søren H. Andersen pers. comm; Torsten Madsen pers. comm. Data after Table 59.

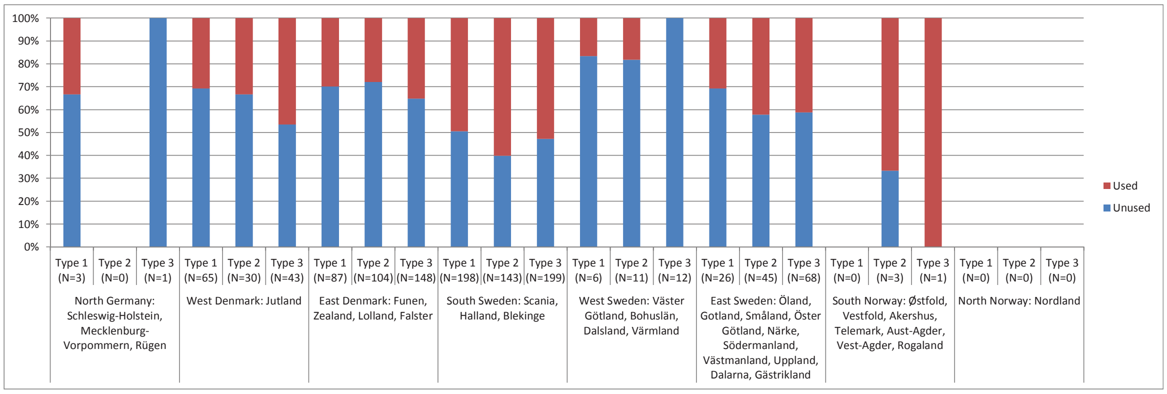


Fig. V. 106. The amount of used and unused pointed-butted axes of type 1, 2 and 3 from the early Funnel Beaker culture in South Scandinavia. Data after Table 59.

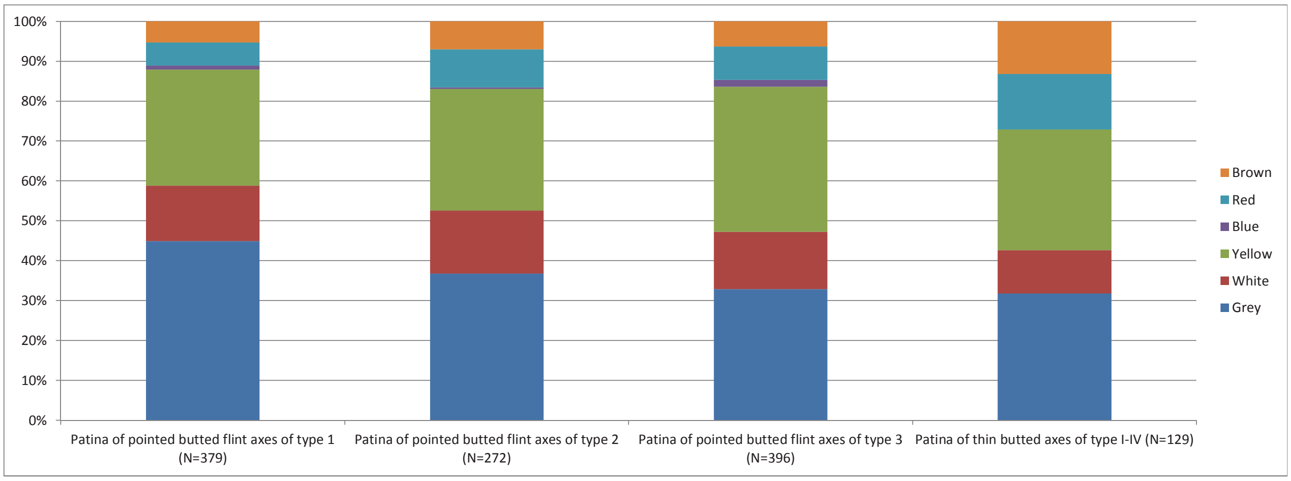


Fig. V. 107. Patina on pointed and thin-butted axes from the early Funnel Beaker culture in South Scandinavia. Data after Table 59.

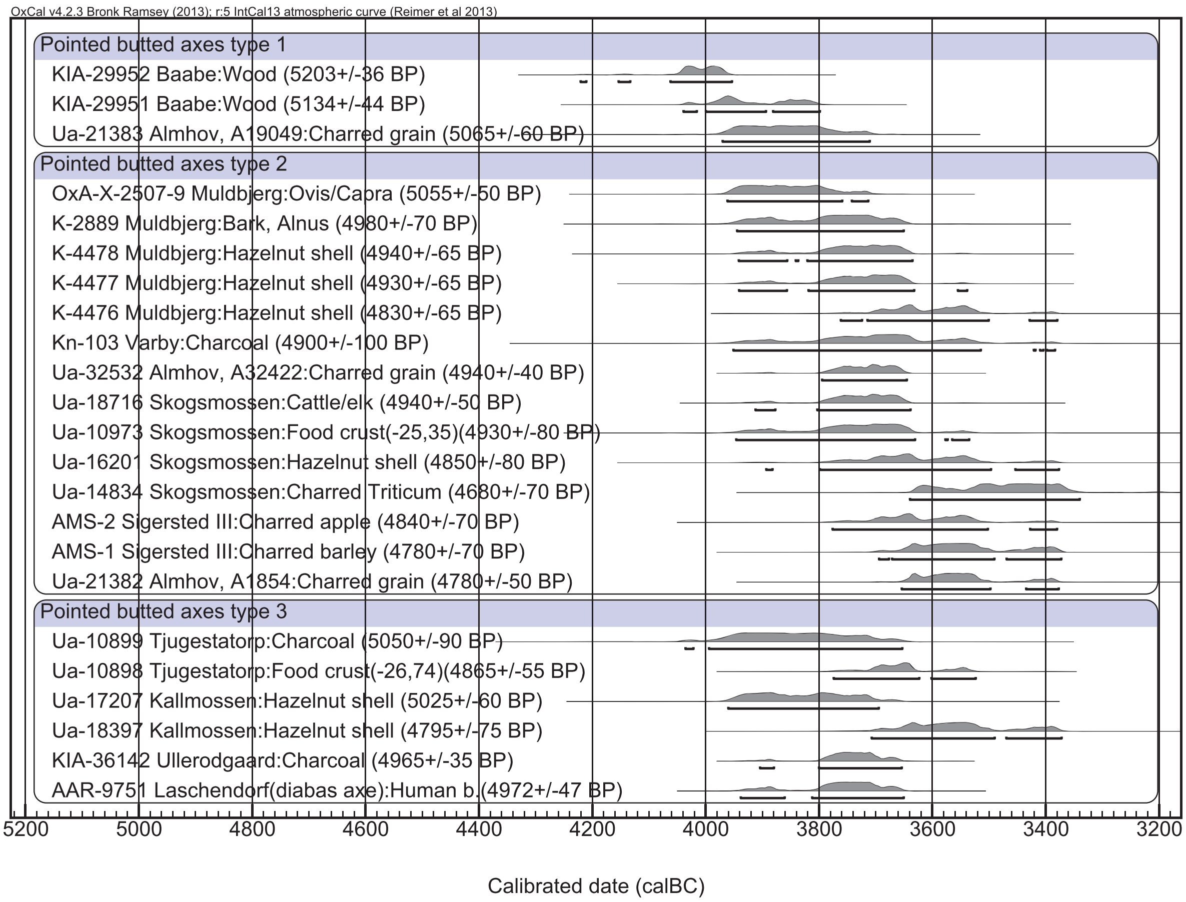


Fig. V. 108. ^{14}C dates of contexts containing pointed-butted axes from the early Funnel Beaker culture in South Scandinavia. Data after Table 23.

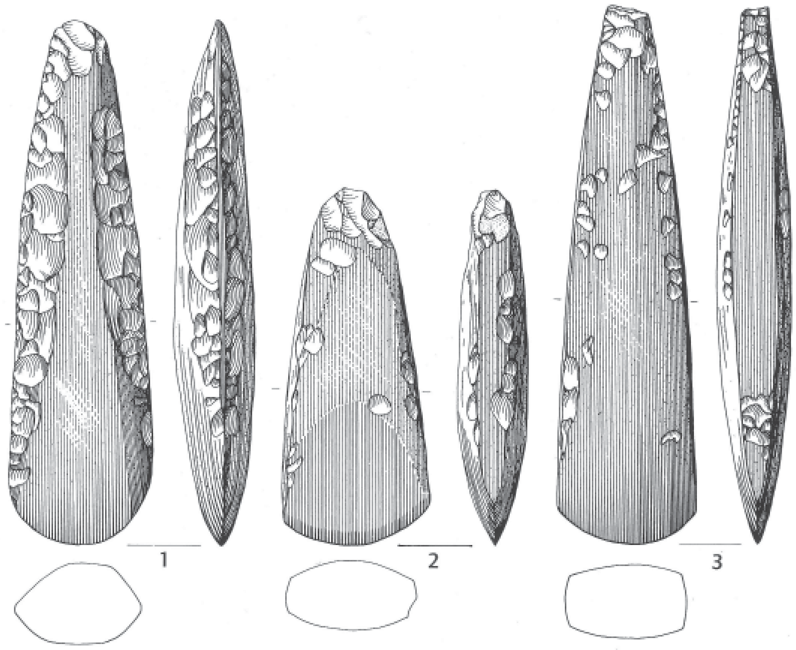


Fig. V. 109. Drawing of pointed-butted flint axes of type 1, 2 and 3. Type 1 has an oval cross section. Type 2 has a three-sided cross-section. Type 3 has a four-sided cross section. After Nielsen 1977, 66.

duced finds of short-necked funnel beakers (Skaarup 1975; Madsen & Petersen 1984; Liversage 1981; Rudebeck 2002) (Table 29). These sites were inhabited by the first pioneering farmers in South Scandinavia and were better protected than those not partly covered by long barrows. The construction of long barrows on top of earlier settlements from the early EN I phase is not accidental, but instead represents a repeated pattern of symbolic significance, as these monumental burial structures should be interpreted as visible markers of territories, as discussed in section 10.3. Despite the rare occurrence of inland sites located on easily worked arable soils, it is obvious that the stray finds of pointed-butted axes highlight areas where we should be able to find more of these sites.

9.8. Flint mines in Western Europe and southern Scandinavia during the 5th and early 4th millennium BC

Regions rich in flint sources may have been some of the specific areas where the first farmers settled in colonies, in order to control the production and distribution of pointed-butted flint axes. One of the reasons why it was important to gain control of the flint sources, may have been connected to the continuous depositional practices, often involving unused axes, that were carried out in these Early Neolithic agrarian societies. These offerings or sacrifices seem to have been of vital importance to these agrarian societies in relation to a possible symbolic negotiation with nature or other powerful forces. It is therefore not surprising that people were willing to compromise by using axes made from local materials rather than genuine jade axes. Jadeite may have been difficult to gain access to, as it is only found in a few places in the Italian Alps and because the supply of this raw material decreased during the late 5th and early 4th millennium BC (Pétrequin et al. 2012c). The result would have been an increased focus upon the exploitation of more abundant raw materials, like flint sources. This may be one of the reasons why several flint mines were established at almost the same time, around 4200 to 3800 cal BC, in northern France, Belgium and the Netherlands (Bostyn & Lanchon 1992; Becker 1993; Collet et al., 2004, 151ff; Grooth et al. 2011, 77ff, Giligny et al. 2012, 1167; Marcigny 2010; Baczkowski 2014) (Fig. V.114). If certain territorial rights were connected with the exploitation of flint, then this could, in association with other cultural or social factors, have generated a migration of people to other areas rich in flint sources. Such a scenario may explain why some of the earliest agrarian sites in both Britain and South Scandinavia have been found near contemporary flint mines, which have been ^{14}C dated to the beginning of the 4th millennium BC (Olausson et al. 1980; Rudebeck 1986; Becker 1993; Barber et al. 1999; Stevens & Fuller 2012; Sørensen 2012a; Sørensen & Karg 2012) (Fig. V.115 and Table 25). The interpretation is supported by the fact that around 90% of the pointed-butted flint axes are made of high-quality Senon flint, which sometimes displays traces of cortex with a white chalk surface, thus indicating that the flint was quarried from a primary source (Figs. V.116-117). Furthermore, the clustering of pointed-butted axes of type 1 near important flint sources located at Sallerup in Scania, Stevns on Zealand, Forsnæs in Djursland, Thy in North Jutland and Rügen in Mecklenburg-Vorpommern also supports the theory of a connection to these quarrying areas (Fig. V.105). Currently, Early Neolithic mineshafts have been excavated at Hov (Figs. V.119-121) and Bjerre in North Jutland and Sallerup in Scania (Figs. V.122-123). Charcoal pieces and small mammals from Sallerup and Hov have been been ^{14}C dated to the beginning of the 4th millennium BC, and Volling ceramics have been found at Bjerre in shaft D, thus indicating that they are contemporary with the other Western European flint mines (Rudebeck 1986; Sørensen 2012a) (Fig. V.118). There were probably several other flint mining sites in the Stevns area during the Early Neolithic period, but these have probably been eroded away by the sea in later prehistoric times. However, several pointed-butted flint blanks found in the area document that production did take place during the Early Neolithic (Mathiassen 1934, 18ff). The potential for finding further mining sites in Denmark is present in areas where the chalk is located high up in the terrain. It is, for instance, still unknown where the long thin-butted axes from the late EN I and EN II phases were produced (Nielsen 1977).

At Hov the early ^{14}C dates from shafts V, 7 and 51 were supported by Volling ceramics, which was found in a redeposited layer in the upper part of shaft 52 (Plate 7). Arguably the earliest ^{14}C date of a Water vole (*Arvicola amphibiusfrom*) from Hov V could be problematic and exposed to a reservoir effect, as these rodents live in a semi-aquatic environment. Nonetheless, the majority of the roughouts and planks found in all the excavated shafts at Hov had a two- or three-sided cross section and a triangular or teardrop shape, which indicates that they are preforms for pointed-butted axes, thus supporting a typological date to the Early Neolithic (Figs. V.124-126). Comparative studies of the lengths of blanks from Hov and Petit-Spiennes in Belgium also show similarities (Fig. V.127 and Table 26). The typical length for the blanks at both mining sites is 10-25 cm, thus corresponding to the general length of the pointed-butted flint axes (Fig. V.128). However, some of the other ^{14}C dates from the shafts at Hov (V and 51) are clustered around 3000 cal BC, which could indicate prolonged usage of the mines and that some of the blanks may be preforms for pointed-butted axes with a hollow-edge, thin- or thick-butted axes. But this interpretation can be refuted for the excavated mines, as a detailed investigation of the flakes from the upper layers in the shafts reveals a white patina, whilst the lower layers contained flakes with no patina, thus suggesting that some of the mineshafts were left open in prehistoric times, which could explain the later ^{14}C dates (Figs. V.129-130). Nevertheless, it is possible that other as yet unexcavated shafts could provide evidence of flint mines during later periods of the Neolithic.

Currently, no major Early Funnel Beaker sites have been found near the flint mines at Hov, which is surprising, as the blanks found in the mines are all roughouts. It is therefore clear that the fine production must have taken place at other locations, which are yet to be identified. Examples of such contemporary sites have, however, been found at the site of Almhov, near the flint mines at Sallerup in Scania (Rudebeck 2010). The site consisted of several pits, which besides short-necked funnel beakers, charred cereals grains and domesticated animals, also contained a large assemblage of several hundred kg of flakes from the various manufacturing stages involved in the production of pointed-butted axes (Table 15). Many can be categorized as classic wing-shaped flakes, which proves that large-scale axe production was taking place at this site. Moreover, up to 40 polished and unpolished pointed-butted axes have been found at the site, making it the largest assemblage of its kind in southern Scandinavia. The scale of the production suggests a systematic manufacturing process, in which many axes could have been intended for further distribution to other neighbouring regions lacking flint resources (Fig. V.105). However, other researchers have argued that Early Neolithic mining represents small-scale exploitation concentrated in certain seasons, based upon the lack of any large settlements near the mines. Furthermore, it has been suggested that the mining shafts were only in use for a very short period

Fig. V. 110. Table showing the depositions of pointed-butted flint and stone axes and their combinatios also with other types of axes. After Rydbeck 1918; Nielsen 1977; Karsten 1994; Klassen 2004; Gustafsson 2005; Rosenberg 2006; Rudebeck 2010; Sørensen 2013c.

Nr. on map (Fig. V.111)	Site	Region	Number of axes	Polished or unpolished	Pointed butted flint axes type 1	Pointed butted flint axes type 2	Pointed butted flint axes type 3	Thin butted flint axes type I-IV	Axes with neck perforation	Pointed butted stone axes	Thin butted stone axes	Remarks	Reference
1	Almhov (A15849)	Scania	3	polished	X							Pointed butted plank, axe and reused pointed butted axe as a hammerstone	Rudebeck 2010, 156
2	Järavallen	Scania	11	unpolished	X							some planks	Rydbeck 1918, 9
3	Hammelen	Scania	2	unpolished	X								Rydbeck 1918, 9
4	Stora Råby	Scania	2	unpolished	X								Lunds Historiska Museum (LUHM 12728)
5	Lackalänga	Scania	1	unpolished	X							Together with a grindstone	Karsten 1994, 226
6	Svedala	Scania	1	polished	X							Together with a grindstone	Rydbeck 1918, 9
7	Grönby	Scania	8	unpolished	X								Nielsen 1977, 121
8	Arrie	Scania	4	unpolished	X	X						Located in a bog	Rydbeck 1918, 9ff
9	Ravnekær	Bornholm	5	polished and unpolished		X				X		Together with a foursided stone axe	Nielsen 1988
10	Karaby	Scania	2	unpolished		X							Rydbeck 1918, 9
11	Dalby	Scania	2	polished		X							Rydbeck 1918, 12ff
12	Borgeby	Scania	2	polished		X							Rydbeck 1918, 12ff
13	Eslöv	Scania	2	unpolished		X						Bog	Nielsen 1977, 121
14	Fränninge	Scania	1	polished		X						Together with a grindstone	Karsten 1994, 309
15	V. Ågården	Vendsyssel	3	unpolished		X	X						Nielsen 1977, 121
16	Li Markie nr. 7	Scania	3	unpolished		X	X						Rydbeck 1918, 11ff
17	Vid Lundavä-gen	Scania	7	polished		X	X						Malmö Museum (MM 32165)
18	Gualöv	Scania	3	polished		X	X	X				Axes has been reworked	Karsten 1994, 348
19	Vanstad	Scania	2	polished			X						Rydbeck 1918, 16ff
20	Bolshög, Ö. Broby	Scania	3	polished			X						Stockholms Historiska Mus. (SHM 2791:244-247)
21	Torup, Bara	Scania	4	polished and unpolished			X						Robert Hernek personal comment
22	Smeby Slöta	Västergöta-land	5	polished			X					Bog	Nielsen 1977, 121
23	Ullerødgård	Zealand	1	polished			X					Found in a pit together with several scrapers	Rosenberg 2006

Nr. on map (Fig. V.111)	Site	Region	Number of axes	Polished or unpolished	Pointed butted flint axes type 1	Pointed butted flint axes type 2	Pointed butted flint axes type 3	Thin butted flint axes type I-IV	Axes with neck perforation	Pointed butted stone axes	Thin butted stone axes	Remarks	Reference
24	V. Ågården	Vendsyssel	2	unpolished			X	X					Nielsen 1977, 121
25	Kvistofta	Scania	3	polished			X	X					Karsten 1994, 215
26	Skegrie	Scania	2	unpolished			X	X				With burned flint	Karsten 1994, 294
27	Skurup	Scania	10	polished and unpolished			X	X					Karsten 1994, 303
28	Svedala	Scania	11	polished and unpolished			X	X					Karsten 1994, 274
29	Södra Åsum	Scania	2	polished			X	X					Karsten 1994, 310
30	Fjälkinge	Scania	2	polished and unpolished			X	X					Karsten 1994, 343
31	Kverrestad	Scania	3	polished			X	X					Karsten 1994, 328
32	Öster Sön-narslöv	Scania	2	unpolished			X	X					Karsten 1994, 347
33	Hörby	Scania	6	polished			X	X				Together with thin butted thin blade axes	Karsten 1994, 238
34	Bodarp	Scania	6	unpolished			X	X					Karsten 1994, 282
35	Lemmeströ, Börringe	Scania	7	unpolished			X	X				3 pointed butted axes and 4 thin butted axes	Stockholms Historiska Mus. (SHM 3765)
36	Limhamn, Kolsyrefabrik-ken	Scania	7	unpolished								Pointed butted planks	Lunds Historiska Museum (LUHM 29138)
37	Amalielunds Gård	Scania	2	polished			X		X			Found together in a cleft in connec. with removal of stones	Lunds Historiska Museum (LUHM 25491:1 & 2)
38	Brebol, Lerbo	Söderman-land	5	polished and unpolished						X	X	1 pointed butted and 4 thin butted axe. Found together in a cleft	Gustafsson 2005, 241ff
39	Hyll-ested Mark (14.02.07)	Jutland	2	polished				X	X			Type 3 pointed butted stone axe and one with perforated neck	Klassen 2004, 430

of time, corresponding with the more mobile lifestyle in the settlement systems of the Early Neolithic (Edmonds 1995; Barber et al. 1999). It has also been argued that mining was related to other socially important processes, which did not necessarily include the extraction of high-quality flint nodules in some of the British mines, as flint of a lower quality located in deeper flint seams was preferred to higher quality flint at or near the surface (Baczkowski 2014). Nevertheless, some of the flint mines at Spiennes were surrounded by a causewayed enclosure, thus indicating that the control of the resource must have been of some importance (Hubert 1969; 1980; Collet et al. 2004, 152; Manolakakis & Giligny 2011).

A connection between causewayed enclosures and flint mines is also suggested in the county of Sussex in southern England (Oswald et al. 2001, 117). The probable causewayed enclosure on Halnaker Hill in West Sussex overlooks the flint mining complex at Long Down. In South Scandinavia one of the largest causewayed enclosures covering 14.5 ha has been identified at Liselund, near Thisted, which is located around five km from the flint mines at Hov. The enclosure at Liselund is also one of the earliest causewayed enclosures in South Scandinavia, as Volling ceramics have been found at the bottom of one of the ditches (Nielsen 2004, 32). On the island of Møn, near Møns Klint, some of the best flint in South Scandinavia can be collected. Here a possible causewayed enclosure from the Early Neolithic may have been located at the site of Timmesø Bjerg, which includes a well preserved structure with visible ditches, as the locality is located in a protected area. The enclosure was previously dated to the Iron Age, but recently several flakes were found in the structure, together with a small copper disc, which also contained tin. The high proportion of tin (4%) may indicate that the disc was in fact made of bronze and thus can be dated to the Bronze Age. But recently tin pieces and bronze artefacts have been found in Serbia, which have been dated to the mid-5th millennium (Radivojević et al. 2013). It is therefore possible that the copper disc from Timmesø Bjerg may be from the early 4th millennium BC, which is further supported by finds of similar copper discs in the long barrows at Salten and Rude in Jutland (Klassen 2000). All these examples of causewayed enclosures located near flint mines indicate that the exploitation of flint during the Early Neolithic could have been under the management and control of local tribes. Furthermore, the identification of mines, manufacturing sites and the widespread distribution of the flint axes demonstrates that a major production and exchange of pointed-butted flint axes was initiated, and was contemporary with appearance of the first agrarian societies in South Scandinavia. It is also clear that the unlimited access to flint sources could have had a pull effect on the first pioneering farmers migrating to both Britain and South Scandinavia. Furthermore, the control of this particular resource may also have been important in creating a widespread network with more distant agrarian societies lacking flint sources in Central Sweden, Bornholm and Gotland.

The tribes controlling these flint resources must have had a great deal of practice in this area and had an understanding of the landscape, in order to find suitable mining sites in areas where the chalk was located high in the terrain. Mining for flint was a time-consuming activity, which required a significant amount of organization, as it sometimes did not produce the expected yields. Such disappointing results can be revealed when the numbers of discarded blanks are limited and the flint quality is poor. Shaft V at Hov contained a water vole (*Arvicola amphibious*), found at a depth of 5.5 metres, which was ^{14}C dated to 5130±40 BP (4037-3800 cal BC, Poz-7675). The total depth of the shaft was 6.5 metres and the finds from the mine indicated that it had not produced a high yield, as only a few flint nodules of poor quality were recovered. As a result, the mining of shaft V was abandoned after the opening of the first gallery. Nevertheless, it appears that the organization behind the mining process was capable of overcoming such mistakes. Sometimes, as in the case of shaft 2 at Hov, a layer of flint was found and exploited at a depth of five metres. Afterwards, the shaft was dug around 3 metres deeper to another layer of flint, which was of better quality, thus showing a detailed knowledge of where the best flint could be found (Becker 1993). Such a task would have been easier for a group of people from the Michelsberg culture, where mining for flint first began around 4300 cal BC. Perhaps the search for suitable places to exploit flint sources in South Scandinavia may have been undertaken by several scouting expeditions. Here the objective could have been to find suitable arable land near to abundant flint sources.

Obtaining flint by mining several metres down is a very difficult activity. A central shaft area is often connected to radiating galleries, the entrances of which are supported by chalk pillars (Baczkowski 2014). Such mining features have been observed associated with the Michelsberg culture at Jablines (Bostyn & Lanchon 1992), Spiennes (Collet et al. 2004), Rijckholt (Grooth et al. 2011) and Cissbury (Barber et al. 1999). The same mining features have also been observed in the larger Early Neolithic mines at Hov in shaft 7 and Bjerre in shaft E (Becker 1993). These characteristic galleries radiating out from a central shaft area can only be produced when the exploitation of flint in areas of primary deposits is undertaken (Plate 8). This is the reason why deep mining with galleries did not take place in the mines at Sallerup, as the flint sources in southern Scania were secondarily deposited during the last ice age (Rudebeck 1986). However, based on the overall similarities in the mining features, it is likely that the practice of deep flint mining came to South Scandinavia during the Early Neolithic period due to the immigration of farmers from the Michelsberg culture. Perhaps some of the first founding pioneer farmers in South Scandinavia were specialists in both agrarian and mining practices.

Flint mining is actually not a very logical activity in southern Scandinavia, because excellent nodules of flint of the right length, shape and quality for producing pointed-butted axes can be found on beaches. Throughout the Mesolithic period the beach had been the preferred place to obtain flint, which means that the procurement pattern changed with the emergence of the first agrarian societies in South Scandinavia. However, pointed-butted blanks have been found along the west coast of Scania and in Djursland at Fornæs, thus indicating a continuation of this strategy during the Neolithic (Glob 1951; Högberg 2006, 203f). However, this may have been a different product, which was not of the quality of the axes produced in the mines. Pointed- and thin-butted axes from the mines display a characteristic trait, in that many of them have cortex on the butt, which is a visible feature for future owners of the axes (Rudebeck 1998) (Fig. V.117). The cortex could be interpreted as an indication that these axes had the right origin and had been produced according to certain conventions and rituals. Such information is not only associated with axes, but a wide range of artefacts recorded in various ethnographic records (Hughes 1977; Højlund 1979; Hodder 1982; Pétrequin & Pétrequin 1993a).

The functional aspects of the flint mining sites have played a dominant role in their interpretation, but it can also be argued that the mines were important symbolic places for these Early Neolithic societies in the late 5th and early 4th millennium BC. The fills of the mineshafts sometimes contain human remains, like, for instance, at Spiennes in shaft 11, which was ^{14}C dated to 4500±50 BP (3362-3027 cal BC, Beta-110683). In mine 11 at Hov, the remains of an undated individual were found, who had been placed in the hocker position. Other human burials found in mineshafts have been recorded at Sallerup in pit A2408, which was ^{14}C dated to 4990±80 BP (3954-3650 cal BC, Ua-18757), and at Cissbury in shaft VI, where an undated individual was placed in the hocker position. These human burials may indicate that the shafts played a part in ritual activities after the extraction of flint had ceased (Becker 1964; Rudebeck 1994; Barber et al. 1999; Collet et al. 2008, 71). Furthermore, deposits of pottery, antler picks and animal bones that have also been found in many of the mineshafts could be interpreted as symbolic offerings made after the flint extraction. Ritual activities have also been connected with the actual extraction phase, especially in the British mines. Here unusual markings on the chalk walls of the mineshafts have been interpreted as animals or vertical lines (Teather 2011) (Fig. V.131). Normally such "decoration" has mostly been interpreted as functional markings made using antler or flint picks when the miners dug through the thick layers of chalk (Bostyn & Lanchon 1992, 115). When Carl Johan Becker excavated the mines at Hov, he retrieved some samples of chalk, which for the most part were interpreted as displaying functional markings made with stone or antler picks. But some of the chalk pieces from shaft 7 at Hov, which was ^{14}C dated to 4835±35 BP (3698-3527 cal BC, Poz-7670), display long grooved lines (Fig. V.132). The lines are very similar to those interpreted as art depicting phalluses or a deer from shaft 27 at Cissbury, which has been ^{14}C dated to 4710±60 BP (3635-3370 cal BC, BM-3086) (Teather 2011, 243). These possible pieces of art may indicate that the extraction of flint was much more than just a simple process of acquiring raw materials, but also involved ritualized behaviour.

Based on the presented evidence, it is likely that the procurement of flint using mining was introduced in both southern Scandinavia and Britain by groups of pioneer farmers from the Western European Michelsberg culture (Tresset 2003; Sheridan 2010, 89ff; Sørensen 2012a; Sørensen & Karg 2012). Perhaps the digging of mines was linked with the need to control and maintain continuous access to flint, in order to produce axes, which were of both functional and symbolic importance to these agrarian societies. Furthermore, the pointed-butted axes can also be interpreted as significant agents in preserving an agrarian network in South Scandinavia during the Early Neolithic, thus connecting regions that were rich and poor in flint sources with one another. In addition, many new types of prestigious axes appeared during the Early Neolithic, suggesting that the first farmers in South Scandinavia were part of a larger European network.

9.9. Ceremonial axes, battle axes, copper axes and other interesting objects from the Early Neolithic

In many areas that lacked flint sources in Sweden (Vastergotland, Östergötland, Dalsland, Narke, Södermanland, Västmanland and Uppland) the exchange of flint axes continued during the later part of the Early Neolithic, as these regions received a large number of thin-butted flint axes (Oldeberg 1952; Sundström 2003) (Table 60). The typological separation of the four thin-butted axe types (I, II, III and IV) of the Early Funnel Beaker culture is based on measurements of the axes, although there are some overlaps in the proposed typology (Nielsen 1977) (Figs. V.133-134). The typological overlaps are also confirmed by the ^{14}C dated contexts containing thin-butted axes, with types I, II, IIIa and IV dating from 3800 to 3500 cal BC, whereas type IIIb, V and VI date from 3500 to 3300 cal BC (Sørensen 2012a) (Fig. V.135). The thin-butted axes of types I, II, III and IV of the Early Funnel Beaker culture can also be said to be imitations of thin-butted copper axes of the Gumelniţa type (Todorova 1981, Plate 2: 26-37). The Gumelniţa copper axes were distributed throughout the north-eastern part of Bulgaria and were imitated in flint from the mid-5th millennium BC on (Klimscha 2007) (Fig. V.136). Impulses from Eastern Europe had already reached South Scandinavia during the EN I phase, as pointed-butted copper axes have been found at several places in Denmark (Klassen 2000). Nevertheless, the impulses continue during the late EN I and EN II, as some of the thin-butted copper axes found in Denmark and Scania (Maglebrænde, Hesbjerg Skov, Horsens Mark, Nørreskoven and Sjösvalpet) show similarities with thin-butted and thin-bladed flint axes from the Early Funnel Beaker culture (Nielsen 1977; Klassen 2000) (Figs. V.137-138). Furthermore, thin-butted copper axes with splayed edges have also been found in South Scandinavia, which are also imitated using local diabase (Figs. V.139-140). One of these thin-butted axes with splayed edges made of diabase was found, along with a Volling beaker, in the stone-built burial of the long barrow at Bjørnsholm, thus placing the type within the later EN I phase (Andersen & Johansen 1992, 43ff). Therefore, the imitations of axes demonstrate that the symbolic value of such objects was maintained: they were used in both burials and depositional practices, as almost all of them are unused (Table 61).

The first thin-butted copper axes with splayed edges are long and slender axes, which have been found in North-East Bulgaria, dating to the late 5th and early 4th mellenium BC (Todorova 1981). A shorter and wider variant of copper axes with splayed edges of the Altheim type was then produced on a larger scale in the Mondsee region of Austria during the early 4th millennium BC (Mayer 1977) (Fig. V.141). Several of the shorter copper axes with splayed edges have been found in Denmark and Scania, where the most well known find is the Bygholm hoard (Fig. V.142). The hoard belongs to the EN II phase, dated by a funnel beaker with vertical stripes on its belly (Klassen 2000). It is still uncertain whether the Early Neolithic farmers melted and casted their own copper axes, as crucibles for melting copper have not yet been found in South Scandinavia. However, Lutz Klassen (2000) has observed that some of the copper axes from South Scandinavia are very crudely made compared to similar axes from the Mondsee region. It is therefore probable that some South Scandinavian farmers may have experimented with the production of copper axes in the Early Neolithic. Currently, metallurgical investigations suggest that the majority of copper axes from the Early Neolithic in South Scandinavia are made of copper from Mondsee, near Salzburg in Austria (Klassen 2000). But similarities with the copper axes from Bulgaria could indicate that at least some of the axes are made of copper from mines in the Balkans or Bulgaria, which may be confirmed by future metallurgical analysis. The Mondsee region may have been an area interconnecting South Scandinavia with the southeastern part of Eastern Europe, in a larger exchange system of copper artefacts. Transportation routes via the major European rivers might have made such exchanges possible. Such a scenario is possibly supported by the distribution of thin-butted copper axes with splayed edges, which are concentrated in Bulgaria, the Mondsee region in Austria and in South Scandinavia, thus showing how copper axes could have been exchanged in an interconnected network. The continued practice of imitating various types of axes from Western and Eastern Europe demonstrates that the farmers in South Scandinavia were integrated partners in this larger European network, in which ideas and prestigious objects of jade and copper were exchanged and imitated to suit local preferences. Sometimes the imitations, through a process of hybridisation, could result in the production of new and more local axe types.

In South Scandinavia, the distribution of thin-butted flint axes differs from that of pointed-butted axes. Both types of axes are concentrated in the same regions, but the thin-butted axes show a much broader distribution, thus demonstrating that the agrarian societies expanded during the later phases of the Early Neolithic (Mathiassen 1948; 1959; Hinsch 1955; Malmer 2002; Lüth 2011). The unified material culture observed during the early EN I phase is still present in the late EN I and EN II. But boundaries seem to emerge, reflected by differences in ceramic styles, which are further supported by the distribution of hoards containing thin-butted axes. Types I, II and III of the thin-butted axes are observed on Zealand and in Scania, whereas type IV is mainly concentrated in Jutland (Nielsen 1977) (Fig. V.143). A few thin-butted axe hoards have also been found in Central Sweden, thus suggesting that the depositional practice of sacrificing unused flint axes continues all over South Scandinavia. However, some researchers have argued that the thin-butted axes found in Central Sweden should be interpreted as being associated with a down the line exchange, thus indicating a more indirect connection between agrarian societies in Denmark and Scania with central parts of Sweden (Sundström 2003). However, some of these thin-butted flint axes from Central Sweden are over 30 cm in length, thus indicating that they had no functional value (Fig. V.144). Instead, based on ethnographic parallels, it can be suggested that these were ceremonial axes (Højlund 1979; Pétrequin & Pétrequin 1993a; 1993b). Such ceremonial axes may have been associated with important symbolic practices, which is supported by the fact that over 95% of these thin-butted axes that are over 30 cm in length were unused when they were deposited in wetland areas, at sites or in burials all over South Scandinavia (Nielsen 1977; Karsten 1994; Ebbesen 1994; Rudebeck 2002; Hansen 2009) (Fig. V.73). As at least 60% of these thin-butted axes display a brown, red, blue or yellow patina, most of them must have been deposited in wetland areas (Fig. V.107). Exchanges of ceremonial axes were probably important for maintaining direct social relations, through marriage alliances with neighbouring or more distant agrarian societies, located in the boundary areas of the Funnel Beaker culture in Central Sweden.

In boundary areas of the Funnel Beaker culture the acceptance of certain trends and the rejection of others may have occurred. The agrarian region of East Central Sweden received impulses from the hunter-gatherer societies of Central and northern Scandinavia, as slate knives have been found at Early Funnel Beaker sites (Bakka 1976; Taffinder 1998; Hallgren 2008) (Fig. V.145). There does not seem to have been any production of slate at the Early Neolithic sites, which means that the knives must have been imported through direct or indirect social contact with hunter-gatherers. Direct contact may have occurred, which is supported by the appearance of double-edged battle axes in Central and North Scandinavia (Fig. VI.6). These hunter-gatherers in northern Scandinavia were probably interested in the symbols of power associated with the agrarian Funnel Beaker culture, but did not adopt any of its agrarian practices (Kaul & Sørensen 2012). One of these slate knives has been found as far away as Denmark, at the kitchen midden site of Vaalse Vig on Falster, thus showing how extensive the networks were in the Early Neolithic period, these also involving objects from Central and northern Scandinavia (Bahnson 1892, 166ff; Müller 1896, 313; Taffinder 1998) (Fig. V.146 and Table 71). Another important object associated with the first agrarian societies in South Scandinavia is the polygonal battle axe.

9.10. Polygonal battle axes

Polygonal battle axes have been interpreted as symbolic objects associated with rituals. They could not have been used for any practical purposes, as they are small and do not have sharp edges (Jażdżewski 1936; Zápotocký 1992). However, their elaborate and unsharpened edges could have been utilised as striking weapons. A number of rare finds suggest that the polygonal battle axes had a shaft measuring 50-60 cm, thus making them impressive weapons that expressed individuality and power, therefore reflecting a more hierarchical agrarian society in Central Europe (Zápotocký 1992, 158ff; Christensen 2004, 140). The polygonal battle axes were initially produced in Eastern Europe during the late 5th millennium BC, and were made from copper and stone (Fig. V.147

and Table 62). The axe type swiftly spread further north to Central Europe during the early 4th millennium BC, where it was primarily imitated in stone (Todorova 1981; Zápotocký 1992; Ebbesen 1998; Hallgren 2008; Sørensen 2012b). The distribution of the Early Neolithic battle axes shows some rather dense concentrations in Central Europe connected to both the Michelsberg and Baalberg cultures (Lüning 1968). Polygonal battle axes have also been found in significant numbers in South Scandinavia, of the same types as those found in Central Europe, once again indicating contact with Central European agrarian societies during the Early Funnel Beaker culture from the start of the early EN I phase (Tables 27 and 63). A few polygonal battle axes of copper have also been found in South Scandinavia, at Oxie and Steinhagen, which suggest possible contacts with either the Mondsee region in Austria or North-East Bulgaria (Todorova 1981; Klassen 2000). Most of the polygonal battle axes found in South Scandinavia are made from diabase or basalt, therefore suggesting that they were produced locally. The interpretation is further supported by finds of rough-outs for making polygonal battle axes. But the detailed knowledge and imitations of the shape of these axes indicates that South Scandinavian farmers were interconnected in a large agrarian network, in which new trends relating to the shape of these battle axes could spread rapidly between the different societies.

The earliest battle axes are types I-II in Klaus Ebbesens typology (1998, 77ff) or types F-I, II and III in Zápotockýs typology (1992), which are characterized by a flat neck, while the other types K-I, II, III, IV and V (Ebbesen types III, IV and V) have a knob-shaped neck (Fig. V.148). The F-I type battle axe was found in the Dragsholm burial. An antler pick from the burial was ^{14}C dated to 5090±65BP (4036-3712 cal BC, AAR- 7418-2), while a human bone was ^{14}C dated to 5102±37BP (3973-3797 cal BC, AAR-7416-2), thus dating this battle axe type to the beginning of the 4th millennium BC (Brinch Petersen 2008: 33ff). Another polygonal battle axe of type F-IV was found in the long barrow at Rustrup, where three radiocarbon dates of charcoal from the ditches clustered around 3800 to 3600 cal BC, thus indicating that this type belongs to the late EN I. Polygonal battle axes of type K III or V have also been found in radiocarbon dated contexts from the Early Funnel Beaker sites at Anneberg, Alby, Hyllie and Skumpaberget in Sweden (Hallgren 2008). The majority of the ^{14}C dates are concentrated around 3800 to 3600 cal BC, thus placing the types K III and V within the late EN I phase of the Early Funnel Beaker culture (Fig. V.149). The distribution of the earliest types F I-III in South Scandinavia also reaches its limit between the boreonemoral and southern/middle boreal vegetation zone, as is the case with the distribution of all the other artefact groups and agrarian evidence associated with the Early Funnel Beaker culture (Fig. V.150). The distribution of types K I and K II shows concentrations in Zealand, Scania and the Mondsee region in Austria, thus indicating a connection to this region during the early EN I and EN II phases. The connection to the Mondsee region is further supported by the distribution of thin-butted copper axes with splayed edges (Fig. V.151). The distribution of the polygonal battle axes of type K IV, on the other hand, shows concentrations in Zealand, Scania and Mecklenburg-Vorpommern, which suggests that there may have been a number of connections to different regions at different times in these agrarian networks (Fig. V.152). There are also some examples of more local South Scandinavian polygonal battle axe of types K-III and K-V, which are concentrated in Central Sweden and southern Norway (Fig. V.153). The quantities of locally produced preforms indicate that it was important for these agrarian societies in Central Sweden to create their own imitations, and perhaps their own meanings for the objects, in a process of hybridisation. The necessity of creating a more regional material culture seems to have been a growing tendency during the latter part of the Early Neolithic in certain regions of South Scandinavia, which took place at the same time as the adoption of selected trends and ideas from the larger agrarian network.

10. BECOMING PART OF A LARGE AGRARIAN NETWORK DURING THE EARLY 4TH MILLENNIUM BC

The establishment of an agrarian society in South Scandinavia during the early 4th millennium BC also involved the construction of visible structures and monuments, which demonstrated that the region was an integrated part of a larger European agrarian network. The introduction of two-aisled houses, paired pits, long barrows and causewayed enclosures, together with their European connections, will therefore be investigated and discussed in the following section.

10.1. Huts, houses and halls during the transition between the 5th and 4th millennium BC in Western Europe

The transition between the Late Ertebølle and Early Funnel Beaker culture is also characterized by a shift from smaller huts to two-aisled houses (Nielsen 1999; Grøn 2003) (Table 28). In general, these huts and houses are very difficult to identify and record, because excavations of Mesolithic settlements only cover very small areas and because the two-aisled houses from the Early Neolithic are located on sandy soils. However, the few hut structures that have been identified from the Late Ertebølle culture are all located at coastal or lake shore sites. The huts are usually very small, round or D-shaped and cover an area of below 20 square metres, which shows that hunter-gatherers lived in small dwellings during the late Ertebølle culture (Simonsen 1952; Andersen 1975; Karsten 2001; Mandrup et al. 2002; Friman 2005) (Fig. V. 159 and Table 64). However, there are also larger possible hut structures from the Middle to Late Ertebølle culture, which cover an area of 70 square metres. It is possible that the hunter-gatherers built these larger constructions as gathering places (Larsson 1985; Karsten & Knarrström 2003) (Fig. V.154).

At the beginning of the 4th millennium some of the earliest two-aisled houses were constructed in South Scandinavia (Figs. V.155-156). The majority of the houses have been found at inland oriented sites, located on easily worked arable soils, thus connecting these structures with the first pioneering farmers. Many of the houses are badly preserved and often consist of one row of roof-bearing posts, thus making it difficult to assess the size of the structure. It is only possible to calculate the size of the houses when the roof and wall posts are preserved, which also provides important morphological information (Fig. V.157). The two-aisled houses are oval shaped, contain a single row of roof-bearing postholes and covering an area ranging from 13 to 150 square metres, thus showing a considerable variation in size (Fig. V.154 and Table 64). The size of the houses provides important evidence of the organization of these early agrarian societies, as this affected the ability to store cereals and fodder for the animals during the winter months, as discussed in section 4.4. The two-aisled houses of the Early Neolithic are apparently found in three sizes. A small number of houses cover an area of 100-150 square metres, whilst most of the two-aisled houses of the Early Funnel Beaker culture belong to the middle group, which cover an area of 60-100 square metres. A third group consists of the smallest houses, covering 13-60 square metres. The differences in sizes could suggest that the earliest farming was characterized by different habitation and cultivation strategies (Fig. V.157). The larger two-aisled houses covering an area of above 100 square metres are known from both the Early and Middle Neolithic, and could possess the necessary storage capacity to support a more permanent habitation and cultivation strategy. However, the middle- and especially the small-sized houses only had a storage capacity for a limited number of livestock. Furthermore, the more limited investment in building medium-sized to small houses may reflect a type of habitation associated with greater mobility, which once again could be associated with a cultivation method using slash-and-burn methods and a long-term fallow strategy. Small huts have also been found in the same areas as two-aisled houses, and may represent specific buildings used for storage or livestock. These small huts are round, oval or D-shaped in plan, and cover an area of 14-60 square metres. The huts were also built during the Early and Middle Neolithic and have been identified at a number of sites in South Scandinavia (Figs. V.159-160). Use of the huts for various human activities is also a possibility, as some are of the same size as a number of the two-aisled houses. However, some interpreted huts at Glumslöv (hut 5), Kvärlöv (hut 1) and Dagstorp (hut 54) may equally well have resulted from the uprooting of trees (Newell 1981). However, similar round hut structures of a Neolithic date have also been recorded in Britain and Ireland, thus confirming their presence within the early agrarian societies (Barclay 1996; Darvill 1996, 94; Grogan 1996, 46ff).

The Early Neolithic date of the two-aisled houses is supported by several ^{14}C dates of charcoal and charred cereals found in the fills of postholes, which cluster around 3800 to 3400 cal BC (Nielsen 1999; Artursson et al. 2003; Rosenberg 2006; Hallgren 2008; Hadevik 2009; Ravn 2012) (Fig. V.156 and Table 65). Evidence of two-aisled houses from the early EN I phase from 4000 to 3800 cal BC is therefore rather limited. Possible early EN I houses may include FJ at Limengård, from which a charred cereal was ^{14}C dated to 5000±70 BP (3950-3660 cal BC, OxA-2895) (Nielsen 1999). Other houses have been dayed to the early EN I phase based upon their shape, or finds from postholes, pits or cultural layers located near the house

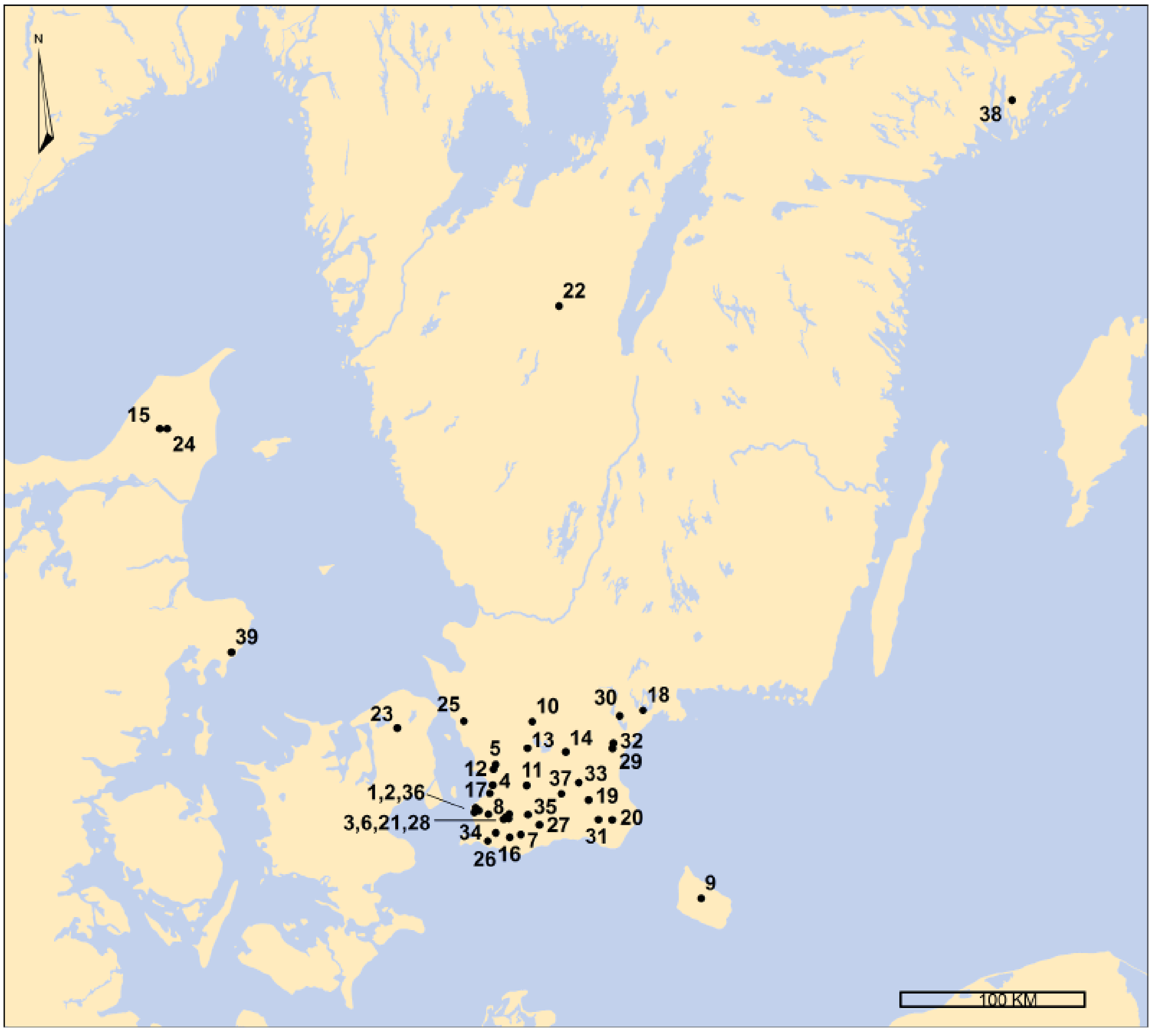


Fig. V. 111. Distribution of the depositions of pointed-butted flint and stone axes in southern Scandinavia. 1. Almhov (Rudebeck 2010, 156), 2. Järavallen (Rydbeck 1918, 9), 3. Hammelen (Rydbeck 1918, 9), 4. Stora Råby (Lund Hist. Mus. LUMH12728), 5. Lackalänga (Karsten 1994, 226), 6. Svedala (Rydbeck 1918, 9), 7. Grönby (Nielsen 1977, 121), 8. Arrie (Rydbeck 1918, 9ff), 9. Ravnekær (Nielsen 1988), 10. Karaby (Rydbeck 1918, 9), 11. Dalby (Rydbeck 1918, 12ff), 12. Borgeby (Rydbeck 1918, 12ff), 13. Eslöv (Nielsen 1977, 121), 14. Fränninge (Karsten 1994, 309), 15. V. Ågården (Nielsen 1977, 121), 16. Li Markie nr. 7 (Rydbeck 1918, 11ff), 17. Vid Lundavägen (Malmö Mus. MM32165), 18. Gualöv (Karsten 1994, 348), 19. Vanstad (Rydbeck 1918, 16ff), 20. Bolshög (Stockholms Hist. Mus. SHM2791:244-247), 21. Torup (Robert Hernek pers. com.), 22. Smeby Slöta (Nielsen 1977, 121), 23. Ullerødgård (Rosenberg 2006), 24. V. Ågården (Nielsen 1977, 121), 25. Kvistofta (Karsten 1994, 215), 26. Skegrie (Karsten 1994, 294), 27. Skurup (Karsten 1994, 303), 28. Svedala (Karsten 1994, 274), 29. Södra Åsum (Karsten 1994, 310), 30. Fjälkinge (Karsten 1994, 343), 31. Kverrestad (Kartsen 1994, 328), 32. Öster Sönnarslöv (Kartsen 1994, 347), 33. Hörby (Karsten 1994, 238), 34. Bodarp (Karsten 1994, 282), 35. Lemmeströ (Stockholms Hist. Mus. SHM3765), 36. Limhamn (Lunds Hist. Mus. LUHM29138), 37. Amalielunds Gård (Lunds Hist. Mus. LUHM25491), 38. Brebol (Gustafsson 2005, 24ff) and 39. Hyllested Mark (Klassen 2004, 430).

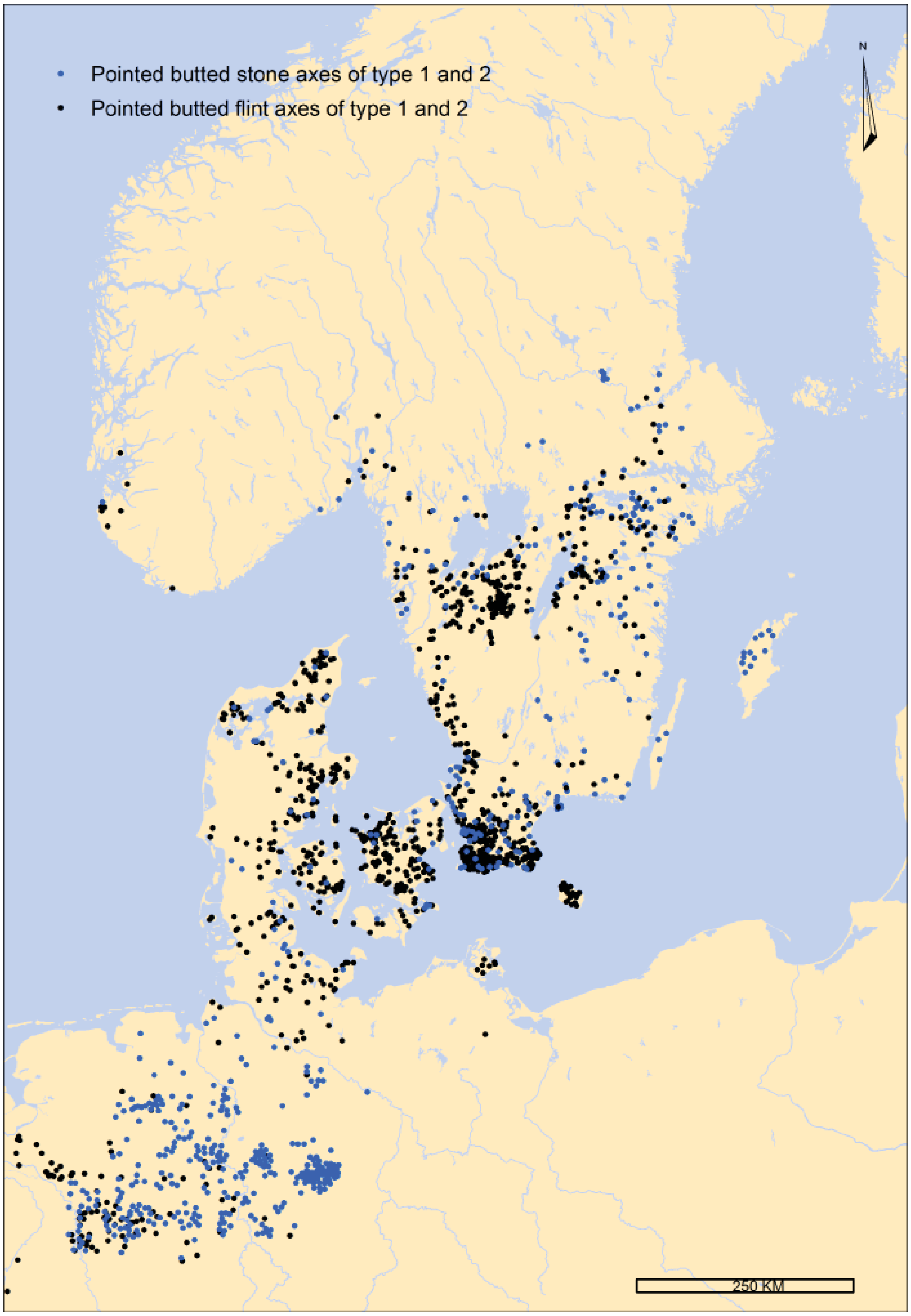


Fig. V. 112. Distribution of pointed-butted flint and stone axes of type 1 and 2 in northern Germany and South Scandinavia. Data after Tables 56 and 59.

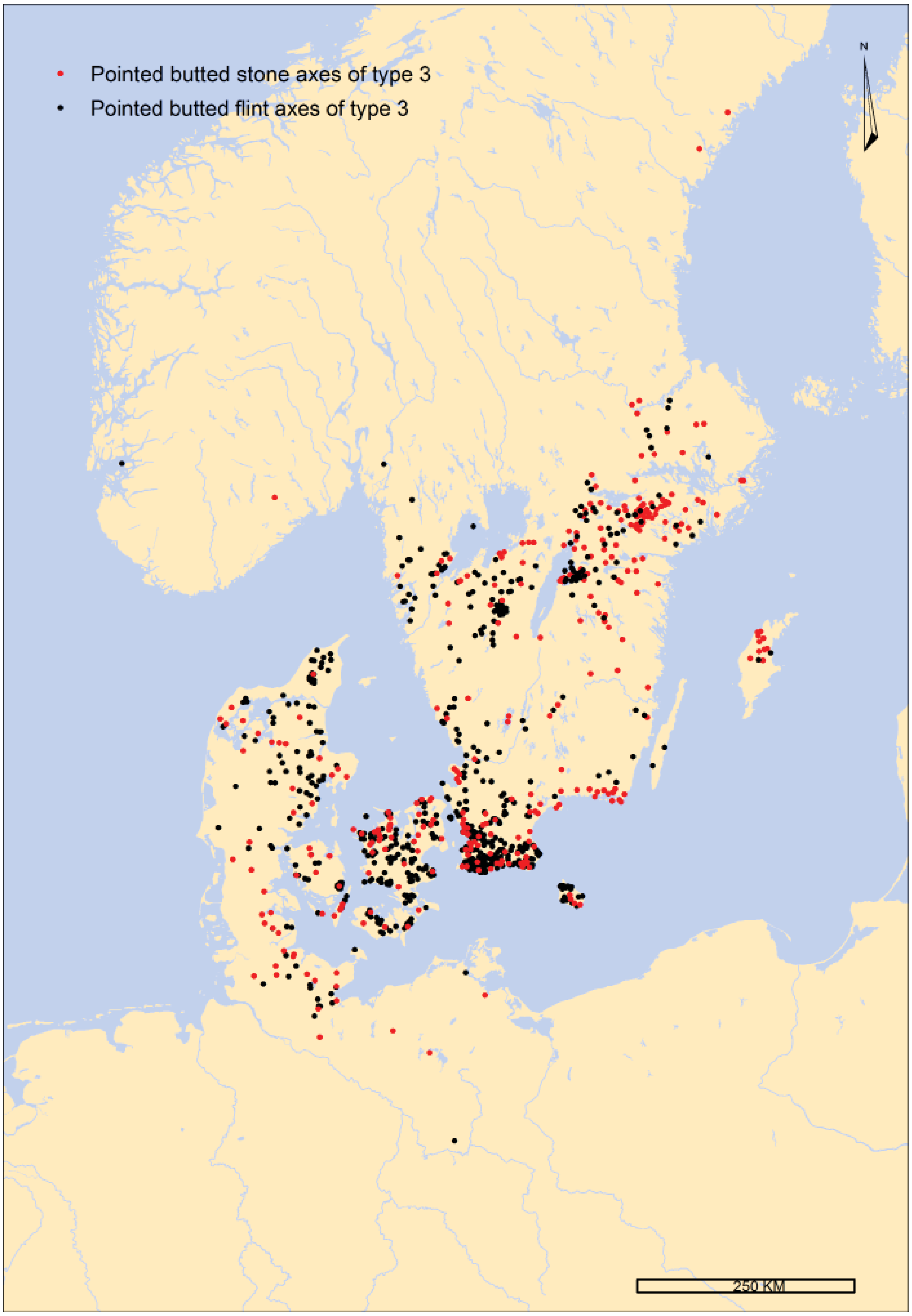


Fig. V. 113. Distribution of pointed-butted flint and stone axes of type 3 in northern Germany and South Scandinavia. Data after Tables 56 and 59.

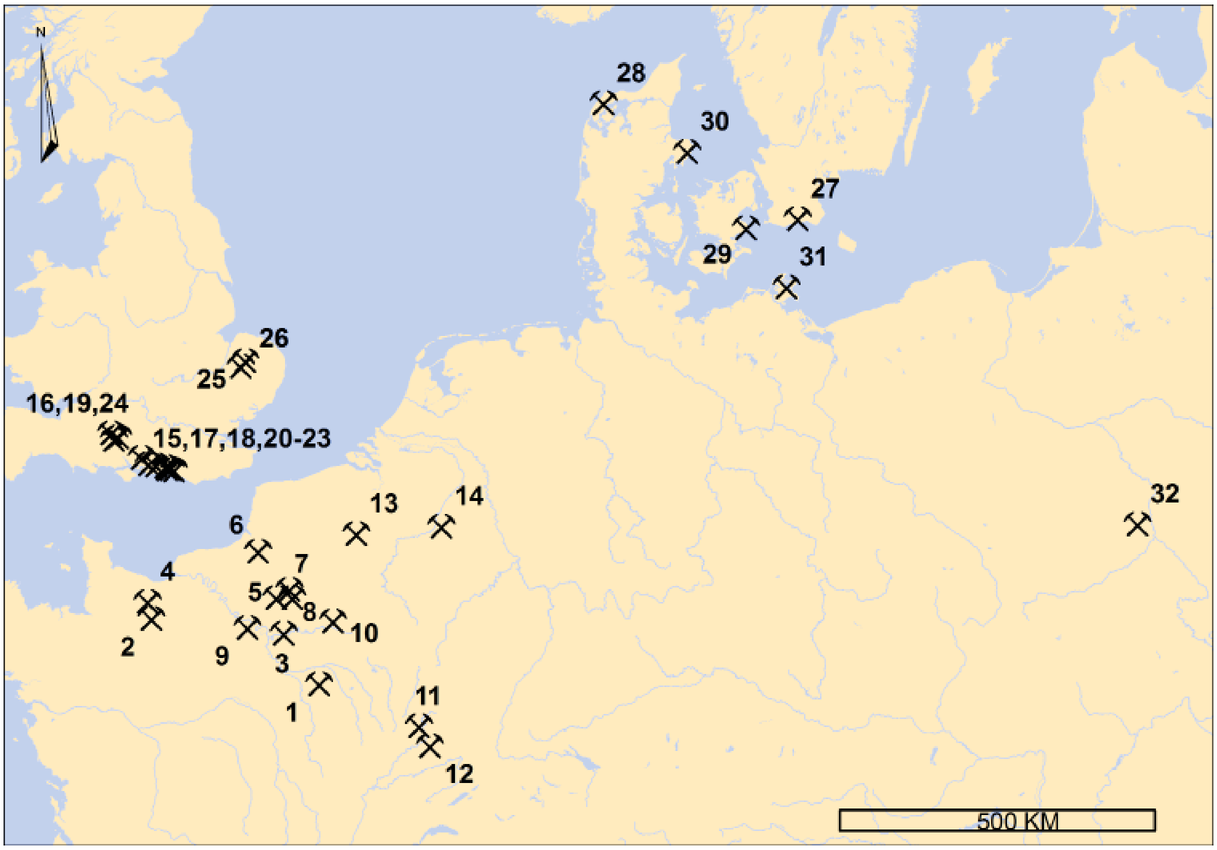


Fig. V. 114. Distribution of flint mines and important flint sources in Western Europe, where pointed-butted roughouts, planks, preforms and axes have been found, except Krzemionki (only thin-butted planks have been found here). 1. Villemaur-sur-Vanne ”Les Orlets” (Giligny et al. 2012, 1167), 2. Ri ”Le Fresne” (Marcigny 2010), 3. Jablines (Bostyn & Lanchon 1992), 4. Bretteville-le-Rabet ”La Fordelle” (Desloges 1986), 5. Parc du Brimborion (Tarrête 1981), 6. Les Bouts du Mont (Giligny et al. 2012, 1167), 7. Le fond Madelon Duriez (Beaujard & Bostyn 2008), 8. La Porte aux Bergers (Chambon & Lanchon 2003), 9. Flins-sur-seine (Bostyn et al. 2008), 10. Rhomigny-Lhéry (Manolakakis & Giligny 2011), 11. Vaux-Le-Montcelot (Pétrequin et al. 2010), 12. Villers-Chemin-et-mont-Les-Etrelles (Pétrequin et al. 2010), 13. Spiennes (Collet et al. 2004), 14. Rijckholt (Grooth et al. 2011), 15. Church Hill, 16. Martin's Clump, 17. Blackpatch, 18. Cissbury, 19. Easton Down, 20. Harrow Hill, 21. Long Down, 22. Stoke Down, 23. Nore Down, 24. Durrington, 25. Grime's Graves, 26. Buckenham Toft (Barber et al. 1999, 81), 27. Sallerup (Olausson et al. 1980; Rudebeck 1986), 28. Hov (Becker 1957; 1959; 1964; 1980; 1993), 29. Stevns (Mathiassen 1934), 30. Forsnæs (Glob 1951), 31. Rügen (Sørensen 2012a) and 32. Krzemionki (Borkowski & Budziszewski 1995).

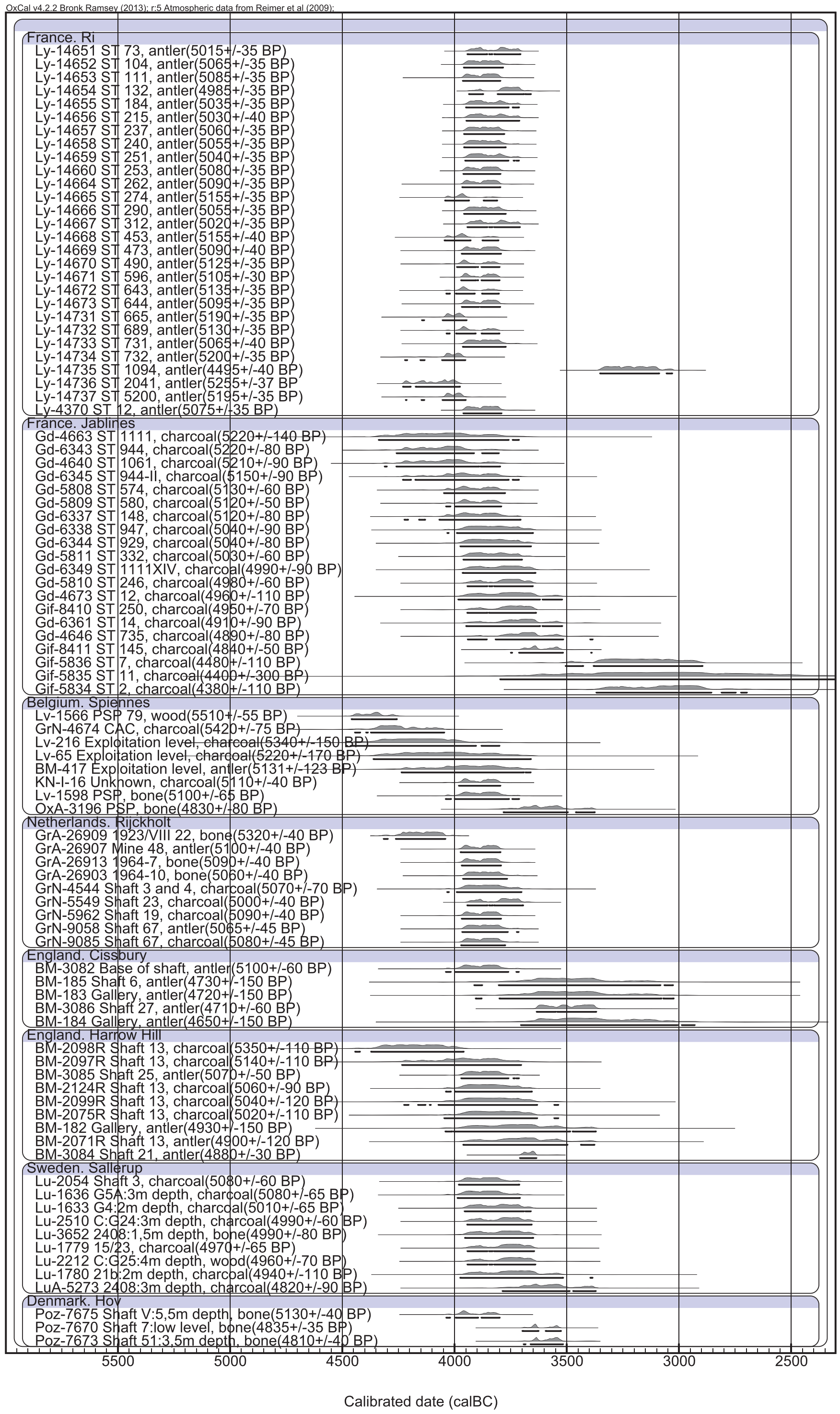


Fig. V.115. ^{14}C dates of organic material found in mining shafts or pits together with pointed-butted roughouts, planks for producing pointed-butted axes in Western Europe. Ri (Giligny et al. 2012), Jablines (Bostyn & Lanchon 1992), Spiennes (Collet et al. 2004), Rijckholt (Grooth et al. 2011), Cissbury (Barber et al. 1999), Harrow Hill (Barber et al. 1999), Sallerup (Olausson et al. 1980; Rudebeck 1986), Hov (Becker 1957; 1980; 1993; Jens Henrik Bech pers. comm.).

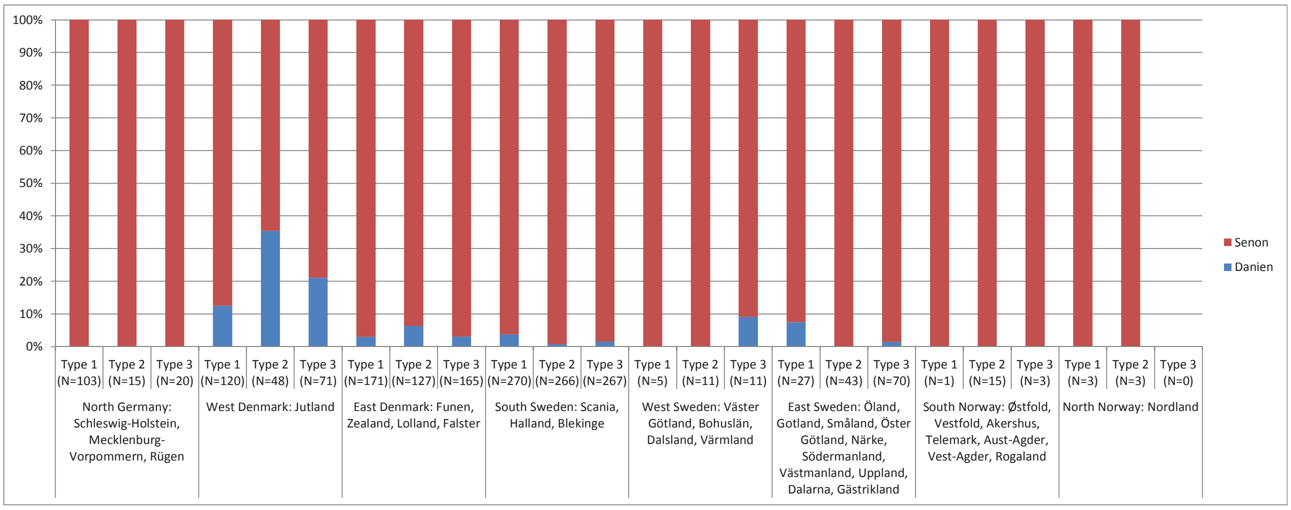


Fig. V. 116. Pointed-butted axes made of Senon or Danien flint in South Scandinavia.

Fig. V. 117. Pointed-butted axes from the suite collection at the National Museum of Denmark containing a white chalk surface on the neck from right to left: A 27015, Kausbjerggård, Syv parish (2.01.10), A 27730, Bedsted, Kværkeby parish (4.02.10), A 25729, Kongstrup, Refsnæs parish (3.01.05).

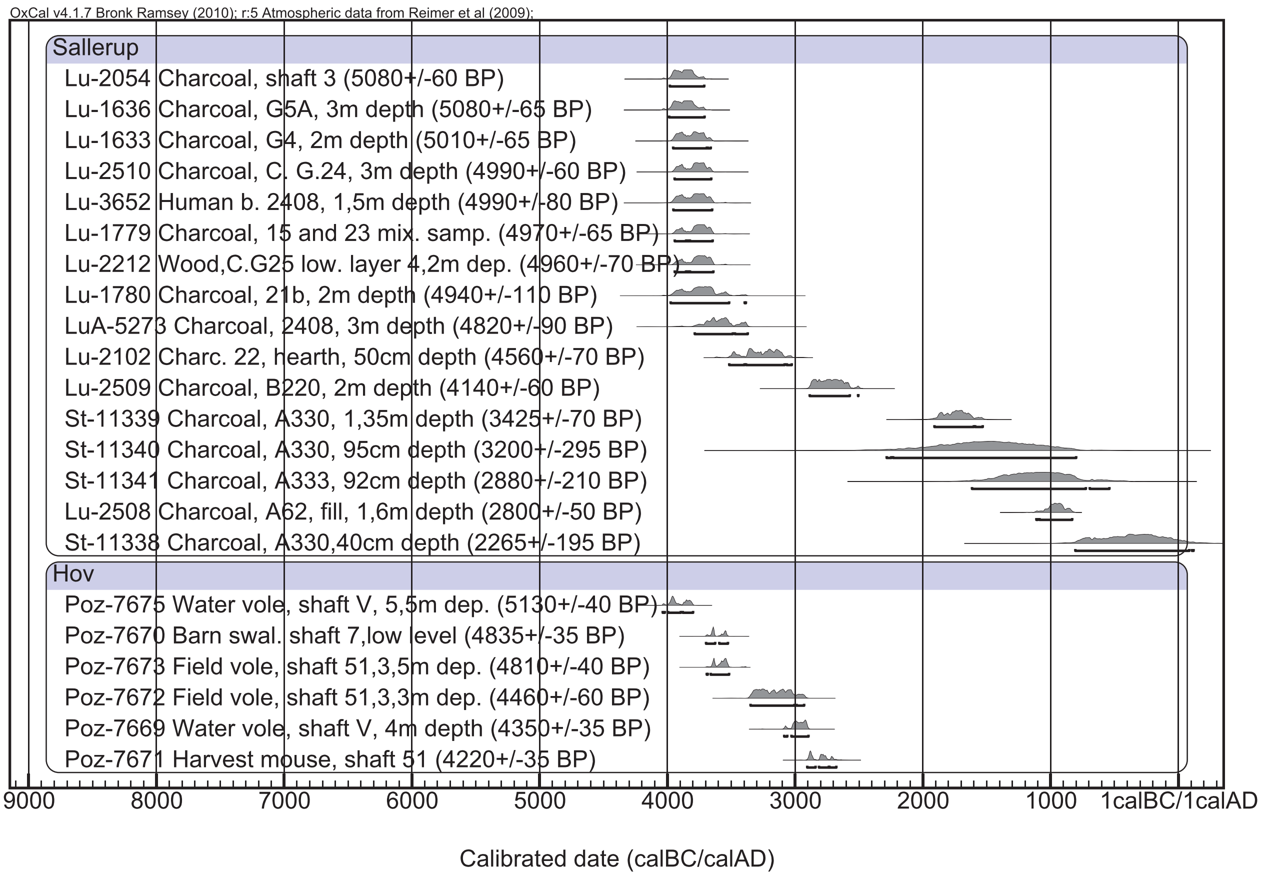


Fig. V. 118. ^{14}C dates of organic material found in mining shafts or pits at Sallerup in Scania and Hov in northern Jutland. After Rudebeck 1986; Jens Henrik Bech pers. comm.

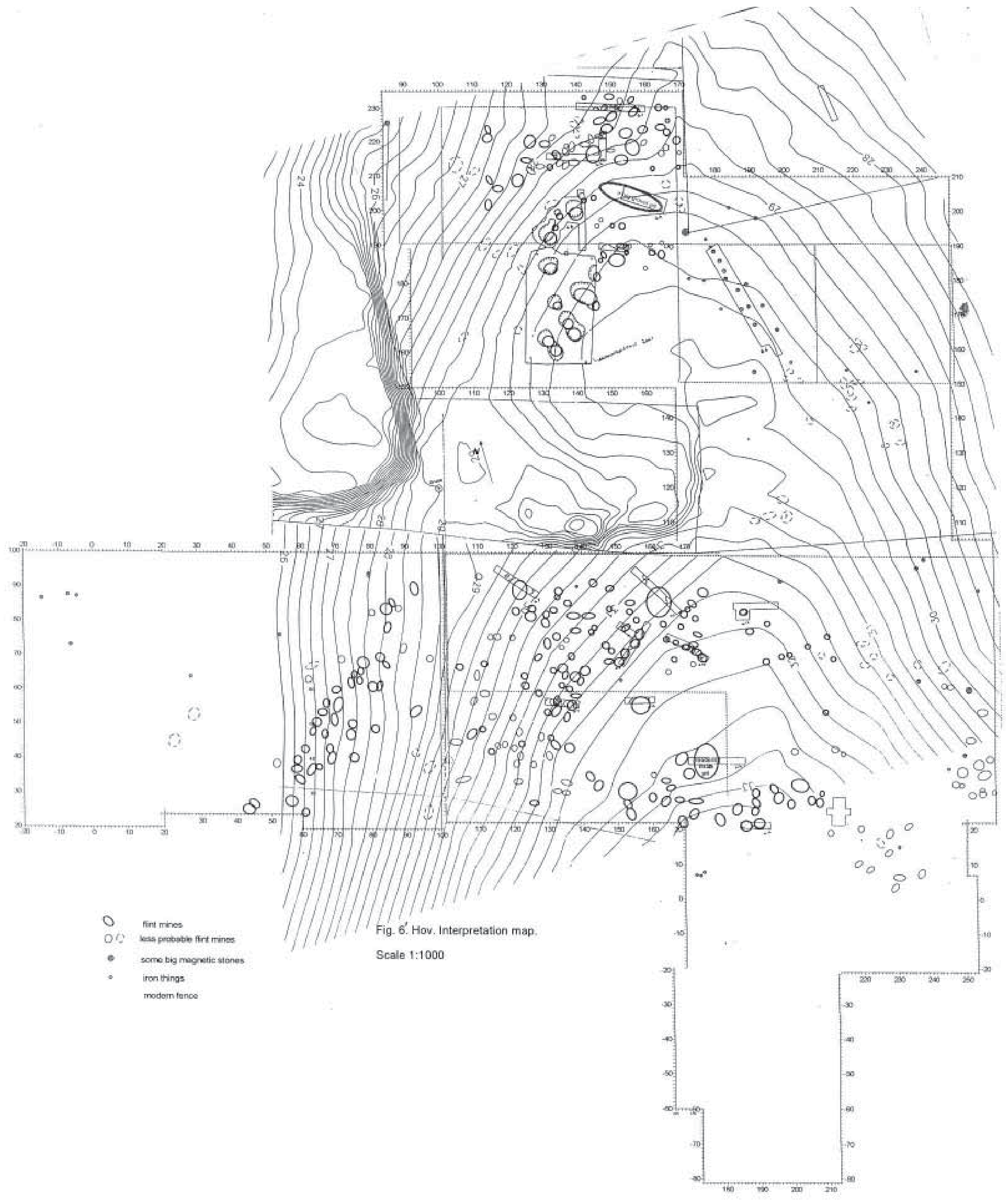


Fig. V. 119. Excavation plan of the flint mines from Hov, North Jutland. After Voss et al. 2003; Jens Henrik Bech pers. comm.

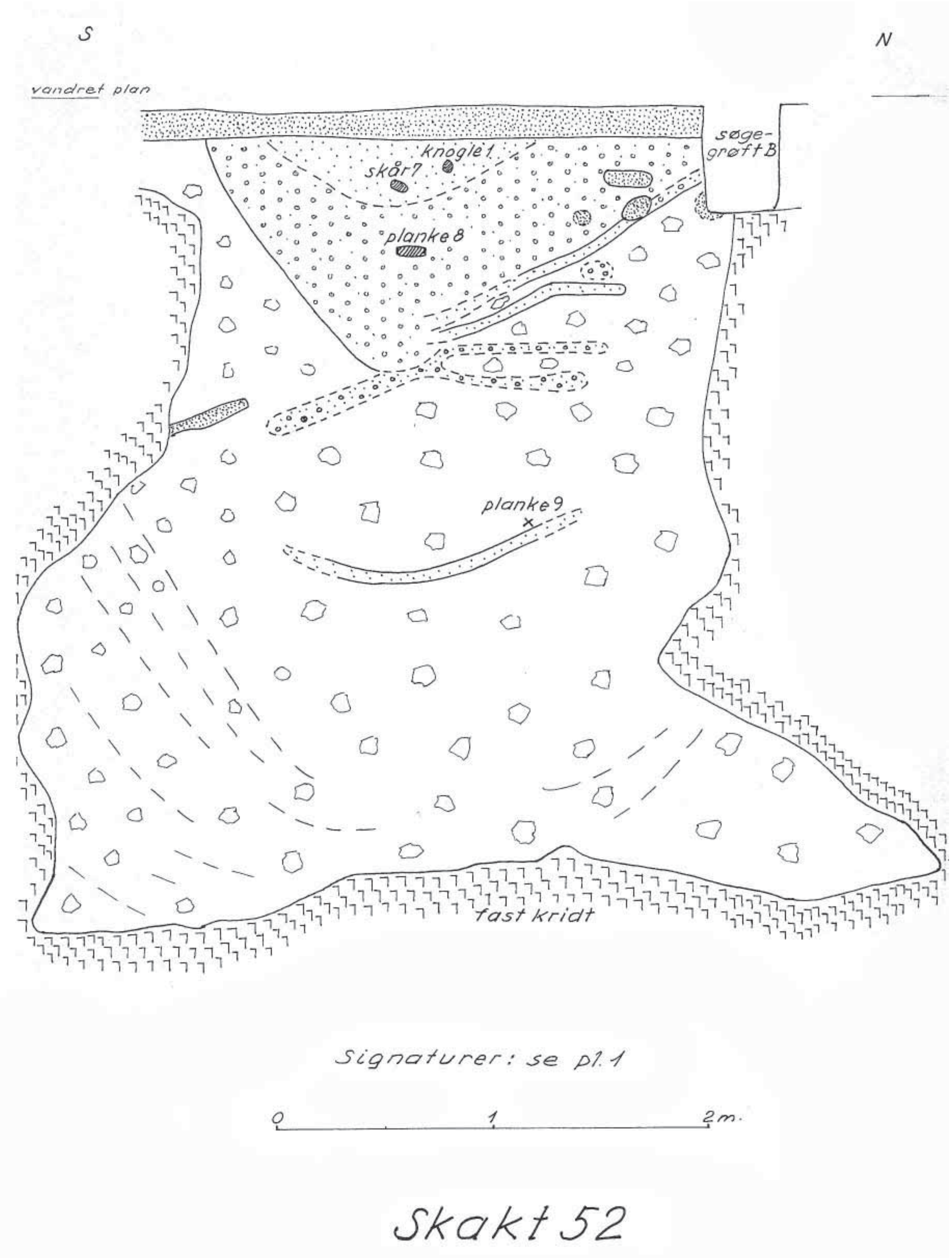


Fig. V. 120. Profile of the flint shaft at Hov 52 containing Volling ceramics. After Becker 1993.

Fig. V. 121. Volling ceramics from the flint shaft at Hov 52. After Becker 1957.

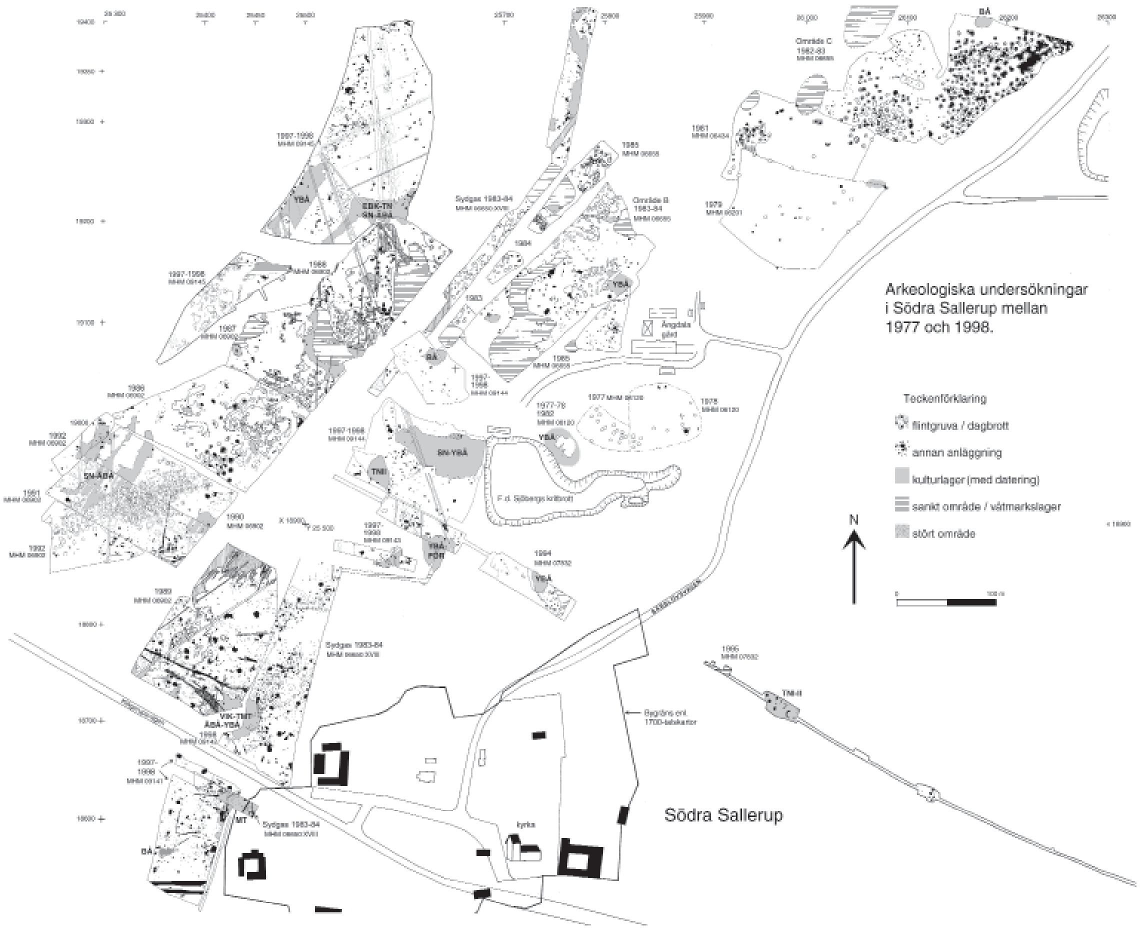


Fig. V. 122. Excavation plan of the flint mines from Sallerup, Scania. Legend. Black dots with lines around them: Flint mines. Black dots: Prehistoric features. Greyscale: Cultural layers. Horisontal stribes: Wetland area. Vertical stribes: Disturbed areas. After Rudebeck 1986.

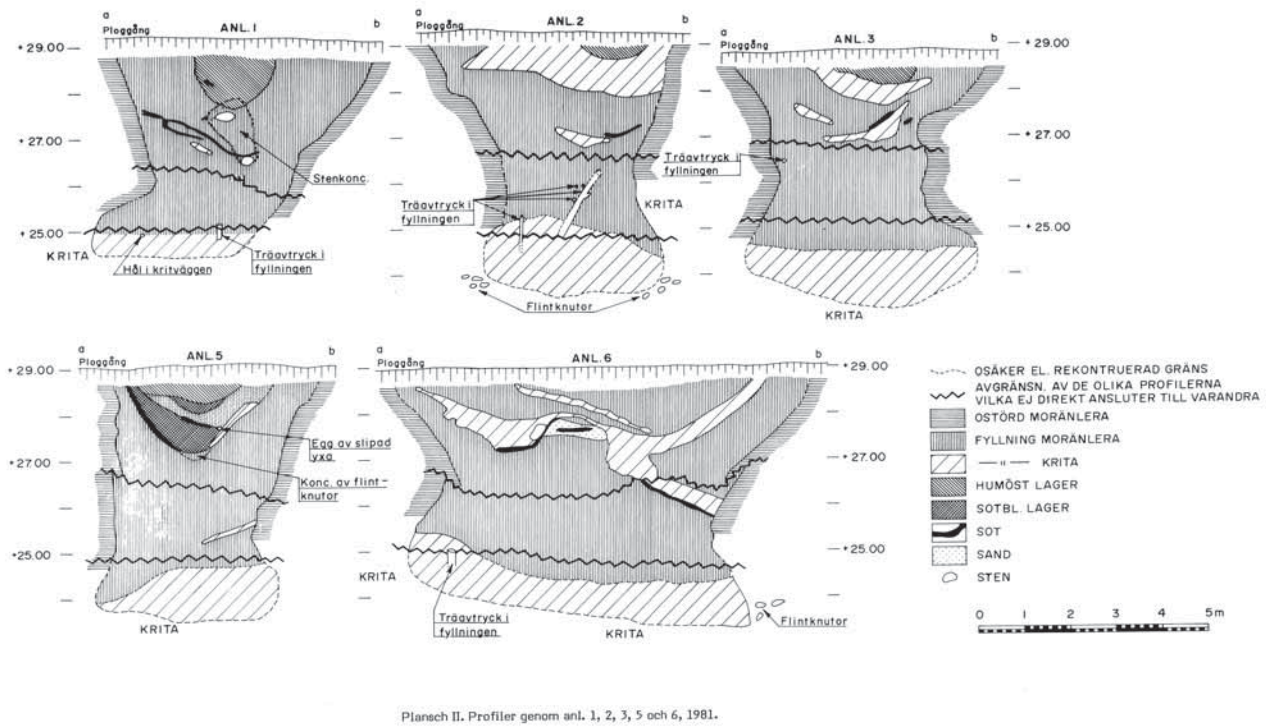


Fig. V. 123. Profile of the flint shafts 1, 2, 3, 5 and 6 at Sallerup. After Rudebeck 1986.

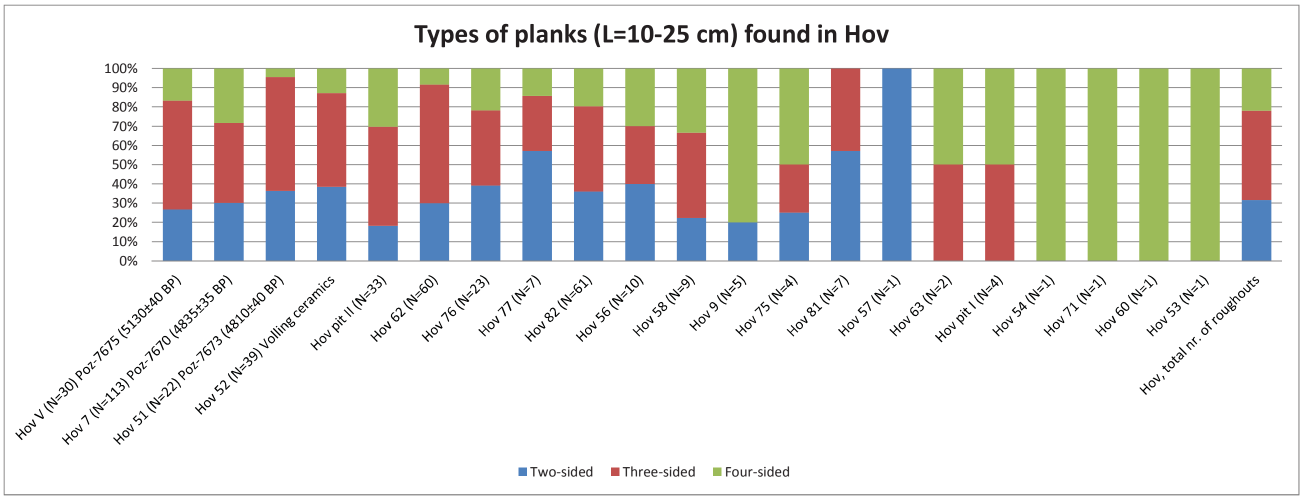


Fig. V. 124. Two-, three- and four-sided cross section of planks from the different mine shafts at Hov, North Jutland. Data after Table 26.

Fig. V. 125. Plank from Hov 51.

Fig. V. 126. Flakes from the production of planks from Hov 51.

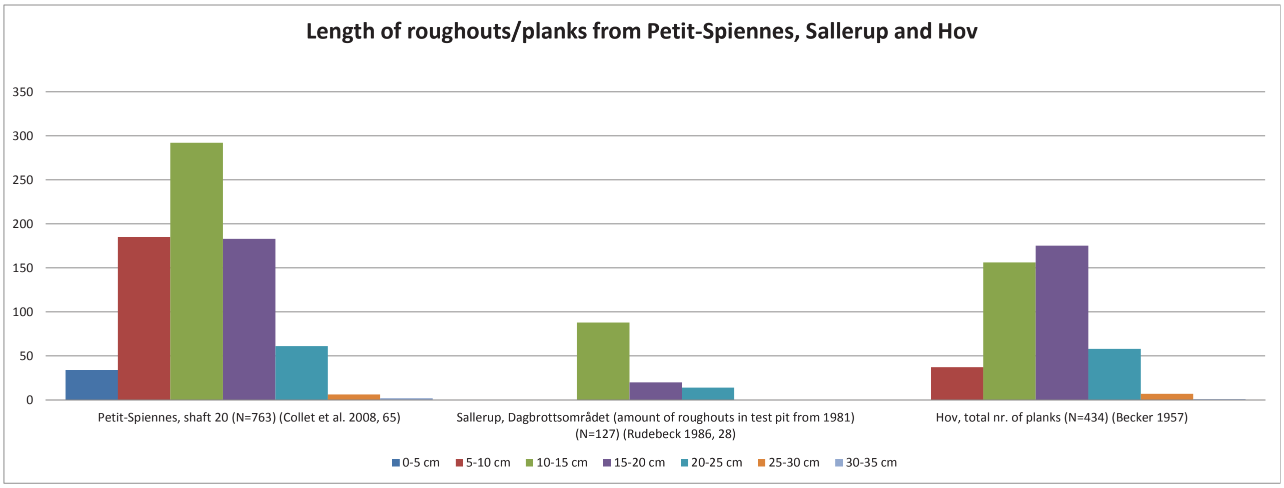


Fig. V. 127. Comparison of the length of planks found in mines from Petit-Spiennes, Sallerup (Dagbrottsområdet 1981) and Hov. After Rudebeck 1986; Collet et al. 2008; Becker 1957.

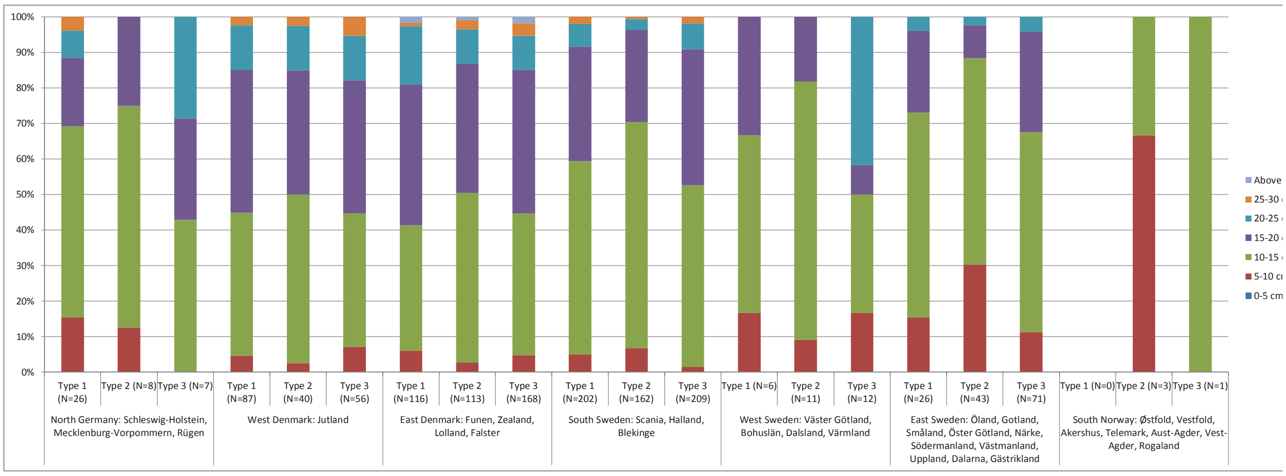


Fig. V. 128. Length of the different types of pointed-butted flint axes. Data after Table 36.

Fig. V. 129. Flakes found in the lower layers of shaft 7 at Hov, which do not show any signs of patina.

Fig. V. 130. Flakes found in the upper layers of shaft 7 at Hov, which contain a white patina.

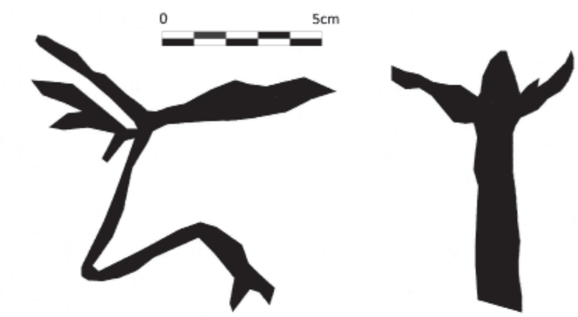


Fig. V. 131. Markings on the chalk walls of the mineshafts at Cissbury shaft 27 depicting a deer and a bull or a phalos. After Teather 2011.

Fig. V. 132. Markings on the chalk of the mineshafts at Hov shaft 7 depicting a deer or a phalos.

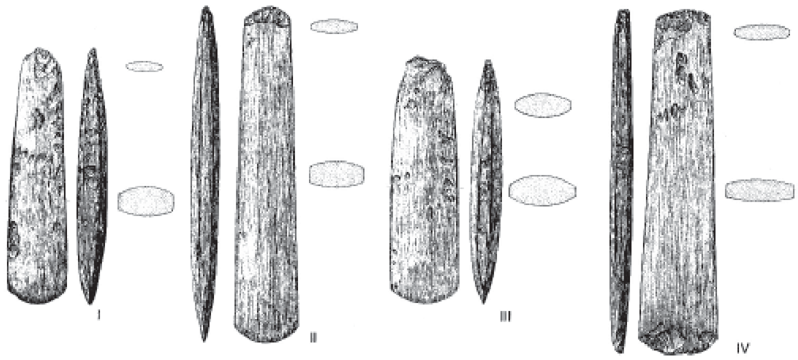


Fig. V. 133. Thin-butted flint axes of type I, II, III and IV. After Nielsen 1977.

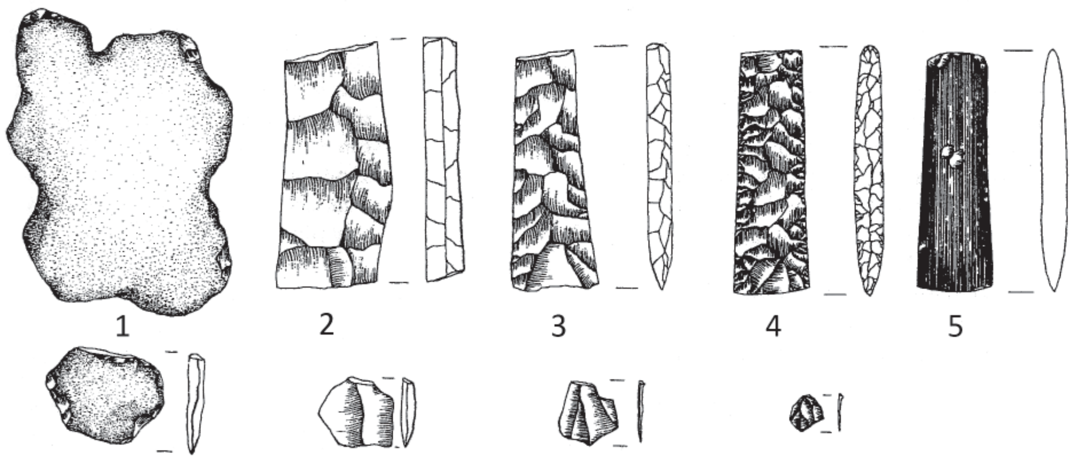


Fig. V. 134. Production stages and diagnostic flakes in making a thin-butted axe. After Knarrström 1997, 19.

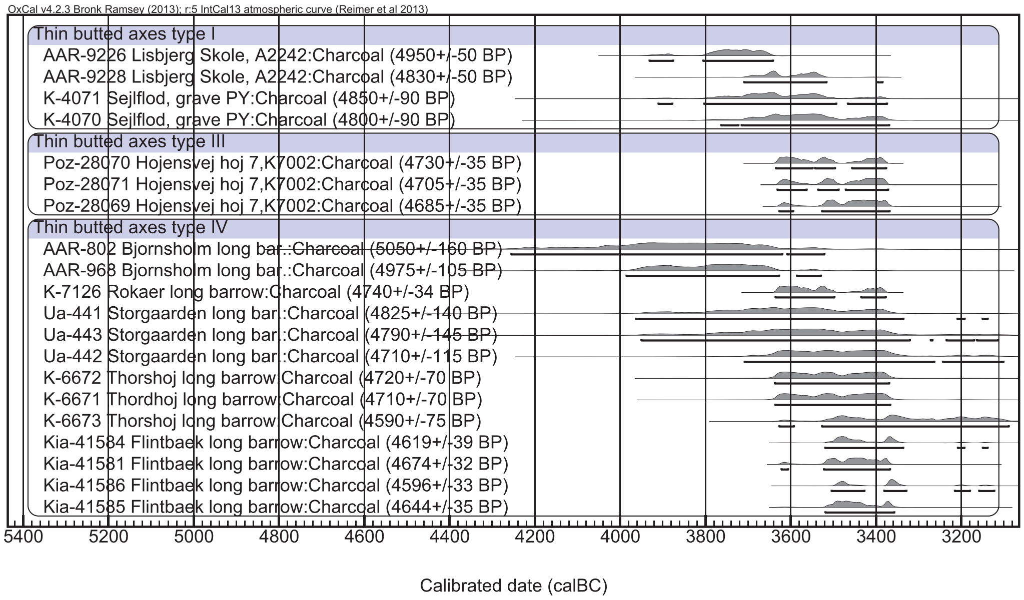


Fig. V. 135. [14]C dates of contexts containing thin-butted axes of type I, III and IV. Data after Table 23.

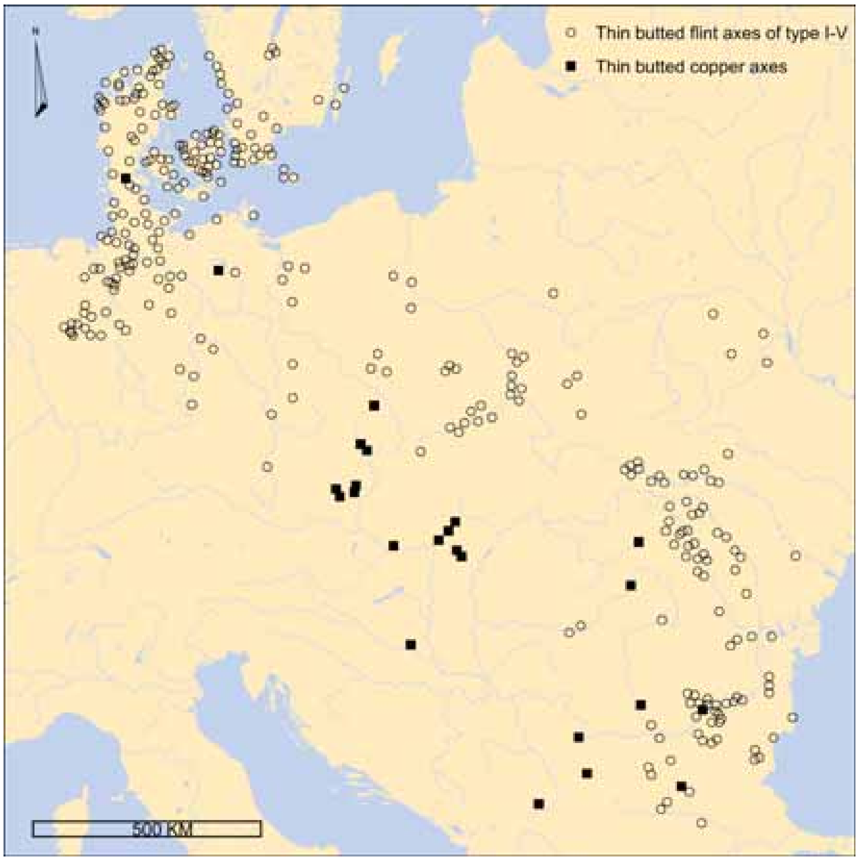


Fig. V. 136. Distribution of thin-butted flint and copper axes in South Scandinavia and Eastern Europe. Black dots: Thin-butted flint axes of type I-V. Rectangles: Thin-butted copper axes. After Klimscha 2007, 23.

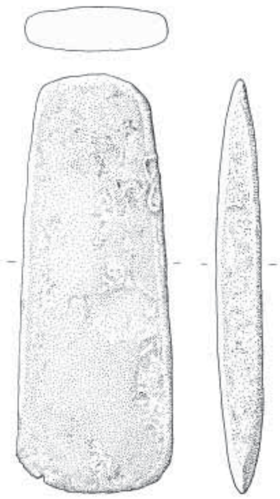


Fig. V. 137. Thin-butted and thin bladed copper axe from Hesbjerg Skov on Funen. After Klassen 2000.

Fig. V. 138. Hoard of two thin-butted and thin bladed flint axes from pit A764 at Ullerødgård dated to the late EN I. After Rosenberg 2006.

Fig. V. 139. Distribution of thin-butted and thin bladed flint and copper axes. After Klassen 2000; Rosenberg 2006; Søren H. Andersen pers. comm. Data from Table 61.

Fig. V. 140. Thin-butted stone axes with splayed edges imitating copper axes with splayed edges. The suite collection at the National Museum of Denmark.

Fig. V. 141. Distribution of thin-butted stone and copper axes with splayed edges. After Åberg 1937; Mayer 1977; Ebbesen 1981a; 1984 Todorova 1981; Andersen & Johansen 1992; Klassen 2000. Data after Table 61.

Fig. V. 142. The Bygholm hoard containing thin-butted and thin bladed copper axes and a funnel beaker from EN II. After Jensen 2001.

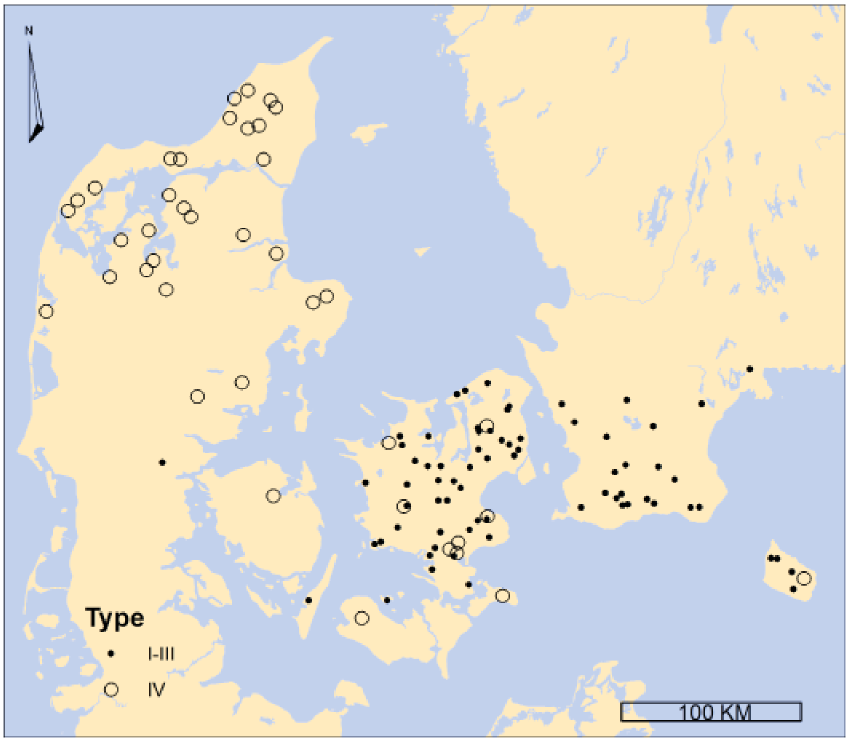


Fig. V. 143. Distribution of thin-butted axe hoards of type I-III and IV in southern Scandinavia. After Nielsen 1977.

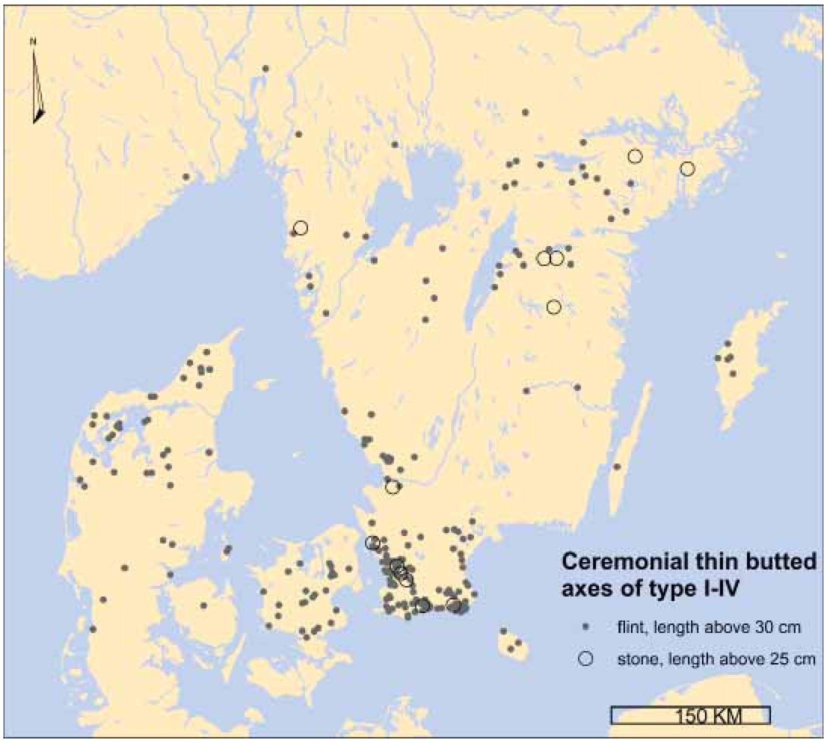


Fig. V. 144. Distribution of ceremonial thin-butted flint axes of type I, II, III and IV having a length above 30 cm shown together with thin-butted stone axes having a length above 25 cm in South Scandinavia. After Lang 1985; Nielsen 1977; Hansen 2009; Sparrevohn 2009; Glørstad 2012. Data after Table 60.

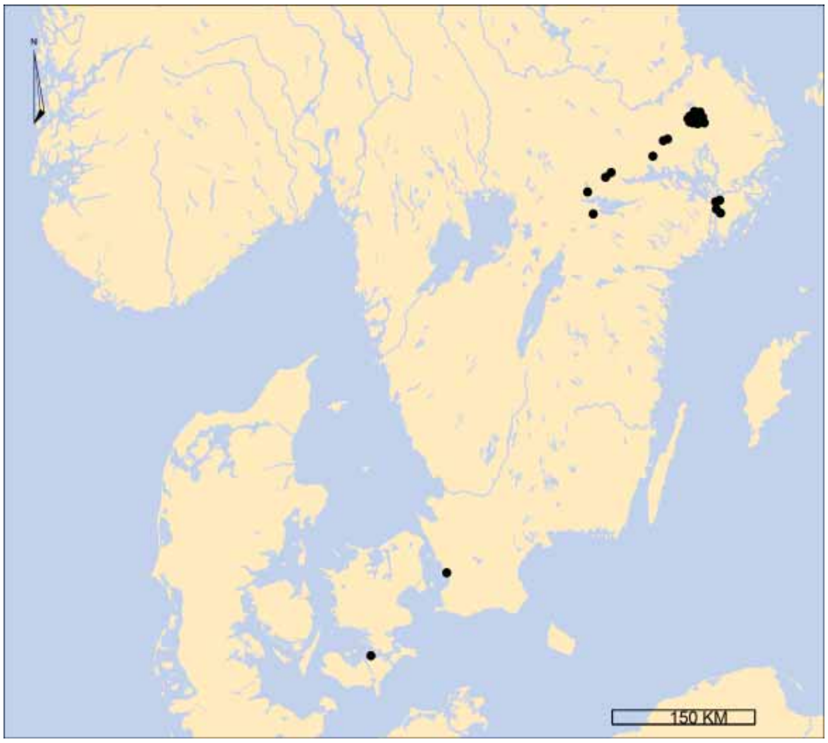


Fig. V. 145. Distribution of slate artifacts from the Early Neolithic in southern Scandinavia. The Danish slate knife was found in a kitchen midden at the site Vaalse Vig on Falster. After Bahnson 1892, 166ff; Müller 1896, 313; Taffinder 1998; Hallgren 2008.

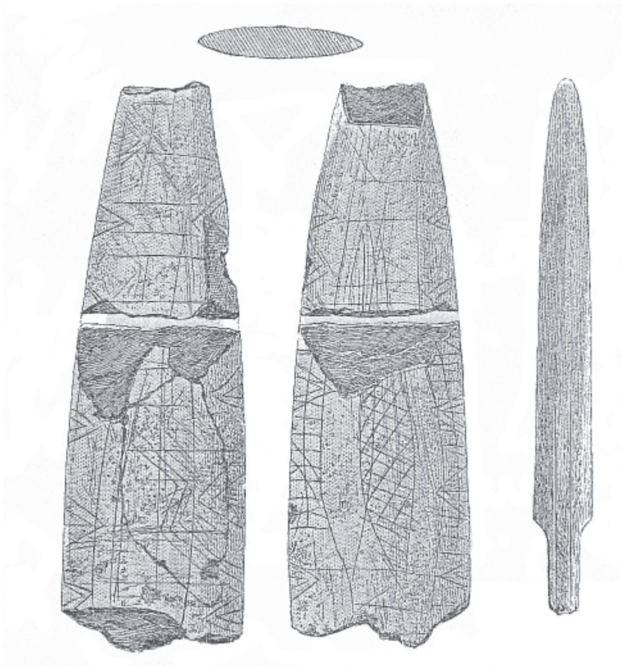


Fig. V. 146. The Danish slate knife from the kitchen midden at Vaalse Vig on Falster. After Bahnson 1892, 166ff; Müller 1896, 313

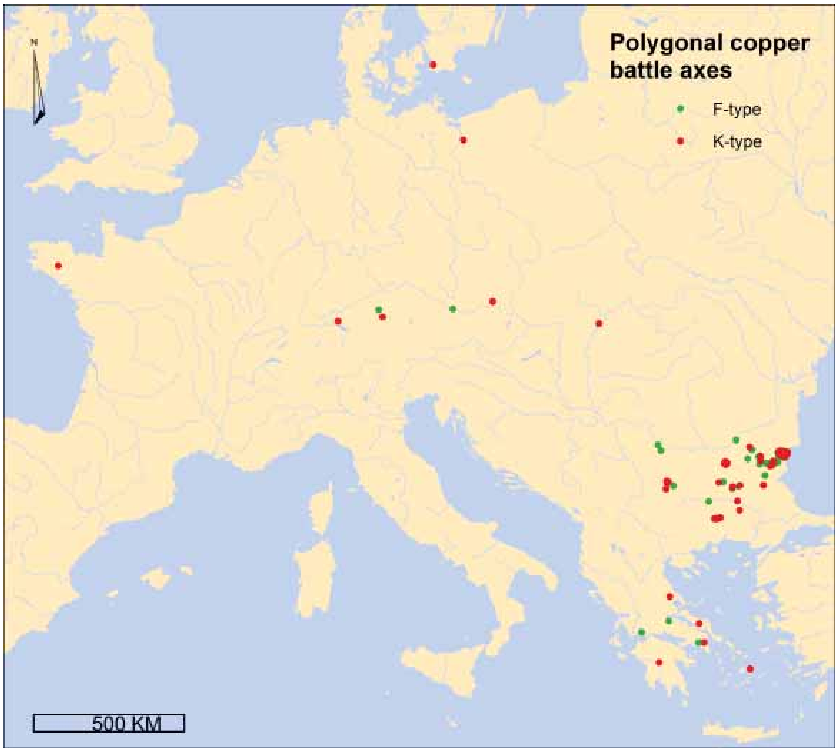


Fig. V. 147. Distribution of polygonal battle axes of copper in Eastern Europe. After Todorova 1981; Zápotocký 1992; Klassen 2000; Zachos 2007; Turck 2010. Data after Table 62.

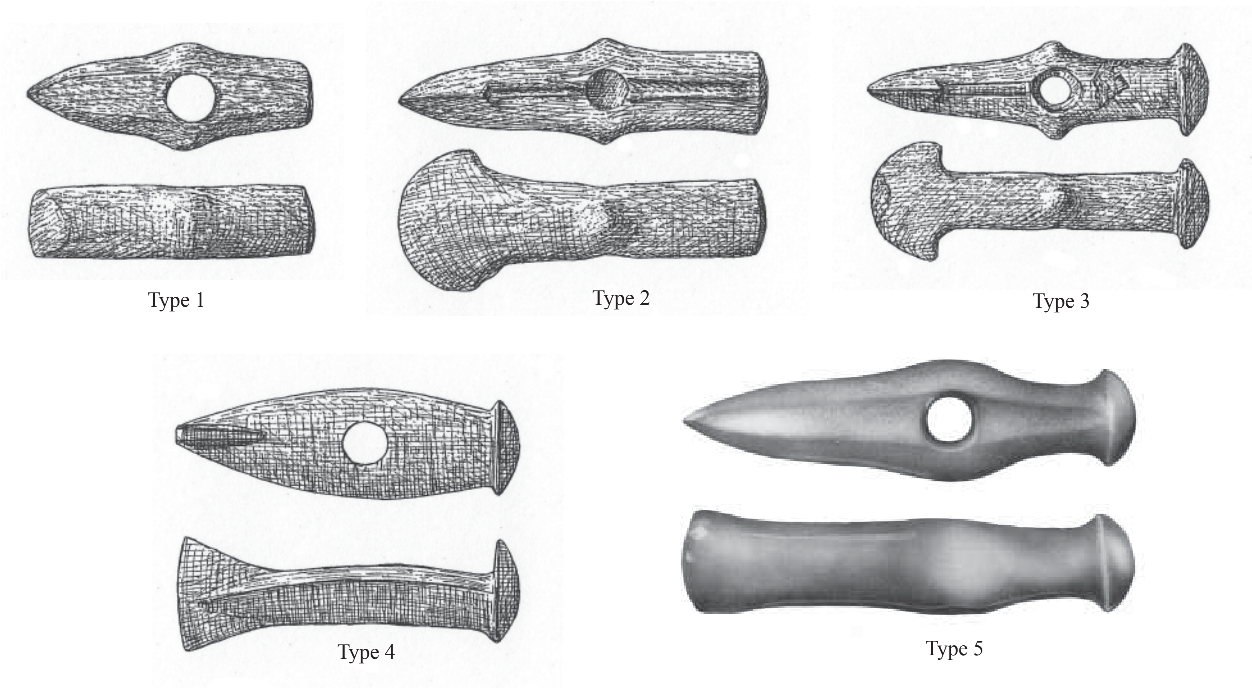


Fig. V. 148. Polygonal battle axes of type F-III (Type 1), type F-IV (Type 2), type K-IV (Type 3), type K-I-II (Type 4), type K-III/V (Type 5). Typology F and K after Zápotocký 1992. Typology 1-5 after Ebbesen 1998.

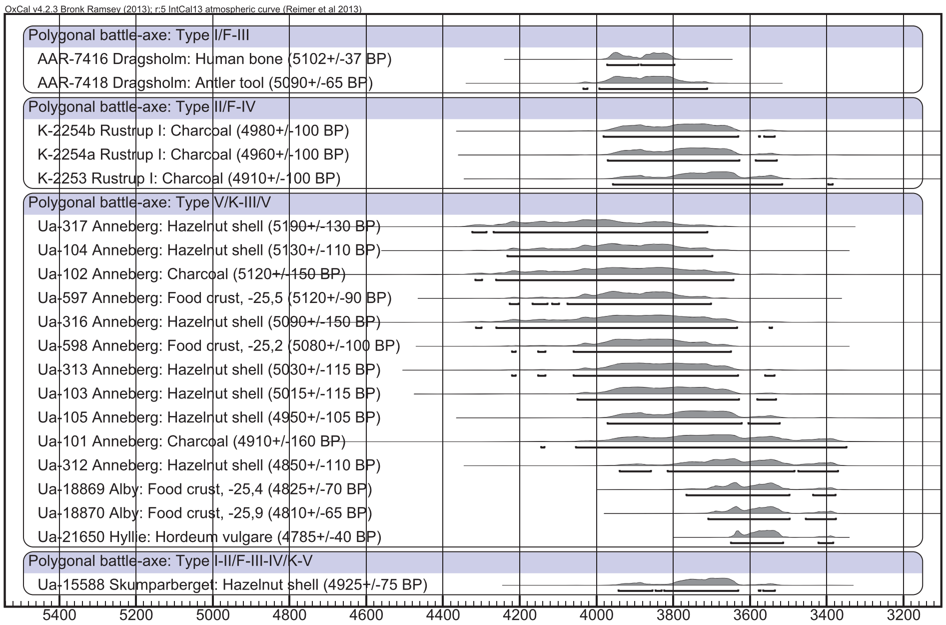


Fig. V. 149. Polygonal battle axes found in ^{14}C dated contexts. Data after Table 27.

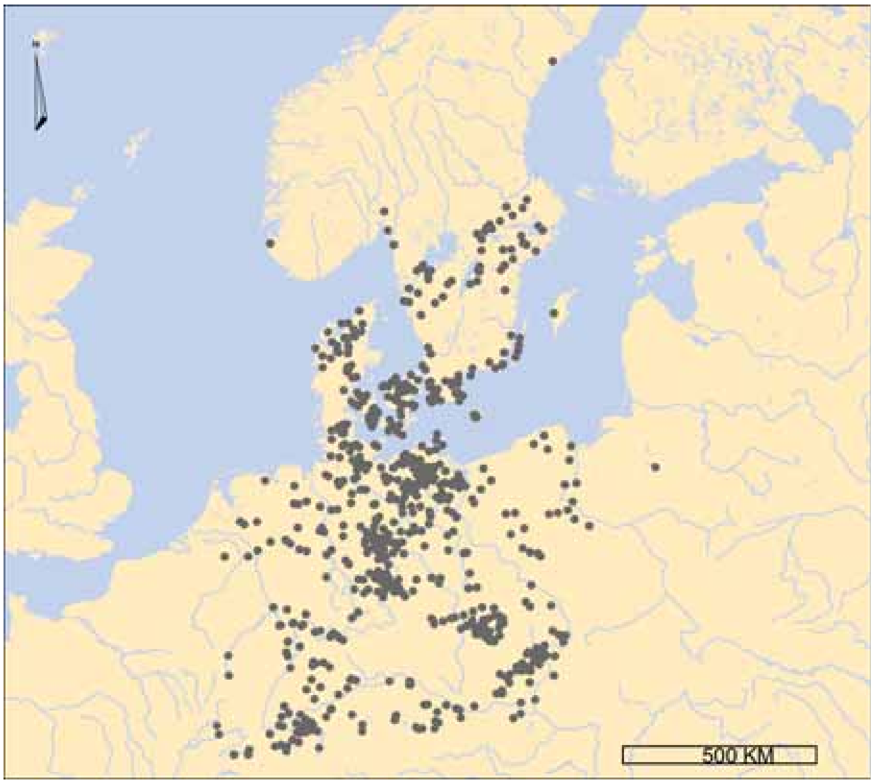


Fig. V. 150. Distribution of polygonal battle axes of type F-I, II, III & IV (Type 1 & 2) in Northern Europe. After Mathiassen 1940; Brinch Petersen 1974; Fischer 1976; Skaarup 1985; Zápotocký 1992; Ebbesen 1998; Hallgren 2008. Data after Table 63.

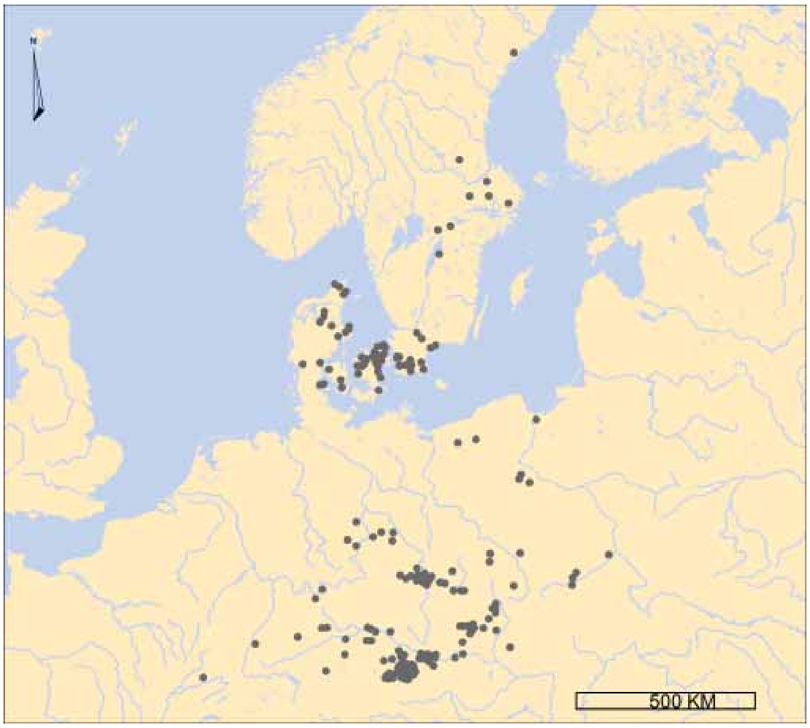


Fig. V. 151. Distribution of polygonal battle axes of type K-I-II (Type 4) in Northern Europe. After Skaarup 1985; Zápotocký 1992; Ebbesen 1998; Woll 2003; Hallgren 2008. Data after Table 63.

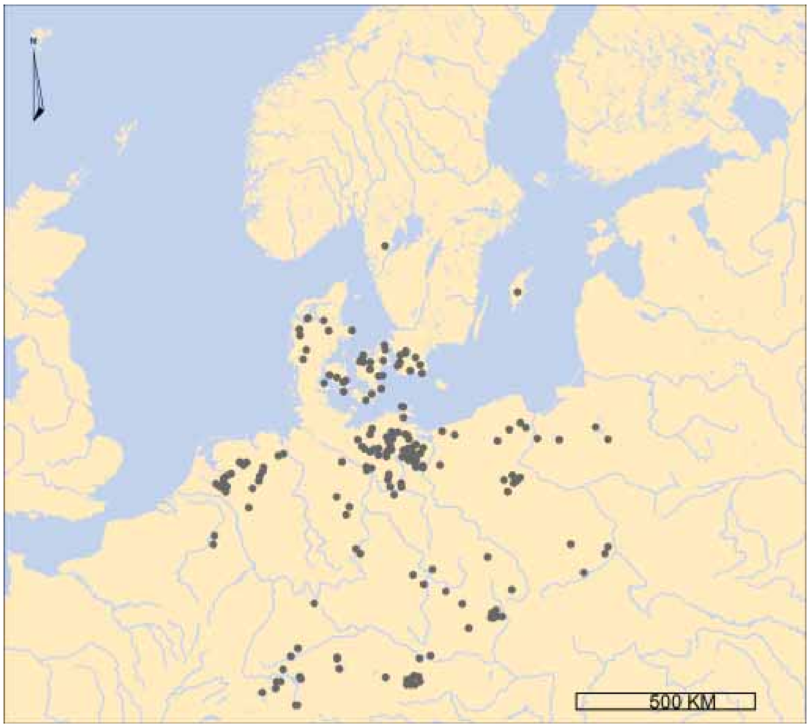


Fig. V. 152. Distribution of polygonal battle axes of type K-IV (Type 3) in Northern Europe. After Skaarup 1985; Zápotocký 1992; Ebbesen 1998; Hallgren 2008. Data after Table 63.

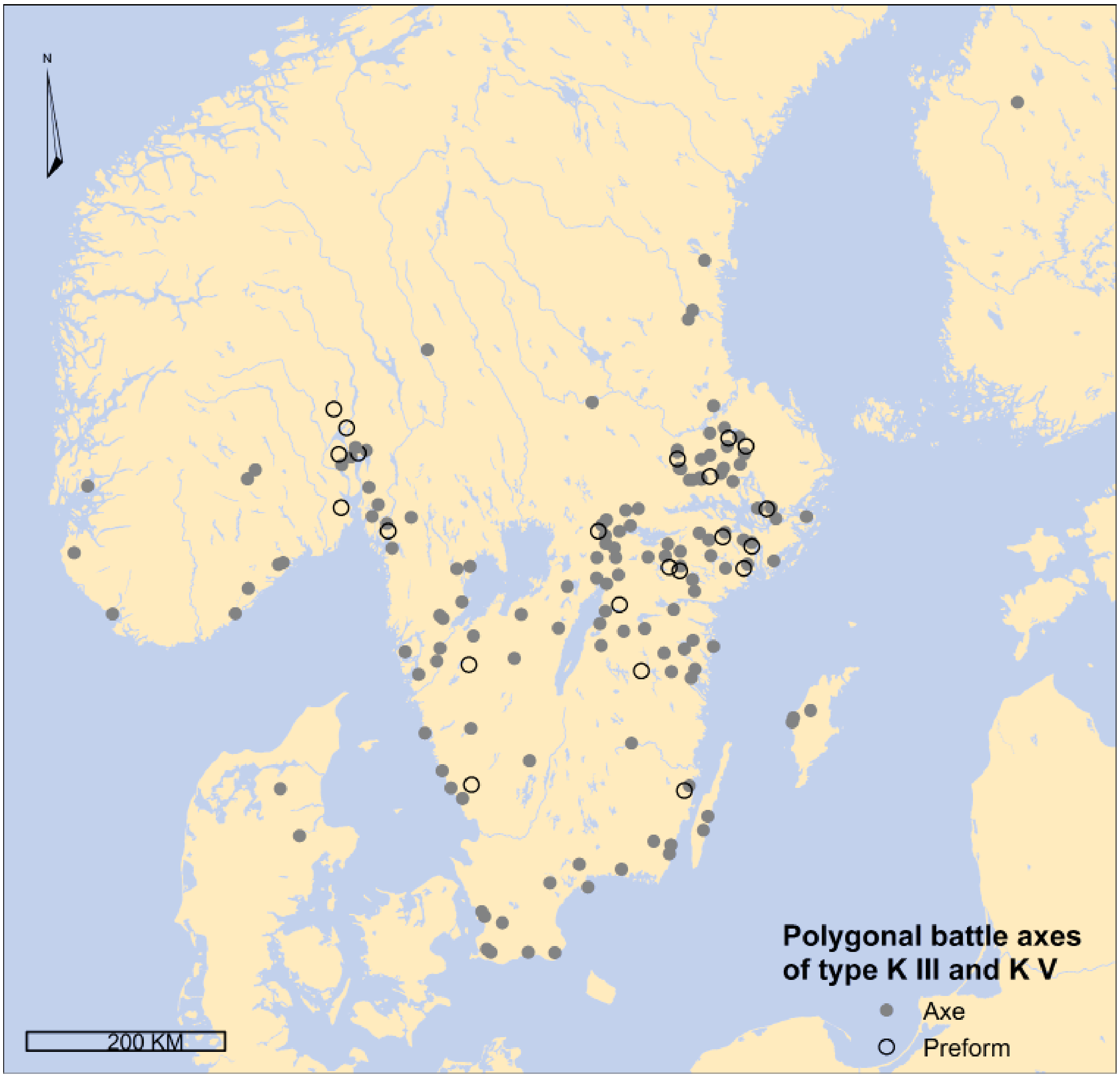


Fig. V. 153. Distribution of polygonal battle axes of type K-III/V (Type 5) in South Scandinavia. After Gjessing 1920; S. Florin 1958; Mikkelsen 1982; Zápotocký 1992; Ebbesen 1998; Hallgren 2008. Data after Table 63.

(Kaul 1988; Eriksen 1992; Henriksen 1996; Nielsen 1998; 1999, 150; Michaelsen 2002; Skousen 2004; 2008; Staal 2005; Rosenberg 2006; Christensen 2008, 57; Hallgren 2008, 95ff) (Table 28). However, it is important to acknowledge that the radiocarbon-dated material from the fills of the postholes may originate from Earlier Neolithic settlements, which means that the actual house structure could be of a later date. It is therefore necessary to make several radiocarbon dates from the same and different postholes, especially when the house is within an area containing several other earlier, contemporary or later structures (Artursson et al. 2003; Rosenberg & Sørensen 2004) (Fig. V.156). It is also problematic when ^{14}C dates from pits located nearby are used to date a house, as was the case at Mossby, because it is uncertain whether these are contemporary, unless both features contain the same material culture (Larsson 1992). Nevertheless, some of the two-aisled houses from the Early Neolithic have been found stratigraphically below long barrows at Bygholm Nørremark and Alstedgaard, and a long dolmen at Damsbo, thus indicating that these houses were built from the early or late EN I phases (Rønne 1979; Lindblom 2004; N. H. Andersen 2009). But whether the two-aisled houses located below these burial structures were actually used as houses is rather questionable, because the stone burials of the long barrows were placed within these houses (Fig. V.158). Perhaps the houses should be reinterpreted as houses of the dead, which contained the deceased individuals whilst the long barrow and its stone chambers were constructed (Hodder 1990, 169ff). The two-aisled houses that emerged therefore served both a domestic and symbolic purpose in the early agrarian societies of South Scandinavia.

The origin of the two-aisled houses is difficult to determine, but some similar houses from the Early Funnel Beaker culture have been found in Lower Saxony and in the Netherlands at Wittenwater, Engter and Wateringen 4 (Schirnig 1979, 245; Rost & Wilberg-Rost 1992, 347; Raemaekers et al. 1997, 144ff) (Fig. V.157). Other two-aisled houses have also been reported from England and Scotland, where they also appear to be contemporary with the introduction of agriculture during the early 4th millennium BC (Barclay 1996, 73; Darvill 1996, 86; Sheridan 2010) (Figs. V.161-162). The small size of the two-aisled houses in both the British Isles and South Scandinavia may have been connected to the expansions of pioneering farmers and their more mobile settlement pattern, as such small house structures are rare in the Central European agrarian societies during the 5th millennium BC. However, a small house structure from the late 5th millennium was found La Pente de Croupeton, near Jablines. This structure had rounded gables and sup-

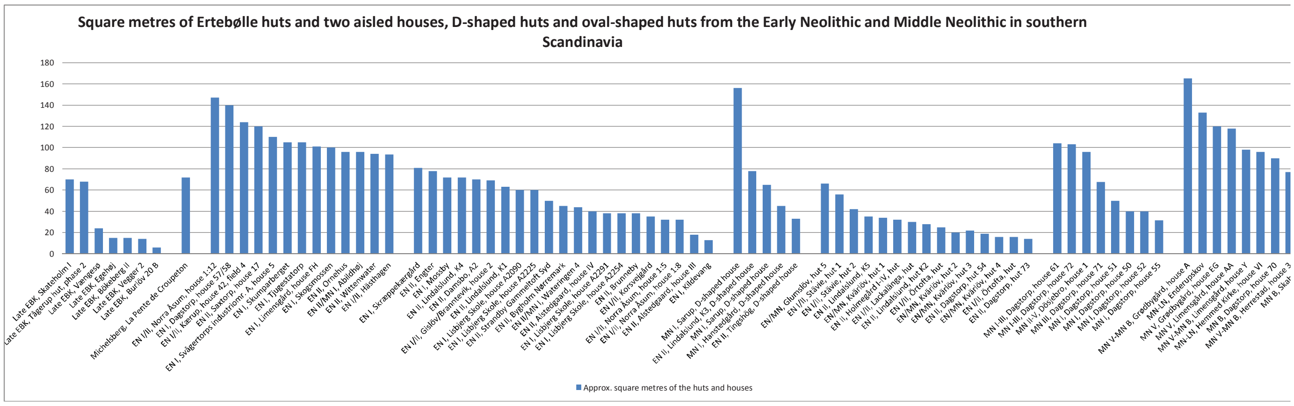


Fig. V. 154. Sizes in square metres of Late Ertebølle huts and two-aisled houses, D-shaped and oval-shaped huts from the Early Neolithic to Middle Neolithic in southern Scandinavia. Late Ertebølle huts. After Simonsen 1952; Andersen 1975; Larsson 1985; Karsten 2001; Mandrup et al. 2002; Karsten & Knarrström 2003; Friman 2005. Early Neolithic two-aisled houses. After Rønne 1979; Schirnig 1979; Kaul 1988; Fonnesbech-Sandberg 1989; Eriksen 1992; Larsson 1992; Larsson & Hedvall 1992; Rost & Wilberg-Rost 1992; Henriksen 1996; Söderberg et al. 1997; Raemaekers et al. 1997; Nielsen 1998; 1999; Edring 1999; Michaelsen 2002; Artursson et al. 2003; Lindblom 2004; Rosenberg & Sørensen 2004; Christensen 2008; Hallgren 2008; Skousen 2008; N. H. Andersen 2009; Hadevik 2009; Ravn 2012; Lotte Sparrevohn pers. comm. Early Neolithic D-shaped houses. After Eriksen & Madsen 1984; Mahler et al. 1991; Tesch 1992; Andersen 1999; Michaelsen 2002. Oval-shaped huts. After Andersson & Pihl 1997; Andersson 1999; 2004; Michaelsen 2002; Artursson et al. 2003. Middle Neolithic two-aisled houses. After Nielsen & Nielsen 1985; 1991; Boas 1993; Jeppsson 1996; Andersson 1999; Jørgensen 2000; Artursson et al. 2003. Data after Table 64.

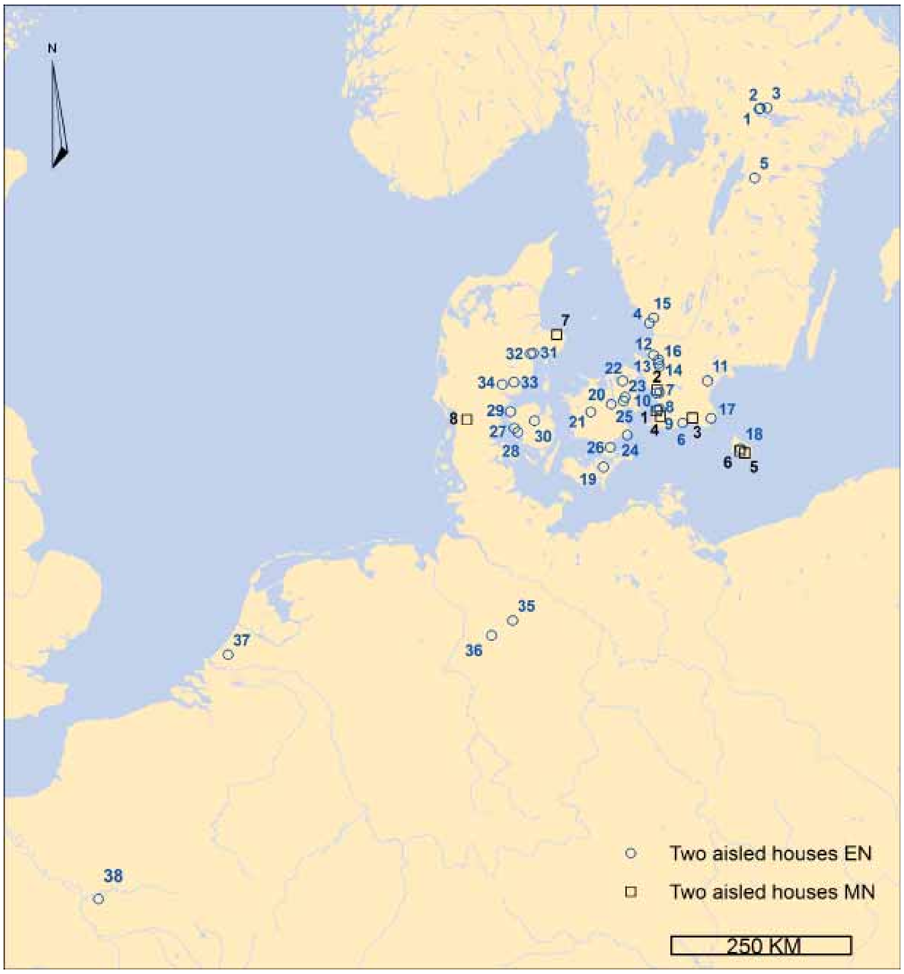


Fig. 155. Distribution of two-aisled Early Neolithic and Middle Neolithic houses in southern Scandinavia, North Germany and the Netherlands. Early Neolithic: 1. Skumparberget, 2. Tjugestatorp, 3. Skogsmossen, 4. Hästhagen, 5. Brunneby, 6. Mossby, 7. Dagstorp, house 57/58, 8. Lunnebjär, house 7, 9. Svågertorps industriomr. A, house 5, 10. Saxtorp, house 17, 11. Norra Åsum, house 1:4, 5, 6, 7, 8, 9, 10 & 12, 12. Munka Ljungby, 13. Mölletofta-Ljungaskog, 14. Snöstorp, 15. Marbäcksgård, house 1, 16. Ålstorp, house 3, 17. Gislöv/Branntevik, house 2, 18. Limensgård, house FJ & FH, 19. Erantisvej, 20. Skræppekærgård, 21. Kærup, house 42, field 4, 22. Ullerødgård, house 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 18, 19, 20 & 21, 23. Korsvejgård, 24. Ornehus, 25. Damgård II, 26. Abildhøj, 27. Strandby Gammeltoft Syd, 28. Damsbo, A2 & A121, 29. Lindalslund, K1, K3, K4 & K6, 30. Trællebjergvej, K1 & K2, 31. Lisbjerg Skole, 32. Kildevang, 33. Bygholm Nørremark, 34. Alstedgaard, house III & IV, 35. Wittenwater, 36. Engter, 37. Wateringen 4 and 38. Jablines. Middle Neolithic: 1. Dagstorp, house 50, 51, 52 & 55, 2. Dösjebro, house 1, 61, 70, 71 & 72, 3. Herrestad, house 3, 4. Skabersjö, 5. Grødbygård, house A & EG, 6. Limensgård, house AA & Y, 7. Hemmed Kirke, house VI and 8. Enderupskov. Data after Tables 28, 64 and 65.

porting wall posts, and was 12 metres long and 6 metres wide, thus showing some similarities with the two-aisled houses in South Scandinavia (Bickle 2008) (Fig. V.157). But there is a general lack of small-scale houses used for habitation in the Central European Michelsberg culture, which may be due to the low archaeological visibility of these lightly-built structures, which have left scant or very vague archaeological traces. The house structures would also have been very susceptible to erosion, making them almost impossible to find in regions characterized by sandy loess subsoils (Vanmonfort et al. 2008). However, the lack of small dwelling structures could suggest a more mobile settlement system in Central Europe (Vanmonfort et al. 2004, 111ff).

Most houses found in Central Europe are from the

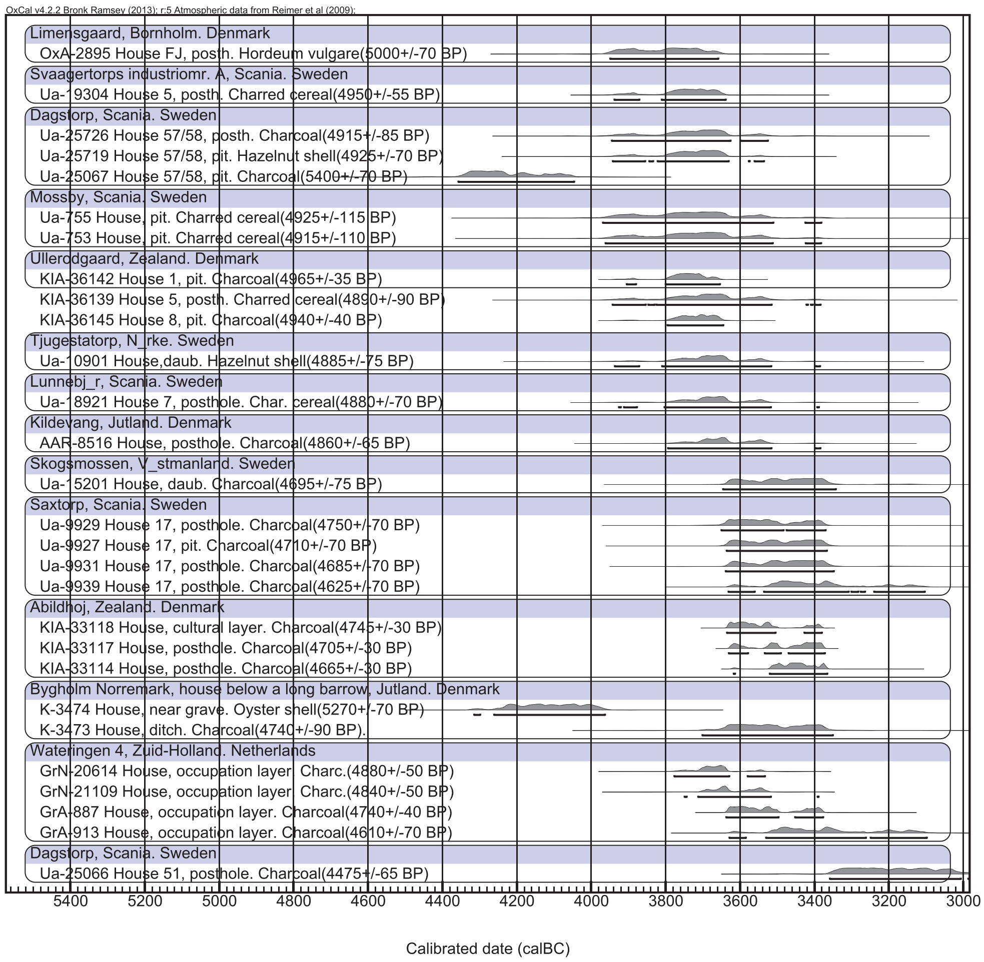


Fig. V. 156. ^{14}C dates of organic materials found in postholes from Early Neolithic two-aisled houses in southern Scandinavia at Limensgård (house FJ), Svågertorps industriomr. A (house 5), Dagstorp (house 57/58), Mossby, Ullerødgård (house 1, 5 & 8), Tjugestatorp, Lunnebjär (house 7), Kildevang, Skogsmossen, Saxtorp (house 17), Abildhøj, Bygholm Nørremark, Wateringen 4, Dagstorp (house 51). After Rønne 1979; Larsson 1992; Raemaekers et al. 1997; Nielsen 1999; Artursson et al. 2003; Rosenberg & Sørensen 2004; Rosenberg 2006; Hallgren 2008; Hadevik 2009; Ravn 2012. Data after Table 65.

first half of the 5th millennium BC. During this period agrarian societies, such as the Rössen, Lengyel and Michelsberg cultures, continued to build very large houses covering an area of several hundred square metres, which were based on a tradition going back to the Linearbandkeramik culture (Bickle 2008). During the Linearbandkeramik culture the houses were rectangular in shape, but in the Rössen and Lengyel cultures these were superseded by houses of a more trapezoid shape. The advantages of such large hall buildings included an increase in storage capacity, as well as protecting and securing agrarian products and livestock. During the later 5th millennium these large houses seem to disappear from Central Europe and instead smaller sites, with a few pits or shallow cultural layers, emerge. However, house structures from the late 5th millennium have not been found in connection with these smaller sites. But further south at the site of Lantremange in Belgium and at Mairy and Bazoche in northern France a number of larger rectangular hall buildings connected to the Michelsberg culture have been ^{14}C and TL dated to the transition between the 5th and 4th millennium BC (Marolle 1989; 1998; Marchal et al. 2004; Bickle 2008). The many hall buildings at Mairy were of an im-

Fig. V. 157. Well preserved two-aisled houses from the Early Neolithic in Northern Europe. After Rønne 1979; Schirnig 1979; Kaul 1988; Eriksen 1992; Larsson 1992; Larsson & Hedvall 1992; Rost & Wilberg-Rost 1992; Westergaard 1995; Henriksen 1996; Raemaekers et al. 1997; Söderberg et al. 1997; Nielsen 1999; Michaelsen 2002; Artursson et al. 2003; Rosenberg & Sørensen 2004; Lindblom 2004; Bickle 2008; Christensen 2008; Hallgren 2008; Skousen 2008; N. H. Andersen 2009; Hadevik 2009; Ravn 2012. Data after Tables 28, 64 and 65.

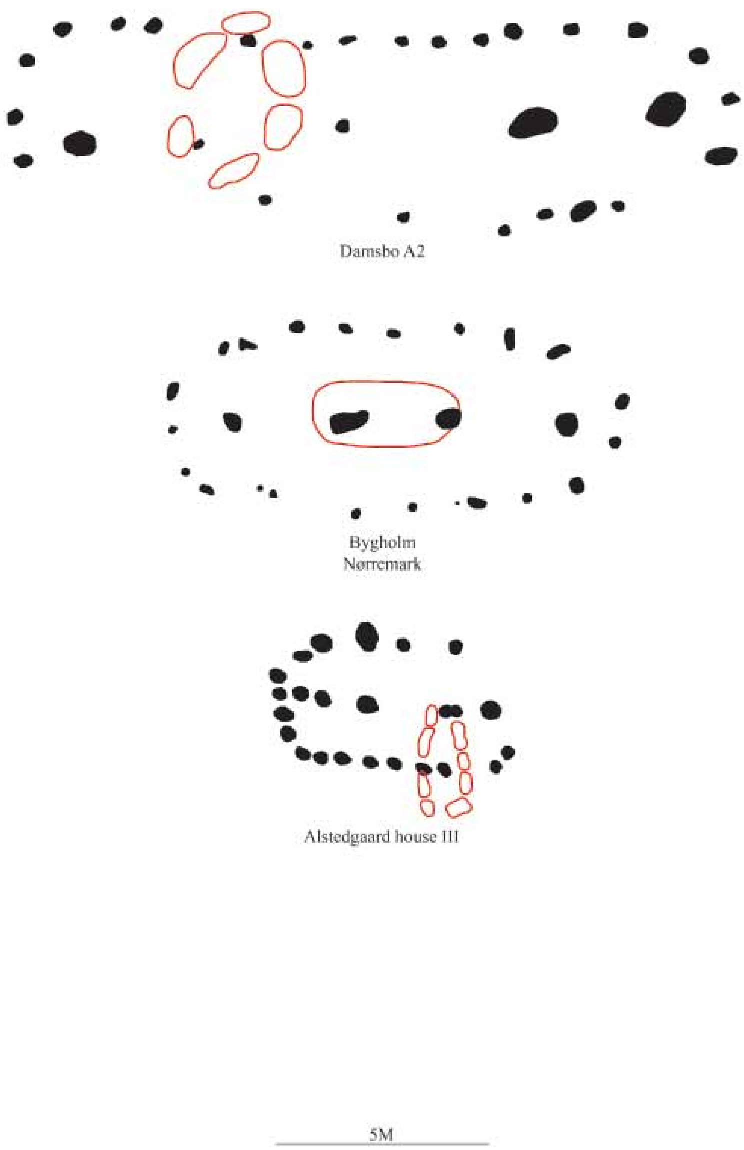


Fig. V. 158. Two-aisled (mortuary) houses from the Early Neolithic located below the long barrows at Bygholm Nørremark and Alstedgaard and a long dolmen at Damsbo. Notice that the stone burials were placed within the houses. After Rønne 1979; Lindblom 2004; N. H. Andersen 2009.

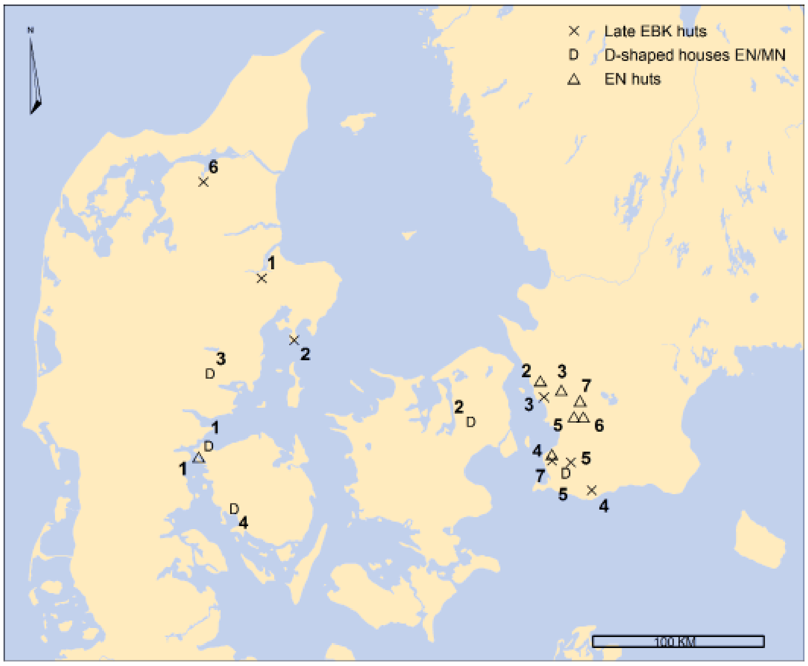


Fig. V. 159. Distribution of Late Ertebølle huts and D-shaped houses and huts from the Early Neolithic in southern Scandinavia. Late Ertebølle huts: 1. Egehøj, 2. Vængesø, 3. Tågerup hut, phase 2, 4. Skateholm I, 5. Bökeberg II, 6. Vegger 2, 7. Burlöv 20 B. Early Neolithic/Middle Neolithic D-shaped houses: 1. Lindalslund, K3, 2. Holmegård I-IV, 3. Hanstedgård, 4. Sarup, western and eastern, 5. Tingshög. Early Neolithic oval huts: 1. Lindalslund, K2 & K5, 2. Glumslöv, hut 5, 3. Kvärlöv, hut 1, 2, 3 & 4, 4. Dagstorp, hut 54 & 73, 5. Stävie, hut 1 & 2, 6. Lackalänga, 7. Örtofta. Data after Table 28.

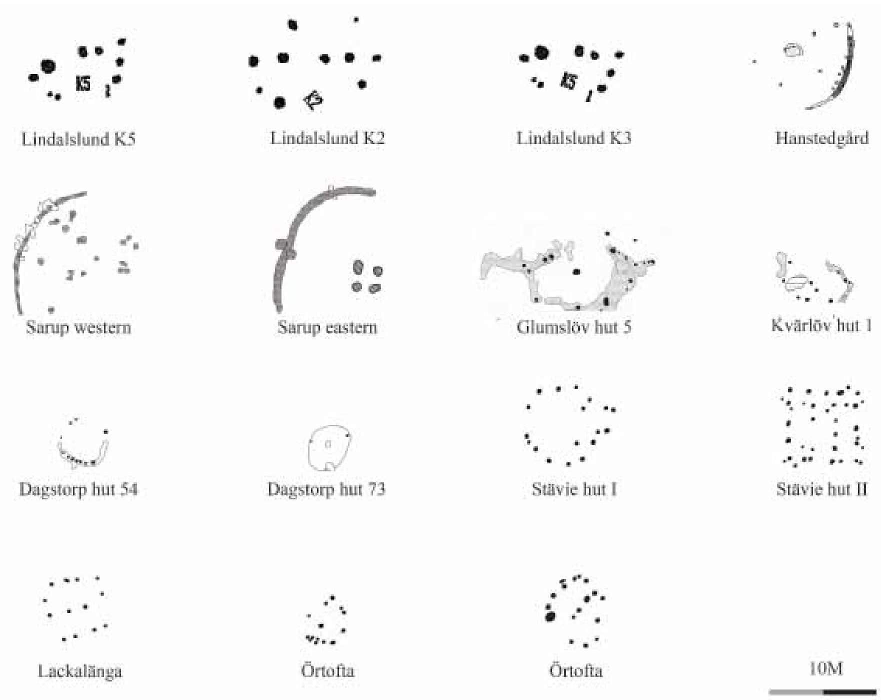


Fig. V. 160. Well preserved Early Neolithic huts of oval or D-shaped construction in southern Scandinavia: 1. Lindalslund K5, 2. Lindalslund K2, 3. Lindalslund K3, 4. Hanstedgård, 5. Sarup western, 6. Sarup eastern, 7. Glumslöv hut 5, 8. Kvärlöv hut 1, 9. Dagstorp hut 54, 10. Dagstorp hut 73, 11. Stävie hut I, 12. Stävie hut II, 13. Lackalänga, 14. Örtofta and 15. Örtofta. After Eriksen & Madsen 1984; Andersson & Pihl 1997; Andersen 1999; Michaelsen 2002; Artursson et al. 2003; Andersson 2004.

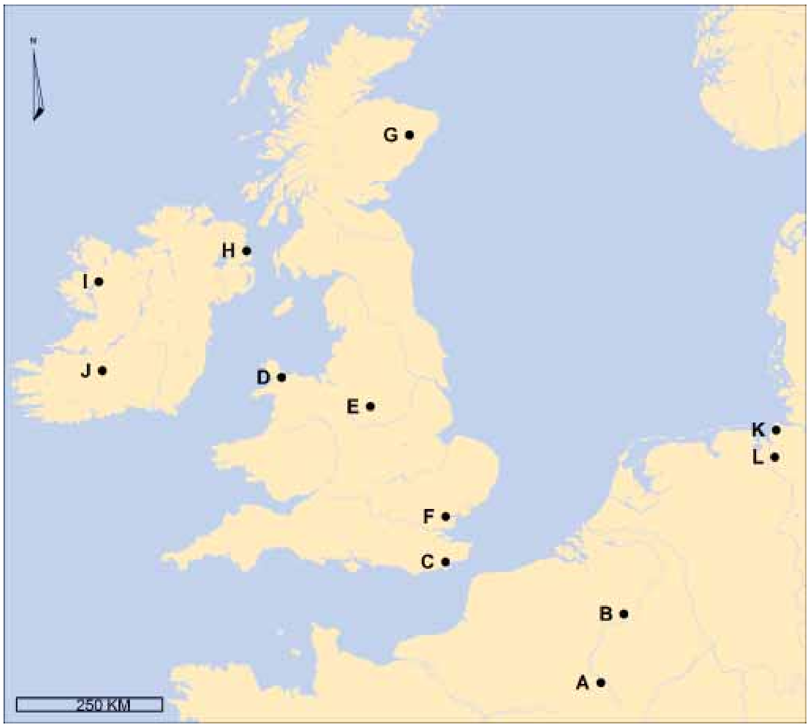


Fig. 161. Distribution of well preserved rectangular houses from the late 5th and early 4th millennium BC. A. Mairy, B. Lantremange, C. White Horse Stone, D. Llandegai, E. Lismore Fields, F. Chigborough Farm, G. Balbridie, H. Ballygalley 1, I. Ballyglass J, Tankardstown 2, K. Flögeln, L. Penningbüttel. After Marolle 1989; 1998; Barclay 1996; Darvill 1996; Grogan 1996; Topping 1996; Marchal et al. 2004; Raemaekers 2013; Hayden in press. Data after Table 28.

pressive size, with a length of 30 to 60 metres and a width of 7 to 13 metres. These rectangular houses covered an area of between 330 and 700 square metres, which means that they could have served as important gathering places for whole tribes. Perhaps the halls represented a place where tribes could keep their agrarian stocks safe from other agrarian societies in the event of conflict. This interpretation is further supported by the fact that some hall buildings were placed within well protected causewayed enclosures at Mairy and Bazoche (Marolle 1989; 1998; Bickle 2008).

Similar rectangular longhouses have been found in Lower Saxony, Britain and Ireland, thus showing some contact with the Michelsberg culture (Zimmermann 1979, 247ff; Darvill 1996, 83ff; Thorpe 2009, 32ff; Raemaekers 2013). The Irish and British houses have been ^{14}C dated to the Early Neolithic, with dates concentrated around 4000 to 3600 cal BC, whereas the dating of the houses at Flögeln and Penningbüttel in Lower Saxony is more problematic (Fig. V.162). ^{14}C dates for the Flögeln 1 house are spread widely between 3700 and 3000 cal BC, and the pottery displays vertical belly stripes, thus indicating a date around 3500 cal BC. Most of these rectangular houses in Britain, Ireland and Lower Saxony cover an area of 60-80 square metres, thus corresponding to the size of the two-aisled houses in South Scandinavia. Once again, the limited size could indicate that the first pioneering farmers were highly mobile and thus smaller houses were preferred. However, one of these rectangular houses at Balbridie in Scotland covered an area of 330 square metres, thus corresponding with the hall buildings of the Michelsberg culture (Topping 1996, 165ff). Perhaps the halls represent the storage buildings of the first settlers, which were built to store large amounts of seed when the first agrarian societies were establishing themselves in a region (Sheridan 2010). However, such hall buildings have not been found in South Scandinavia, as it was probably more important for the first pioneering farmers to invest most of their time in clearing the forest, to make large areas suitable for arable farming. It was instead probably the first agrarian settlements that became the ideological and symbolic markers in a ritualized landscape, as demonstrated by depositional practices at

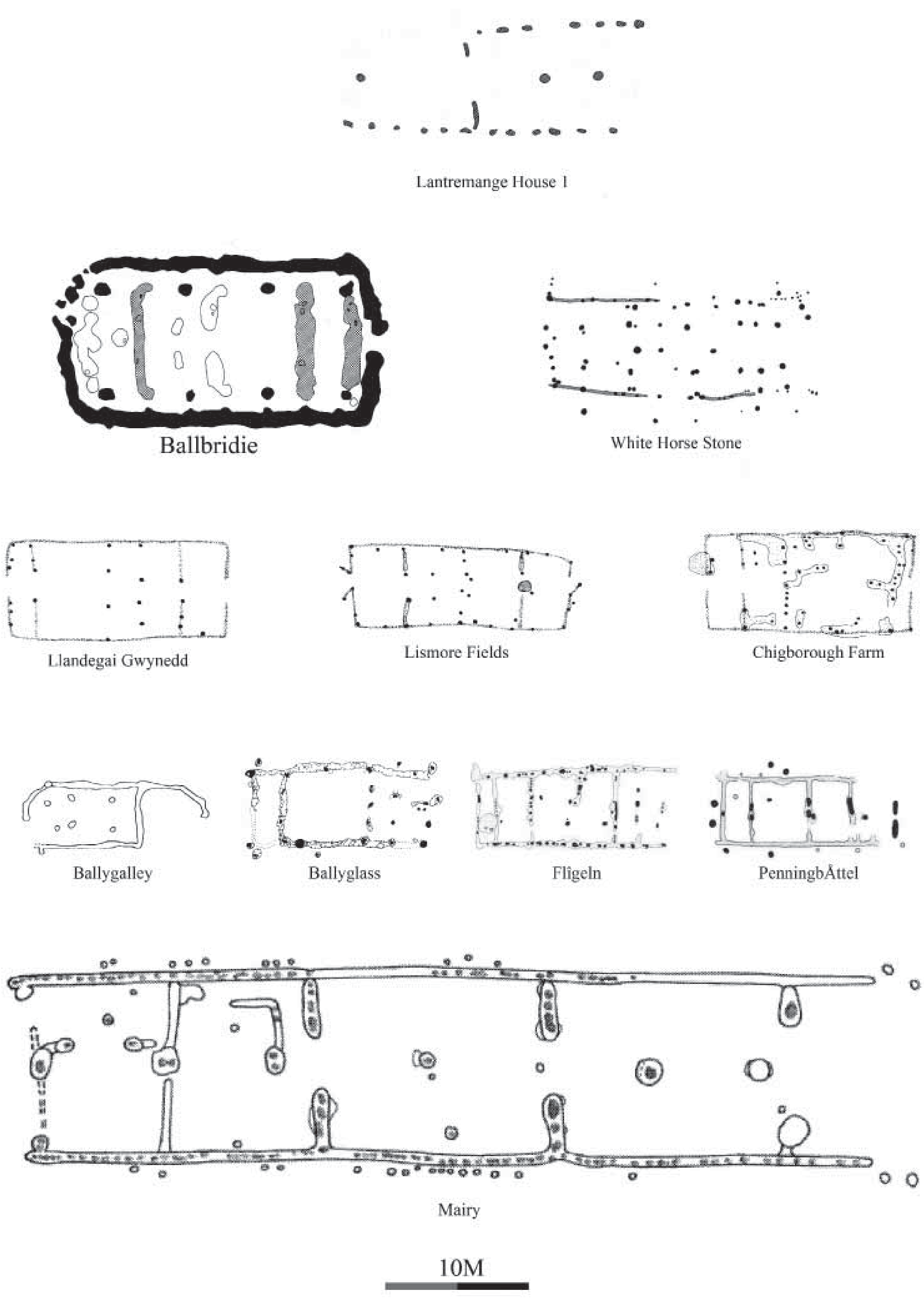


Fig. 162. Well preserved rectangular houses from the late 5th and early 4th millennium BC in Western Europe. After Marolle 1989; 1998; Barclay 1996; Darvill 1996; Grogan 1996; Topping 1996; Marchal et al. 2004; Raemaekers 2013; Hayden in press. Data after Table 28.

settlement sites and in wetland areas. One of these early agrarian sites is at Almhov in Scania, which has been interpreted as a feasting site, where new depositional practices were carried out in paired pits (Rudebeck 2010).

10.2. Paired pits and new depositional practices

The social gatherings of large numbers of people at a site like Almhov, may explain why most of the pits contained large amounts of cattle bones, as it has been argued that the slaughtering of larger animals could have been connected to specific occasions, such as feasts (Hedges 1984, 216). Furthermore, the rim diameters of the ceramic vessels from Almhov are below 15 cm, which is an ideal size for drinking cups, thus suggesting that it may have been a feasting site (Rudebeck 2010). The paired pits probably played an important role in the ritualized practices connected to these feasts (Fig. V.32). The interpretation of the pits as being associated with one another is based on the fact that they are located together, often have the same shape and depth, and contain material culture of the same date. Whether the paired pits are contemporary with one another or palimpsests of separate clusters of occupation can be tested with refitting analysis (Garrow 2006; 2012; Lamdin-Whymark 2008; Beadsmoore et al. 2010). But unfortunately such refitting analysis has not yet been undertaken on the Almhov material.

However, the paired pits may reflect the same depositional practices as those observed on a larger scale in the ditches of contemporary causewayed enclosure sites in Central Europe, which date to the early 4th millennium BC (Geschwinde & Raetzel-Fabian 2009). Pits have been found dug in rows along the palisades of causewayed enclosures in South Scandinavia. But paired pits are not common within the Funnel Beaker culture (Rudebeck 2010). However, one parallel with Almhov can be identified at the Early Neolithic site of Kilverstone in England. This site included several groups of pits dating to the beginning of the 4th millennium BC. The ceramic assemblages from Kilverstone were deposited in pits and covered over soon afterwards (Beadsmoore et al. 2010). The interpretation was confirmed by a detailed refitting analysis of the pottery from Kilverstone, which showed that several sherds could be joined with others from neighbouring pits. It is therefore clear that some pits were open at the same time at Kilverstone. The same phenomenon may also apply at Almhov, where one of the pits (A19049) was open for a longer period of time, as demonstrated by ^{14}C dates, which show charred cereals are concentrated around 4000 to 3700 cal BC and cattle bones from 3700 to 3500 cal BC (Fig. V.34 and Tables 51 and 15). The paired pits could therefore represent several periods of occupation at Almhov, which were perhaps characterized by both symbolic and domestic deposition (Harding 2006; Lamdin-Whymark 2008) (Fig. V. 163).

A parallel with the paired pits has also been reported from the French site of Le Haut Mée in Normandy (Cassen et al. 1998). This site included several paired pits, which surrounded a trapezoidal long barrow of the Passy type (Midgley 1997; Dubouloz 2003). This is comparable to the Almhov site, where paired pits also surrounded a long barrow. A charred cereal grain from one of the facade posts of the long barrow was ^{14}C dated to 4990±90 BP (3946-3656 cal BC, Ua-1715), thus suggesting that some of the paired pits could be contemporary with the long barrow. However, it must be stressed that this rather early ^{14}C date from the long barrow probably originates from earlier habitation rather than the construction of the actual burial structure itself (Table 29). However, the charcoal from the pits at the French site was ^{14}C dated to 4700-4400 cal BC, which is therefore considerably earlier than the Almhov site. But the concept of paired pits could have originated from this part of northern France. The paired pits from Le Haut Mée were 3 to 6 m long, 30 to 100 cm wide and approximately 50 cm deep. Ceramics and lithic materials had been deposited in the pits, as well as stones, which can be interpreted as the foundations for standing stones. Once again, there is a parallel with the Almhov site, as the large pit of A19049 also contained a large post, which thus formed a visible marker at the site (Gidlöf et al. 2006). Cassen et al. (1998) do not mention any parallels with these paired pits, although they do refer to similarities with the much later stone heap graves from Jutland, dated from 3100 to 2800 cal BC (Fabricius & Becker 1996). Perhaps the paired pits from La Haut Mée should be interpreted as features that were dug out when attempting to erect a stone, thus connecting them to the monumental long barrow. The paired pits also contained deposits of ceramics and lithics, which indicate that ritualized behaviour may have taken place in association with burial ceremonies near the long barrow. Such depositions have also been recognised near megaliths (Strömberg 1971; Holten 2000). The paired pits suggest that such ritualized practices were already established in the agrarian societies of northern France in the first half of the 5th millennium BC. The region of northern France is known for its dense distribution of jade axes, which have also been found in South Scandinavia, thus indicating some sort of contact between the two regions (Klassen 2004). Perhaps the spreading of agrarian societies by farmers immigrating to South Scandinavia may have initiated such ritualized practices involving paired pits, which were thus part of a larger European network. In general, awareness of these paired pits has been rather limited, but when excavation plans of Early Neolithic sites in South Scandinavia are examined, some of the pits at Lisbjerg Skole in Jutland or Brunn 17 in North Germany, for example, could easily be interpreted as paired pits (Skousen 2008, 112; Vogt 2009, 142). It is therefore possible that significant depositional practices occurred at these early agrarian habitation sites. The importance of these sites was acknowledged by the next generation of farmers, as they often built their first long barrows on top of these old settlements, which could then justify territorial borders in the land of the living and of the dead.

10.3. Long barrows and simple graves

Long barrows are elongated and intentionally raised earthen monuments, which often contain burials, and include long ditches and a stone frame (Midgley 1985; Kinnes 1992; Larsson 2002; Rudebeck 2002; Hansen 2009; Rassmann 2011; Rzepecki 2011) (Fig. V.164). The first long barrows are of the Passy type and are concentrated in western France, where they have been dated from 4700 to 4300 cal BC, and thus belong to the Cerny culture (Midgley 1985; Burnez et al. 2003; Dubouloz 2003; Rzepecki 2011). The long barrows of the Passy type usually have a trapezoidal shape and can be several hundred metres long. They are characterized by elongated pits and ditches, which sometimes contained larger posts, thus forming a kind of palisade. Furthermore, the Passy long barrows tend to be concentrated in groups, in which they are placed parallel to one another, as observed at Passy-sur-Yonne, Balloy, Rots and Fleury-sur-Orne (Rzepecki 2011). During the Michelsberg culture, the tradition of constructing these long barrows continued, as observed at sites like Beaurieux, Vignely and Saint-Julien-du-Sault, all located in the Paris Basin. The long barrows generally become shorter, with lengths of 20-70 metres and a trapezoidal shape during the Michelsberg culture. The site at Beaurieux was first inhabited by people of the Cerny culture, with the remains of a longhouse dated from 4800 to 4400 cal BC (Colas et al. 2008). During the following phase, around the late 5th or early 4th millennium, the Michelsberg farmers built a long barrow over the former settlement. The long barrow at Beaurieux was 15.5 metres long, had a width of 4 metres and was east-west oriented. The burial structure had been rebuilt several times; it first had a U-shaped form, which was followed by a subsequent façade. Two burial pits were found within the long barrow, which was surrounded by contemporary pits filled with pottery. A more absolute date was obtained from the long barrow at Vignely, where a human bone from the burial chamber was ^{14}C dated. The date was placed between 3800 and 3400 cal BC, which indicates that the long barrow belonged to the late Michelsberg culture (Chambon & Lanchon 2003, 171). The trapezoidal shape of these long barrows has been used to interpret the burial structures as houses of the dead, which were built in order to strengthen the social relations between agrarian tribes in densely populated areas with the more marginal regions (Hodder 1990; Sherratt 1990). The hypothesis is supported by the development of longhouses, which change from a rectangular to a more trapezoidal shape during the early 5th millennium (Bickle 2008). The fact that some long barrows were built on top of earlier settlements also suggests that they can be interpreted as an important communicative agents, which link the living with the dead, and ancestors with both present and future generations (Rudebeck 2002) (Table 29). This connection between the past and the present populations could also indicate that the construction of these long barrows also marked territorial borders or claims to arable land within these agrarian societies. The tradition of building long barrows may therefore have been associated with powerful ideological and economic statements, thus making them important in the discussion of the agrarian expansion from Central Europe to the British Isles and Northern Europe.

Based on ^{14}C dating of the long barrows, it has previously been argued that these structures were introduced to the Britain, Poland, Denmark and South Sweden around 4000 cal BC, contemporary with an agrarian expansion of pioneering farmers from Central Europe. However, many of these ^{14}C dates belonging to the early EN I phase represent earlier occupation, consisting of pits or shallow cultural layers located stratigraphically below the long barrows, which have been clearly identified at Sarnowo in

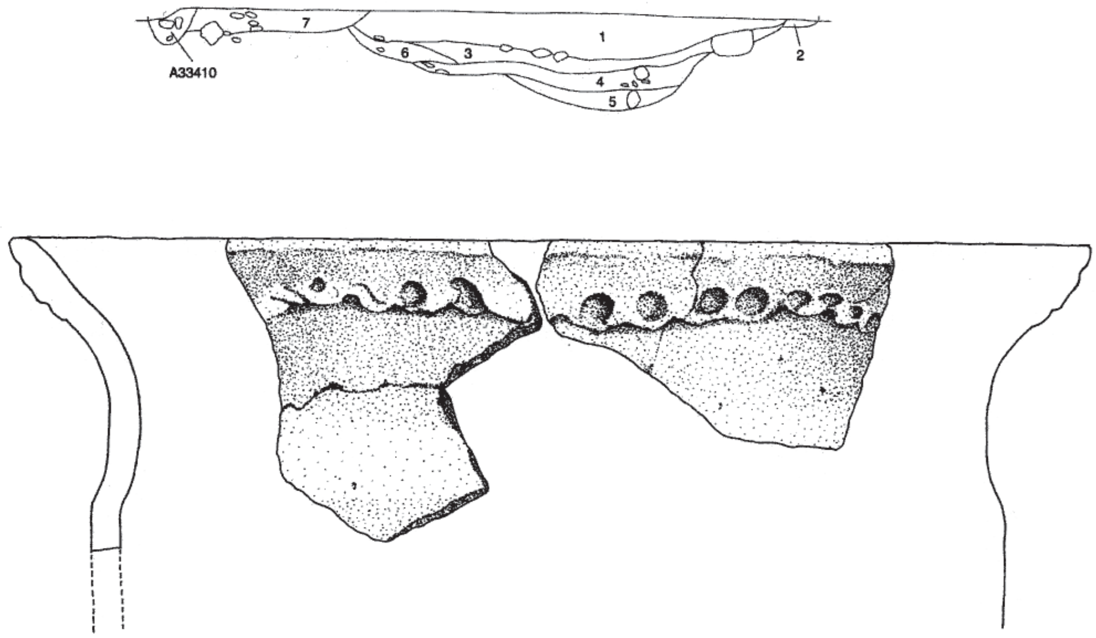


Fig. V. 163. Upper part. Profile of the pit A19049 from Almhov, Scania. The profile show seven layers of the pit and feature A 33410 cutting pit A19049. Lower part. A refitted short necked funnel beaker with a cordon at the rim with finger impressions, where the the sherds was found in layer 4 and 7 (MHM 12875:207595 and 207653). After Gidlöf et al. 2006, 56. Similar ceramics with cordon on the rim has been documented on other early EN I sites in Rosenhof, Wangels, Stilling, Lindebjerg, Store Valby, Stengade I and Stengade II. After Klassen 2004, 158.

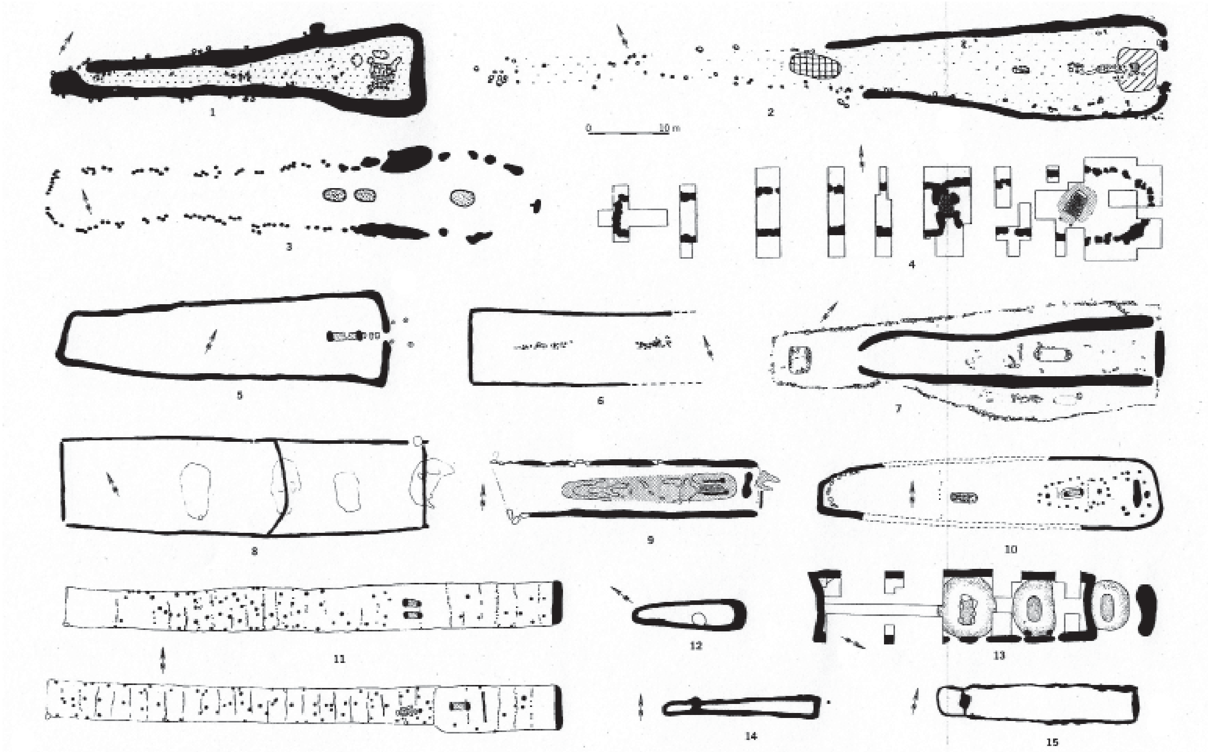


Fig. V. 164. Selected long barrows from Denmark, Poland, England and Northern France 1. Sarnowo 1/3 (Kujawien), 2. Obałki 2 (Kujawien), 3. Passy-sur-Yonne (Northern France), 4. Skibshøj (NW Jutland), 5. Fussel´s Lodge (Salisbury Plain, England), 6. Strandby Skovgrave (SW Funen), 7. Storgård IV (Northern Jutland), 8. Troelstrup (Northern Jutland), 9. Lindebjerg (Western Zealand), 10. Bygholm Nørremark (Eastern Jutland), 11. Barkær I-II (Djursland), 12. Teglværksgården (Western Jutland), 13. Sjørup Plantage (Northwestern Jutland), 14. Harreby (Southern Jutland), 15. Surløkke (Southeastern Jutland). After Kossian 2004.

Poland, Lindebjerg on Zealand, Stengade on Langeland, Højensvej Høj 7 on Funen, and Barkær and Mosegården in Jutland (Gabałówna 1970; Skaarup 1975; Wilak 1982; Liversage 1981; 1992; Madsen & Petersen 1984). Even house structures have, as mentioned above, been found below long barrows at Bygholm Nørremark and Alstedgaard, as discussed in section 10.1. The most common evidence indicating that the long barrow was placed on top of a previous settlement site are finds of flint flakes in and stratigraphically below the mound, which have been reported at several sites (Fig. V.165 and Tables 29 and 66). Furthermore, several long barrows have also included heavily-used quern stones in their stone structures, which could have originated from earlier settlements. Most ^{14}C dates of the actual burial chambers of the long barrows reach from 3800 to 3500 cal BC in both Poland and South Scandinavia (Fig. V.166). These dates were confirmed by a recent research programme in Britain, in which many ^{14}C dates of different long barrows were taken and subjected to a Bayesian analysis (Bayliss & Whittle 2007). The investigations concluded that long barrows were introduced to Britain around 3800 cal BC. The result demonstrates that long barrows came to Northern Europe and Britain at the same time, although not in connection with the first pioneering farmers, but perhaps in association with a second wave of agrarian expansion from Central Europe. The appearance of long barrows between 3800 and 3500 cal BC in South Scandinavia is also supported by the burial finds of thin-butted axes and funnel beakers decorated in the Volling, Svaleklint or Svenstorp styles. All these artefacts can also be dated from 3800 to 3500 cal BC, as discussed in sections 8.3 and 9.9. In certain cases, the grave goods were also coils or discs of copper (Fig. V.167 and Table 67). The copper discs from South Scandinavia have recently been associated with the Stollhof-Csáford type, thus showing impulses from the eastern parts of Central Europe, which again indicates that these agrarian farmers were part of a widespread network (Klassen 2002; Turck 2010; Virág 2010, 217) (Fig. V.168). The long barrows in South Scandinavia are distributed in Denmark and Scania, while only one has been found in Central Sweden, at Mogetorp in Södermanland (Hallgren 2008). Again it is clear that the introduction of burial traditions is very selective in the eastern part of Central Sweden, with cremation burials dominant in this region (Hallgren 2008, 99ff) (Table 30). Nonetheless, long barrows might be expected in Västergötland, as they could be located below the uninvestigated long dolmens in this region (Sjögren 2012). In general, the long barrows from South Scandinavia bear close similarities to those of the Michelsberg culture, as they have a length of 10-70 metres and width of around 5-15 metres (Fig. V.164). Furthermore, they are often orientated east-west and are trapezoidal in shape, thus suggesting that the knowledge of how to build these long barrows could have originated from direct or indirect relations with people from the Michelsberg culture. Several researchers have tried to find variations amongst the long barrows of the different regions (Kinnes 1992; Rudebeck 2002; Kossian 2004; Hansen 2009; Rassmann 2011; Rzepecki 2011). But all have concluded that the long barrows display clear similarities over a wide geographical area, especially in relation to the trapezoidal shape of the structures, thus indicating that they were important mediators within a large agrarian network during the early 4th millennium BC. The trapezoidal shape of these long barrows resembles the shape of longhouses from the Linearbandkeramik and Rössen cultures; they could therefore be interpreted as houses for the dead, which may have been a specific religious practice imbedded in the agrarian societies.

But if the first pioneering farmers were immigrating groups of people, then it seems strange that they did not bring with them the tradition of building these long barrows. However, the construction of these long barrows would have depended on both manpower and the clearance of large areas, which might not have been possible in the initial stages of a pioneering agrarian society. These pioneering farmers were the first to clear the forests and therefore had no real need to mark any territories by building large monumental structures. The clearing of the forests and the settlement sites marked their territories. The construction of long barrows in a pioneering phase of establishing arable land would only have taken up useful space, which could instead have been cultivated. However, a couple of generations later it would make more sense to locate a monumental burial structure right on top of the ancestors' old settlement site, thus marking a territorial claim. This hypothesis is supported by the distribution of the thin-butted flint axes, which from 3800 cal BC onwards show a more intensive use of the landscape in many local regions, such as Himmerland in West Jutland and the inland area of Schleswig-Holstein (Lüth 2011) (see section 12.1-8). Here, new arable lands were being cultivated, showing the spread of agriculture via later im-

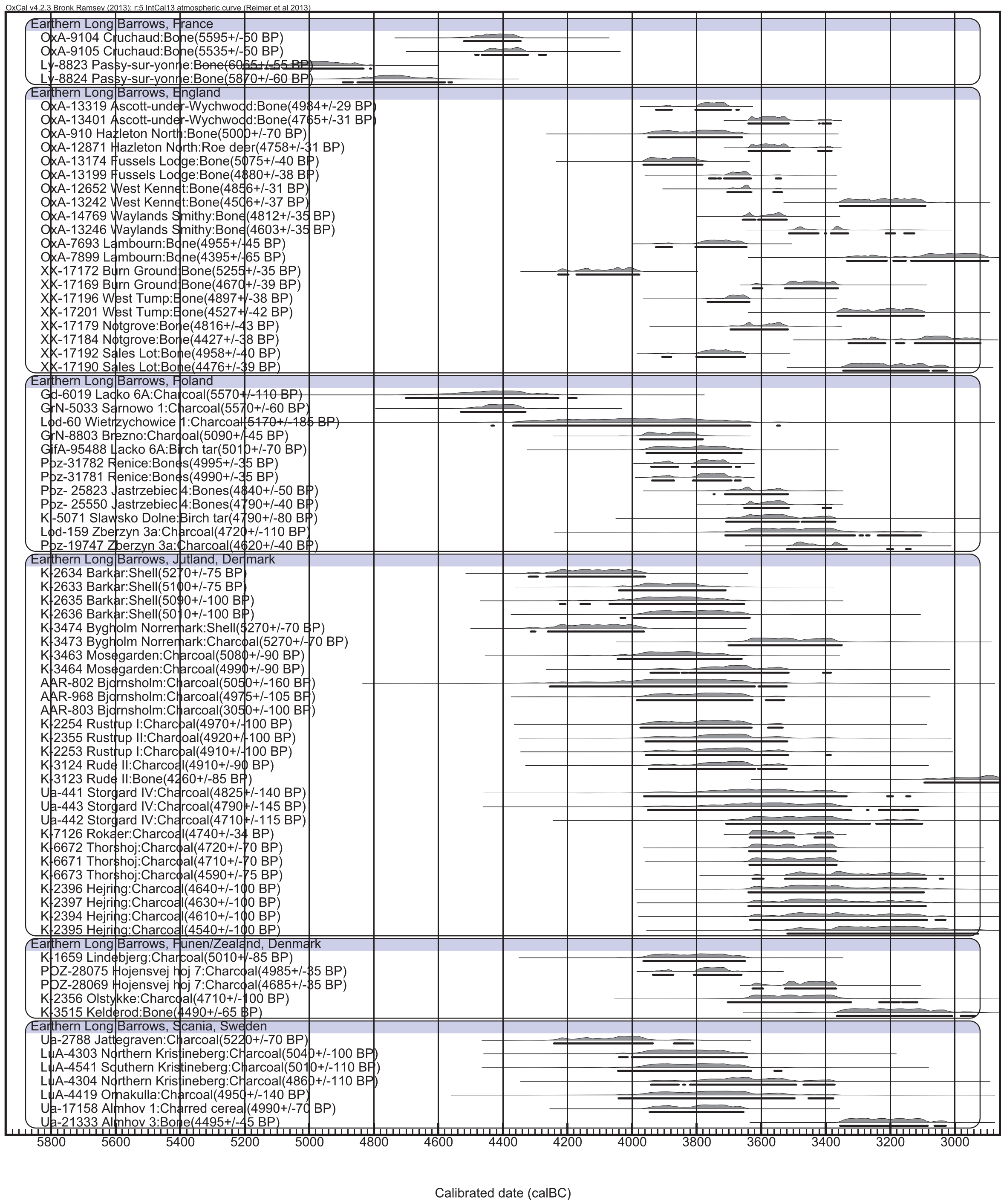


Fig. V. 165. [14]C dates of organic materials from Early Neolithic long barrows in Western Europe. After Gabałówna 1970; Gorczyca 1981; Kanwiszer & Trzeciak 1984; Domańska 1995; Midgley 1997; Schulting 2000; Hildebrand 2001; Rudebeck 2002; Burnez et al. 2003; Dubouloz 2003; Woll 2003; Smith & Brickley 2006; Bayliss & Whittle 2007; Wierzbicki 2008; Gidlöf 2009; Rzepecki 2011; Beck 2013. Data after Tables 29 and 66.

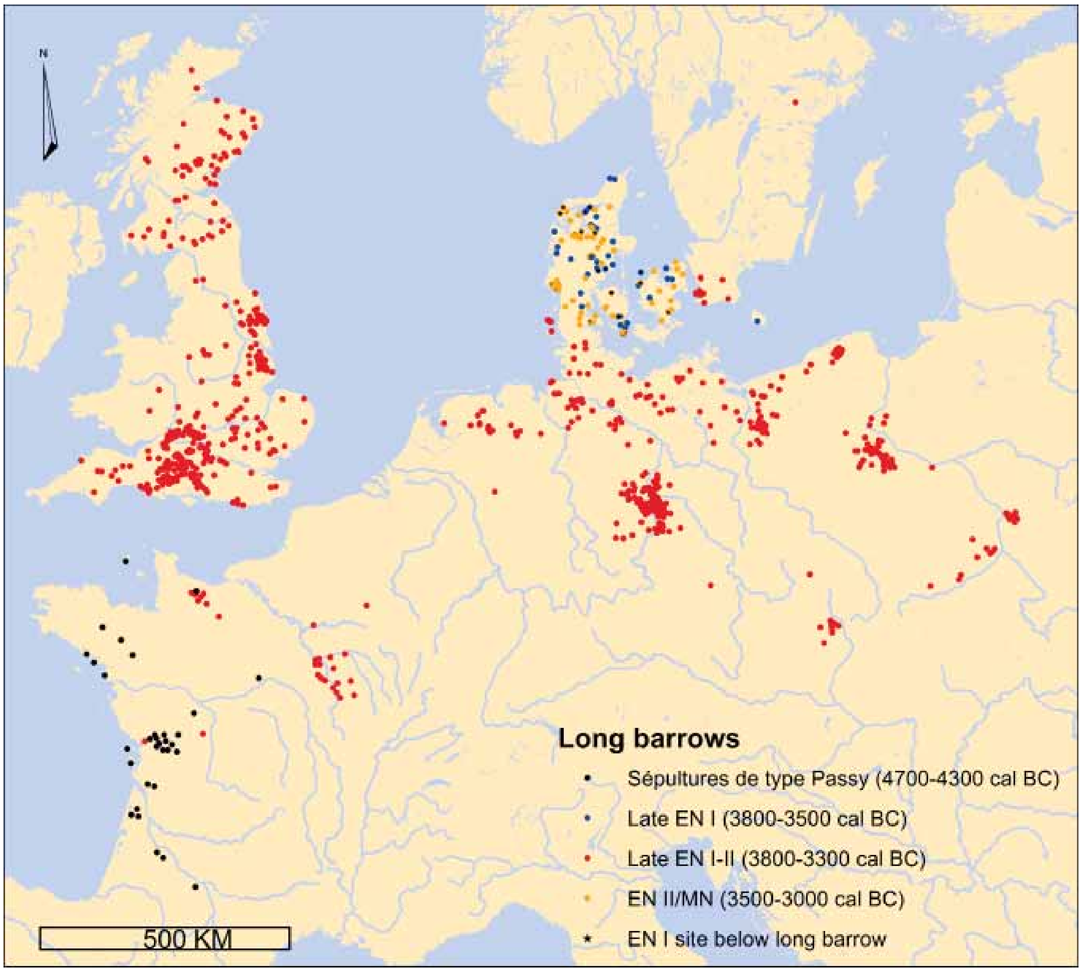
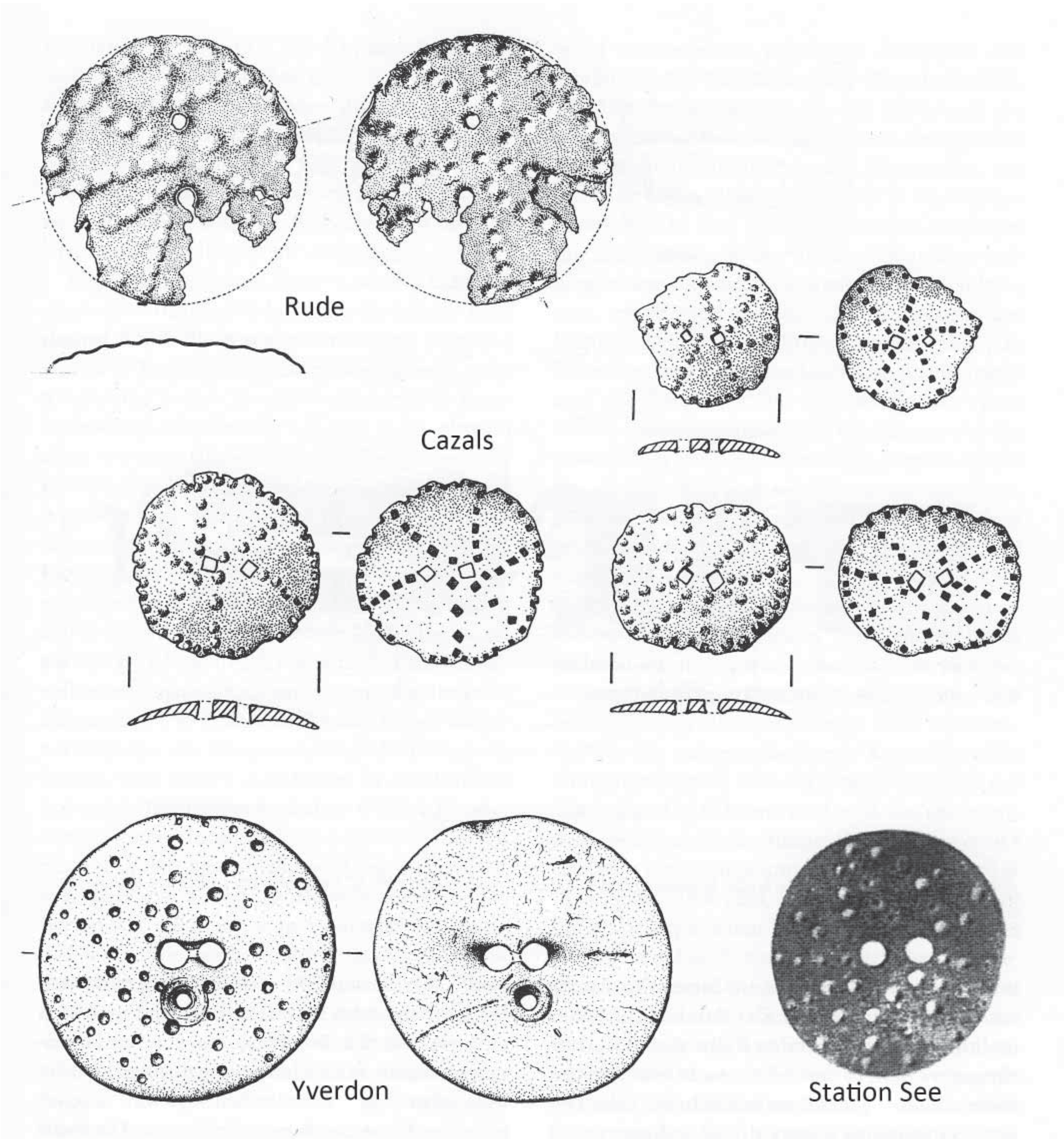


Fig. V. 166. Distribution of long barrows in Western Europe. After Gabałówna 1970; Gorczyca 1981; Watt 1982; Kanwiszer & Trzeciak 1984; Grygiel 1986; Bennike & Ebbesen 1987; Kristensen 1991; Czerniak & Kośko 1993; Ebbesen 1994; Domańska 1995; Kihlstedt et al. 1997; Midgley 1997; Heinemeier & Rud 2000; Schulting 2000; Hildebrand 2001; Rudebeck 2002; Larsson 2002; Burnez et al. 2003; Dubouloz 2003; Woll 2003; Kossian 2004; Smith & Brickley 2006; Bayliss & Whittle 2007; Fischer et al. 2007; Price et al. 2007; Eriksson et al. 2008; Hallgren 2008; Wierzbicki 2008; Gidlöf 2009; Hadevik 2009; Hansen 2009; Lübke et al. 2009; Rassmann 2011; Rzepecki 2011; Sjögren 2012; Beck 2013. Data after Table 29 and Table 66.

migrating farmers from Central Europe or descendants of the first farmers. At the same time, the construction of the long barrows can be interpreted as a method of maintaining and consolidating certain territories, which could have been initiated by closely-related tribes belonging to the first generation of farmers. If the long barrows were territorial markers, it would have been important to locate them in highly visible areas of the landscape, which is a trend continuing with the construction of the megaliths during the EN II. A recent investigation has confirmed that the viewing of the burial structures from a distance seems to have been a decisive factor, which frequently also corresponded with the location of the habitation sites of the first generation of farmers in South Scandinavia (Hansen 2009).

Contemporary with the construction of long barrows were simple inhumation burials, both with and without stones and mounds, which have been found in all parts of South Scandinavia and Northern Europe (Ebbesen 1994; Larsson 2002; Woll 2003; Kossian 2004; Hallgren 2008; Wierzbicki 2008; Hadevik 2009; Hansen 2009; Lübke et al. 2009; Sjögren 2012) (Figs. V.169-170). Inhumation burials were also placed on top of or near earlier settlements from the Neolithic and are especially densely concentrated in northern Jutland, which could reflect regional differences in burial customs (Ebbesen 1994, 88ff). How-



Fig, V. 167. Finds of copper discs in Europe from the late 5th and early 4th millennium BC. After Klassen 2000.

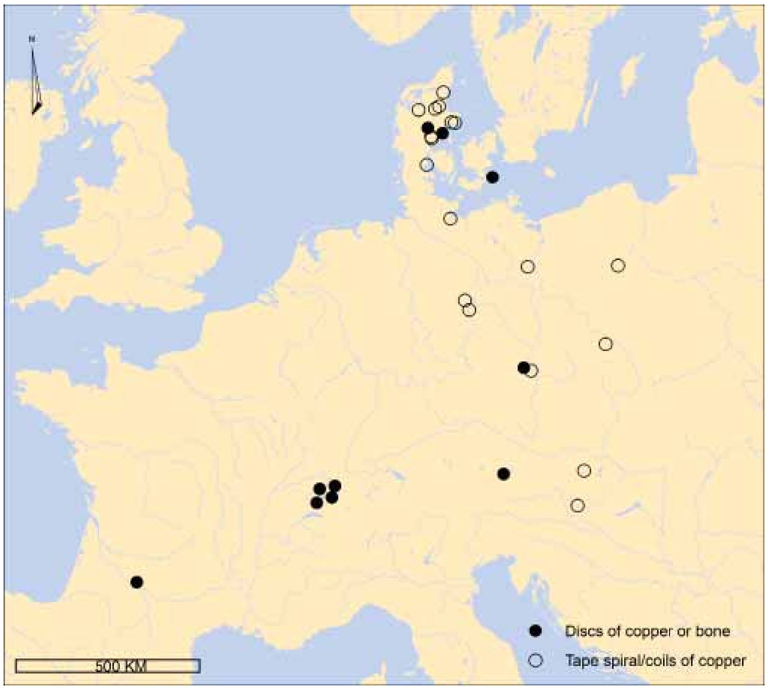


Fig. V. 168. Distribution of copper and bone discs from the late 5th and early 4th millennium BC in Europe. After Moucha 1981; Klassen 2000; Turck 2010; Peter Vang Petersen pers. comm. Data after Table 67.

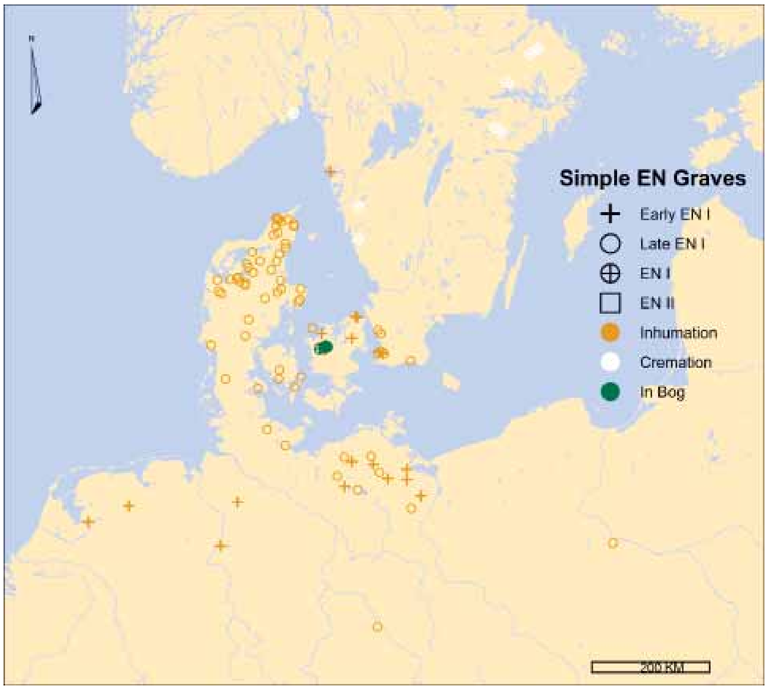


Fig. V. 169. Distribution of simple inhumation graves from the EN I phase in Northern Europe. After S. Florin 1958; Grygiel 1986; Bennike & Ebbesen 1987; Czerniak & Kośko 1993; Ebbesen 1994; Kihlstedt et al. 1997; Glørstad 1998; Larsson 2002; Woll 2003; Kossian 2004; Fischer et al. 2007; Eriksson et al. 2008; Hallgren 2008; Wierzbicki 2008; Gidlöf 2009; Hadevik 2009; Hansen 2009; Lübke et al. 2009; Sjögren 2012. Data after Table 30.

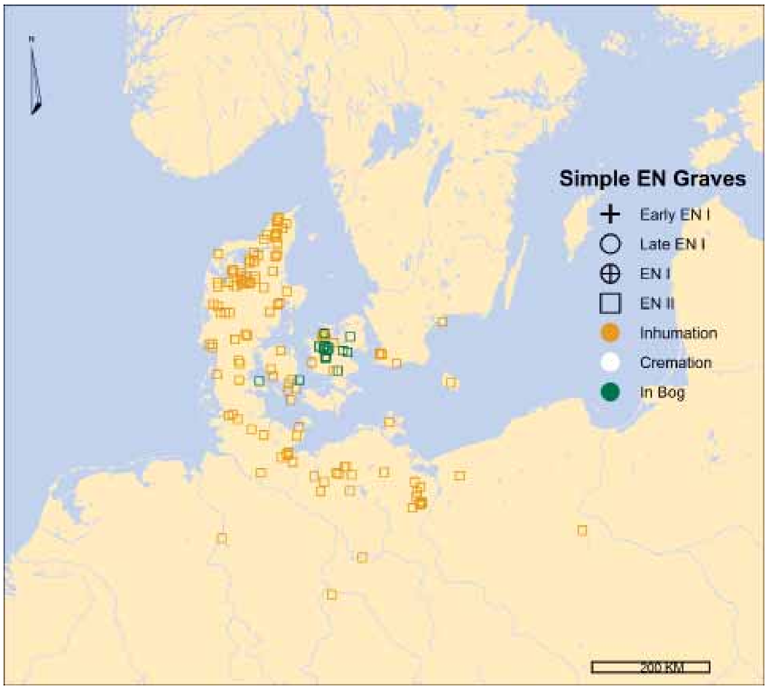


Fig. V. 170. Distribution of simple inhumation graves from the EN II phase in Northern Europe. After S. Florin 1958; Grygiel 1986; Bennike & Ebbesen 1987; Czerniak & Kośko 1993; Ebbesen 1994; Kihlstedt et al. 1997; Glørstad 1998; Larsson 2002; Woll 2003; Kossian 2004; Fischer et al. 2007; Eriksson et al. 2008; Hallgren 2008; Wierzbicki 2008; Gidlöf 2009; Hadevik 2009; Hansen 2009; Lübke et al. 2009; Sjögren 2012. Data after Table 30.

ever, these inhumation burials also show similarities over a large geographical area and in terms of dating, as this burial type without stones was present in Mesolithic times. Excavations of the Early Neolithic inhumation burials containing a stone cist were investigated during the first half of the 20th century during a time, where long barrows were not recognized. It is thus possible that some of the inhumation burials with stone cists could have been part of some unidentified long barrows. A few of the inhumation burials have been ^{14}C dated to the early EN I phase, thus showing that this type of burial was present in South Scandinavia before the introduction of the long barrows (Larsson 2002; Price et al. 2007; Lübke et al. 2009). However, the majority of the ^{14}C dates of inhumation burials are concentrated between 3800 and 3200 cal BC, and continue into the Middle Neolithic (Fig. V.171 and Table 30). The less significant investment of time and resources into these burials, compared to the construction of the larger long barrows, may reflect the different social classes within these early agrarian societies. However, the grave goods are the same as in the long barrows. Inhumation graves also contain thin-butted flint axes, funnel beakers, amber pearls and, in rare cases, copper artefacts (Table 30). There are therefore no indications of actual class differences, when investigating the grave goods. Perhaps the different burial types represent different preferences as to how people wanted to be buried. The remains of the people buried in the long barrows or the simpler inhumation graves are rarely preserved, thus making it difficult to conduct any skeletal analysis. Nevertheless, a greater number of human skeletons from the Early Neolithic have been found in bogs (Bennike & Ebbesen 1987; Bennike 1999; Fischer et al. 2007). The majority of the individuals found in bogs are juveniles, who show evidence of violence, which may indicate that human sacrifies or punishment took place together with the many other symbolic practices associated with the wetland areas. Perhaps these bog finds reflect an increased level of violence in society, which could also have been connected with the increased focus on territorial rights, as reflected in the construction of long barrows. During the later part of the EN I and EN II some people were also buried in the ditches of causewayed enclosures, which have been interpreted as ritual gathering places, but which could also reflect an increase in territorial claims.

10.4. Causewayed enclosures

Causewayed enclosures are circular, oval or more irregular shaped earthworks, which are enclosed by one or several palisades, fences and ditches. The size of causewayed enclosures varies between 1 and 9 hectares (Plate 9). Some researchers argue that they are fortified structures and refuges, whilst other emphasize their role as social and economic centres, and ritual gathering places (Andersen 1997; Christensen 2004; Nielsen 2004; Gronenborn 2010). Finds of human bones and skeletons in the ditches, together with deliberate depositional practices, are key evidence for the argument that the causewayed enclosures were cult centres (Bertemes 1991; Andersen 1997). Based on his excavations of the causewayed enclosure at Sarup N. H. Andersen has argued that the bottoms of the ditches were refilled immediately after the depositions took place (Andersen 1997, 287f). Therefore, the ditches did not serve any defensive purpose, but rather had a symbolic meaning, which was important in ritual practices. However, the bottom layers of some of the ditches at Sarup contained thin layers of sand or clay, which were the result of wind action or water erosion, thus indicating that the ditches could have been left open for some time (Andersen 1999, 70). Detailed studies of the ditches, and in particular their bottom layers, are required in the future in order to investigate whether they were left open for some time or refilled immediately after use. At present, we therefore cannot rule out a defensive element in the functions of these causewayed enclosures, and thus the use of the sites both for refuge and ritualized practices.

The earliest causewayed enclosures have been dated to the late 6th millennium BC and belong to the Linearbandkeramik culture (Jeunesse 2011). These early enclosures usually covered an area of 1 ha, some surrounded by houses and others not associated with any occupation (Keeley & Cahen 1989, 158). Around 4700 to 4400 cal BC, a concentration of causewayed enclosures belonging to the Cerny culture can be noted in northern France, which also corresponds with the concentration of long barrows of the Cerny type (Klassen in press; Rzepecki 2011). During the second half of the 4th millennium, many causewayed enclosures relating to the Chassén and Michelsberg cultures can be identified in Western Europe (Andersen 1997). These enclosures are of a considerable size of up to 9 ha, with between one and five causewayed ditches, and sometimes a rampart, wall or palisade, thus indicating a defensive use. This interpretation is further supported by their location in the landscape, as they are located near wetlands, on plateaus or beside rivers. The causewayed enclosure of Urmitz is one of the largest from the Michelsberg culture, consisting of two ditches and a single palisade, which may have been constructed in different phases. Nevertheless, ten bastions with small passageways or rectangular enclosures were documented in the causeways of the inner ditch, which could have served as extra protection at gates (Eckert 1990). Such narrow passageways have also been found in other causewayed enclosures of the Michelsberg culture, thus indicating that they were a common feature. Conflict and violence did occur in the Michelsberg culture, as human skeletons found in the pits of settlements and in the ditches of enclosures show evidence of skull fractures (Wahl & Höhn 1988; Nickel 1997; Christensen 2004). The distribution pattern of sites from the Linearbandkeramik culture and the Michelsberg culture in Belgium confirms that a more widespread use of the landscape was embarked upon during the late 5th millennium BC (Vanmontfort et al. 2008). From especially 4300 cal BC onwards, migrants from the Michelsberg population moved towards the north, beyond the loess zone and into the Limburg Meuse Valley, the Münster Basin and further into Niedersachsen and Sachsen-Anhalt, thus pushing the border of farming further north (Raemaekers et. al. 2012) (Fig. V.172). Such movements would at some point have created territorial conflicts, when the ideal living areas between different enclaves had been filled up with new sites. In such a situation, the causewayed enclosures may have played a central role as fortified refuges, where the pioneering agrarian societies could store their crops and protect animals from theft, as well as participate in ritualized practices. The expansion into Central Germany during the late 5th and early 4th millennium BC is shown by the construction of causewayed enclosures, which in some cases appear to be located near important salt springs in Niedersachsen and Sachsen-Anhalt (Saile 2012; Weller 2012) (Fig. V.173). Once again, there may have been be a connection between expansions into new regions and the exploitation of important natural resources, which may have been salt in Central Germany and flint in South Scandinavia, as discussed in section 9.8. But currently dating of the salt exploitation is still lacking and it is therefore not certain

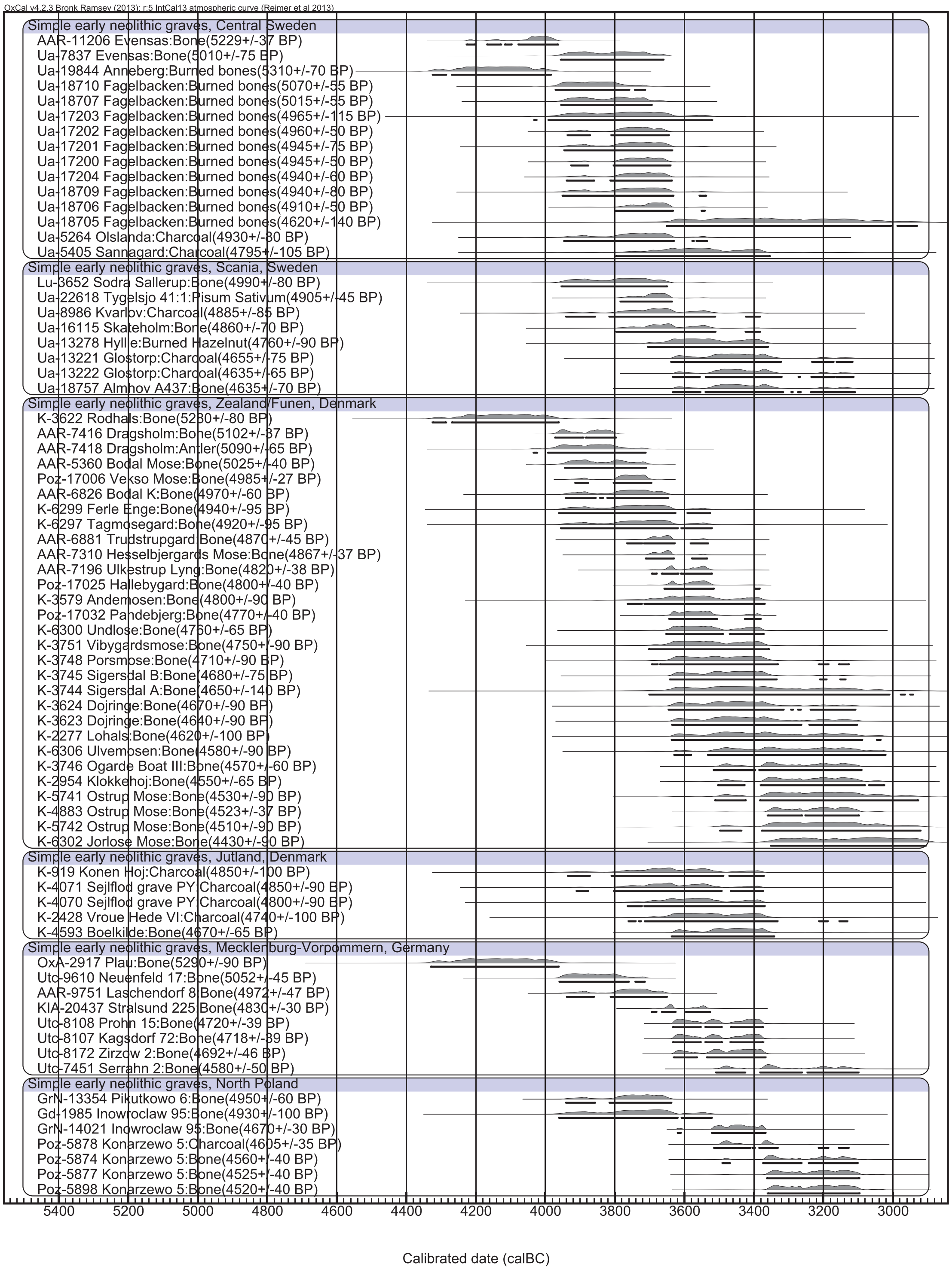


Fig. V. 171. ^{14}C dated organic materials from Early Neolithic inhumation graves from Northern Europe. After Grygiel 1986; Bennike & Ebbesen 1987; Czerniak & Kośko 1993; Ebbesen 1994; Kihlstedt et al. 1997; Heinemeier & Rud 2000; Larsson 2002; Fischer et al. 2007; Price et al. 2007; Eriksson et al. 2008; Hallgren 2008; Wierzbicki 2008; Gidlöf 2009; Hadevik 2009; Hansen 2009; Lübke et al. 2009; Sjögren 2012. Data after Table 66.

that such activity is contemporary with the causewayed enclosures.

In general, increasing territorial demands in certain regions may have resulted in a greater number of conflicts and the construction of enclosures and long barrows, which could have created a push effect, which led some groups of people to migrate further north towards South Scandinavia. However, if pioneering farmers migrated from Central Europe to southern Scandinavia, then it is strange that no causewayed enclosures have been found in the early EN I phase (4000 to 3800 cal BC) in this region (Fig. V.175 and Table 31). It appears, however, that the construction of causewayed enclosures in Central Europe was usually connected to a more intensified use of the landscape, which would not have been the case for the pioneering farmers coming to South Scandinavia. Their exploitation would at least in the beginning have been much more dispersed and focused on specific regions characterized by a limited hunter-gatherer population, an abundance of workable arable soils and flint deposits, as indicated by the distribution of Ertebølle artefacts and pointed-butted flint axes. It is therefore probable that the social organization of much more dispersed enclaves of pioneering farmers was different, and that it was not necessary to mark certain territorial areas by constructing causewayed enclosures during the early EN I phase in South Scandinavia. Furthermore, if the pioneering farmers established an agrarian society by involving the indigenous population, which is indicated by the rapid change in material culture at coastal sites, then this would have been a time of knowledge exchanges, with perhaps a limited focus on conflicts and territorial rights. However, the requirement for initiating religious practices, as documented by the intentional deposits at settlement sites and in wetland areas, was present during the early EN I. It is therefore probable that actual gathering sites may have materialized in a somewhat different way during the initial stages of founding an agrarian society in new surroundings. Such gathering places may have involved more simple structures in the earliest part of the Early Neolithic, like the paired pits at the Almhov site (Rudebeck 2010).

Simple constructions might also be hidden within the complex stratigraphy of typical causewayed enclosures, thus indicating that social gatherings may have taken place at the beginning of the 4th millennium in South Scandinavia (Madsen 2009; Klassen in press). Such constructions may have been enclosure-related sites, which typically consisted of short ditches, measuring 5-30 metres long and 2-4 metres wide, in which intentional depositional practices and other symbolic activities could be identified. These structures may later have become actual enclosures, but by definition did not enclose an area. Examples of such structures have been observed at Kildevang I and Aalestrup in East Jutland and at Hamremoen, near Kritiansand in Norway (Plate 9). The ^{14}C dates from both Kildevang I and Hamremoen cluster between 3800 and 3600 cal BC, which demonstrates that these enclosure-related sites appear in South Scandinavia during the late EN I phase (Fig. V.174). The date is confirmed by the ceramic assemblages. The two Danish sites produced Volling ceramics with twisted cord impressions, which bear some similarities with the ornamental style recorded in the ceramic assemblages at Hamremoen (Madsen 2009; Skousen 2008; Ravn 2012; Glørstad & Sundström 2014). The appearance of such an enclosure-related site in Norway may suggest close contact with Denmark, as such structures have not been found along the west coast of Sweden (Kihlstedt et al. 1997). Furthermore, one of the earliest causewayed enclosures at which Volling ceramics have been found in the ditches is located in North Jutland, at Liselund in the district of Thy, and is thus a possible place where the inspiration for such structures may have originated. Traditionally, the connections to Norway during the Early Neolithic have, based on the distribution of thin-butted axes, been interpreted as occurring along the coast rather than over open water (Hinsch 1955; Østmo 1988; Glørstad 2010). But a funnel beaker with vertical belly stripes from the EN II phase has been found on the seabed at a depth of 120 meters, five to seven nautical miles (9-13 km) north of Skagen. This rare find proves that such voyages to the coasts of southern Norway or western Sweden may have taken place during the Early Neolithic (Fig. V.192).

In the last decade researchers have argued that causewayed enclosures first began to be constructed during the early EN II phase from around 3500 cal BC in South Scandinavia, which is based on a small number of ^{14}C dates from organic materials found in the ditches (Madsen 1988; Andersen 1999; Westphal 2005). It is, however, mostly the ceramic assemblages from the ditches that date the causewayed enclosures. But most of the ceramic assemblages represent later depositions and therefore do not date the actual construction phase, which means that

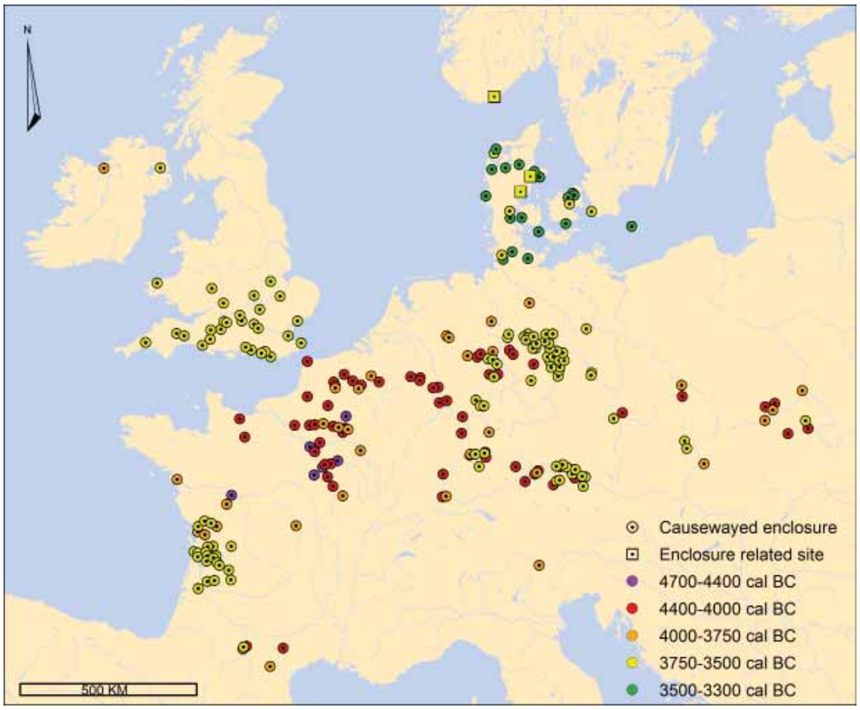


Fig. V. 172. Distribution of causewayed enclosures in Central and Northern Europe. After Andersen 1997; Jeunesse 1998; Nielsen 2004; Raetzel-Fabian 2009; Geschwinde & Raetzel-Fabian 2009; Klatt 2009; Madsen 2009; Cooney et al. 2011; Whittle 2011; Lützau Pedersen & Witte 2012; Andersson & Wallebom 2013; Andresen 2013; Geschwinde 2013, 195; Glørstad & Sundström 2014; Klassen 2014b; in press; Claudio Casati pers. comm; Palle Østergård Sørensen pers. comm.

some of the enclosures could be earlier than the EN II phase. Some causewayed enclosures in Germany have been interpreted as belonging to the Bernburg culture (3100-2800 cal BC) based upon finds from the ditches, but ^{14}C dates taken later on indicate that the actual construction phase belonged to the late Michelsberg period (3800-3600 cal BC) (Geschwinde & Raetzel-Fabian 2009). A similar tendency could be argued to be applicable to some of the causewayed enclosures in South Scandinavia. Here the ^{14}C dates at causewayed enclosure sites like Sarup I, Starup-Langelandsvej and Albersdorf-Dieskknöll suggest an initial building stage dating to around 3700 to 3500 cal BC (Klassen in press). The ^{14}C dates from Starup-Langelandvej in particular are concentrated in the period 3800-3500 cal BC, thus indicating that causewayed enclosures could have been introduced together with long barrows during the Late EN I, from 3800 to 3600 cal BC (Lützau Pedersen & Witte 2012) (Plate 9). But the earliest ceramic assemblages at Sarup I and Starup-Langelandsvej are of the Fuchsberg type, which typologically does not belong to the early EN I phase. Nevertheless, Volling ceramics have been found at the causewayed enclosure site at Liselund near Thisted and Svaleklint ceramics at the enclosure site at Langager, near Roskilde on Zealand (Palle Østergård Sørensen pers. comm.). It is therefore possible that some of the causewayed enclosures were constructed during the late EN I phase. However, more ^{14}C dates of the different layers in the ditches of causewayed enclosures from South Scandinavia are needed in the future before we can confirm these preliminary results.

A recently excavated causewayed enclosure from Döseryggen in Scania has been interpreted as being constructed during the late EN I phase, based upon ^{14}C dates of the dolmens and the palisade surrounding them (Andersson & Wallebom 2013). However, a closer look at the ^{14}C dates reveals that they cover a relatively long time span, and are concentrated from 4000 to 3300 cal BC and from 2800 to 2600 cal BC (Fig. V.174). These two clusters may indicate that the dolmens were constructed during the Early Neolithic, which was followed by the construction of the palisade surrounding the dolmens during the

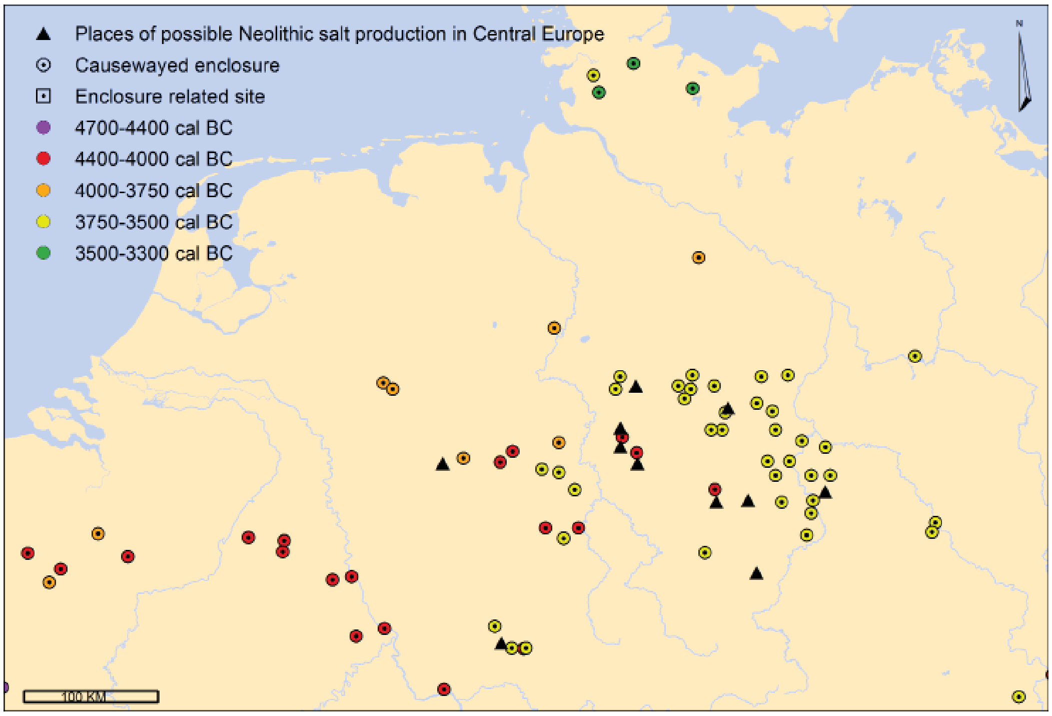


Fig. V. 173. Distribution of causewayed enclosures and possible Neolithic salt springs in Central Germany. Some causewayed enclosures have been located near salt springs at Auleben, Bad Nauheim, Halle on the Saale, Northeim, Salzderhelden, Schöningen and Sülbeck. After Geschwinde & Raetzel-Fabian 2009; Raetzel-Fabian 2009; Saile 2012; Klassen in press.

Battle Axe culture. The palisade at Dösseryggen displays many similarities with those associated with the Battle Axe culture (Brink 2009). However, along the palisade at Dösseryggen large pits were found, similar to those that have been identified at Early Neolithic causewayed enclosures in Denmark and Central Europe (Andersson & Wallebom 2013). Unfortunately, there were not many finds in these pits, which could confirm the early date of the construction. Furthermore, no large house structures were found within the enclosure. But in between the dolmens excavated pits contained short-necked funnel beakers, which demonstrates that there was activity during the EN I phase. In addition, rows of standing stones may have been placed along the palisade and near to the dolmens, based on the evidence of large stoneholes containing stone packing, which may have served as foundations for these larger stones. The standing stones would have stood in groups of two or four and also in long rows of up to ten stones, which would been placed parallel to the palisade. Standing stones were also found in rows near the dolmens and perhaps served as markers between the burial monuments. Standing stones placed in long rows have otherwise not been identified before in the Early Neolithic in South Scandinavia. There are obvious parallels at sites like Avebury and Carnac (Roughley et al. 2002; Gillings et al. 2008). The Avebury monument is from the early part of the 3rd millennium, whereas the standing stones at Carnac have been dated to between the mid-5th and mid-4th millennium BC. Such unique constructions indicate that the region of Scania was well connected with the wider European agrarian network during the 4th millennium BC.

The distribution of causewayed enclosures from the Early Neolithic in South Scandinavia is concentrated in Denmark and currently no such sites have been found in Central Sweden. It appears as if the inhabitants of Central Sweden did not want to adopt the causewayed enclosure because the habitation was not particularly dense. However, investigations of Early Neolithic stray finds show a quite dense concentration in certain areas, which is particularly notable in the Fallbygden area of Västergötland. Furthermore, connections between concentrations

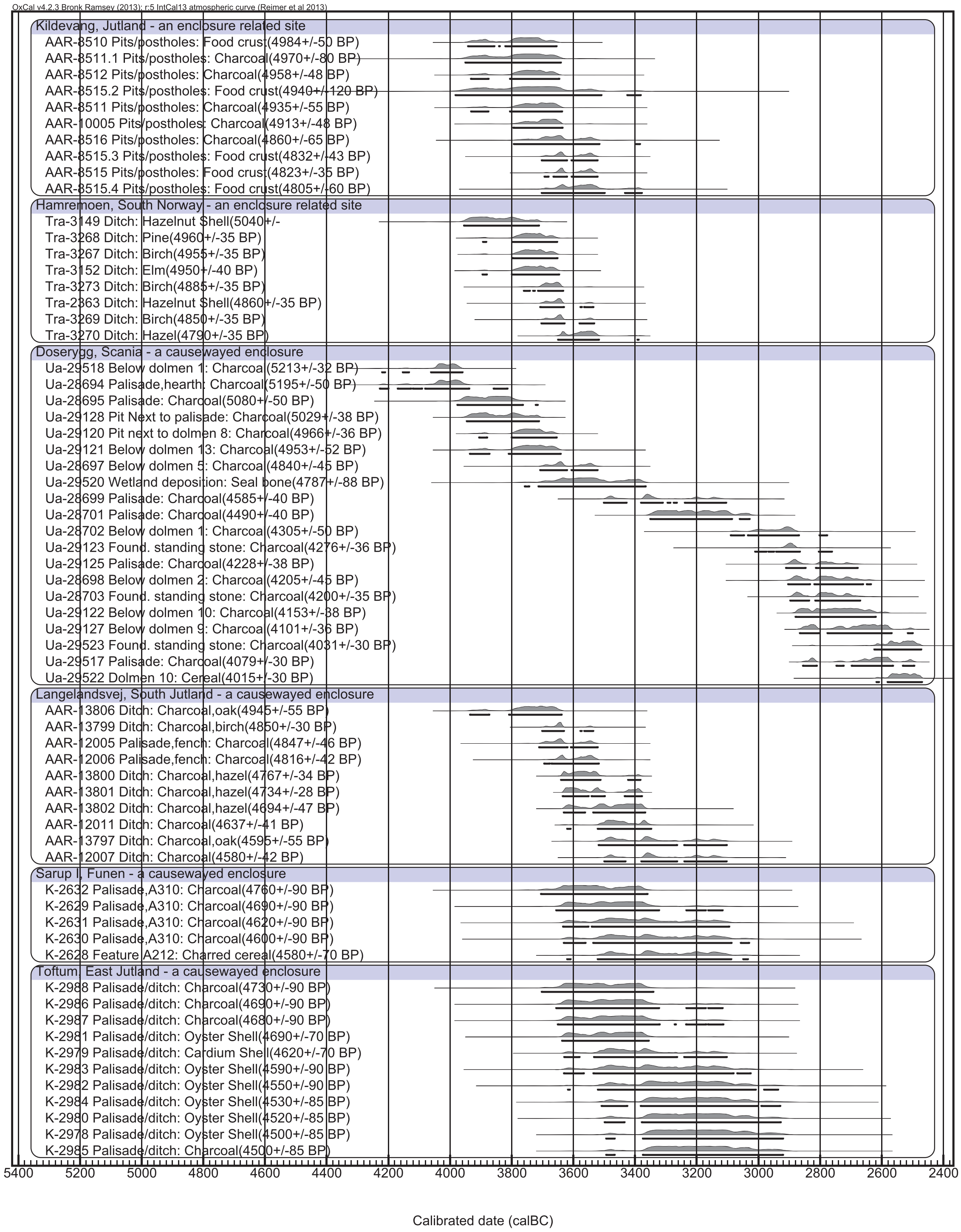


Fig. V. 174. [14]C dates of organic material found in the palisades, fences or ditches from enclosure related sites and causewayed enclosures in South Scandinavia. After Madsen 1988; Andersen 1997; Westphal 2005; Skousen 2008; Lützau Pedersen & Witte 2012; Andersson & Wallebom 2013; Glørstad & Sundström 2014. Data after Table 31.

of megaliths and causewayed enclosures indicate that there should be the potential for finding such structures in Västergötland (Madsen 1988; Persson & Sjögren 2001; N. H. Andersen 2009). Perhaps the archaeological visibility of these enclosures is particularly low, as many of these areas have been subjected to modern cultivation. Nevertheless, many new causewayed enclosures are still being found in Denmark. Some of these causewayed enclosures could have been built during the late EN I phase, thus making them contemporary with the long barrows (Klassen 2014b).

During the late EN I and EN II phases the stray finds presented in section 9.9 reflect a more intensified use of the landscape, which may have resulted in conflicts over territorial rights. The increased use of the landscape may have been connected to population pressure, combined with more intensive cultivation methods, as the earliest ^{14}C dates for ploughing are between c. 3800 and 3600 cal BC, as discussed in section 7.1. Furthermore, skeletons from bogs, which have been ^{14}C dated to the late EN I and EN II phases, also show signs of violence (Bennike & Alexandersen 2007, 146). At such times it would have made sense to build causewayed enclosures, thus corresponding to the pattern observed some centuries earlier in the Michelsberg culture, as discussed above. In the British Isles most causewayed enclosures were also built from around 3800 cal BC onwards, likewise corresponding with a more intensified use of the landscape, thus demonstrating the same pattern as observed in South Scandinavia (Åberg 1912; Manby 1979; Moore 1979; Bradley & Edmonds 1993; Pitts 1996; Oswald et al. 2001). Evidence of conflict has also been recorded in England, at the causewayed enclosure of Crickley Hill, where concentrations of arrowheads around the entrance areas may be evidence of a direct assault (Dixon 1988, 82). It seems likely that the pioneering stage lasted around 200 years, and was then followed by a consolidation phase, which involved territorial claims and the construction of long barrows, causewayed enclosures and later megaliths in the British Isles and South Scandinavia (Figs. V.175-176). Many of the causewayed enclosures in South Scandinavia resemble the location in the landscape and construction, such as oval-shaped structures with frequent ditches or dykes, of the earlier enclosures of the Michelsberg culture (Andersen 1997; Geschwinde & Raetzel-Fabian 2009; Klassen in press) (Plate 9). Furthermore, many of the causewayed enclosures in Denmark are apparently located near natural crossings in the landscape, and thus served as important monuments in the transportation network during the Early Funnel Beaker Culture (Müller 1904; Madsen 1988; N. H. Andersen 1997; 2009; Klassen 2014b). As argued above, the causewayed enclosures may have had a number of functions, as places of refuge where farmers could store their crops and at the same time initiate ritual practices.

11. INFLUENCES OF THE MICHELSBERG CULTURE AND IMMIGRATING FARMERS

Investigations into the material culture and structures of the Early Neolithic period in South Scandinavia have demonstrated some clear influences on the first farmers in South Scandinavia from the Michelsberg culture, as discussed in sections 8.8, 9.6, 9.7 and 9.8. It is therefore possible that an actual immigration of pioneering farmers to South Scandinavia was initiated by people who came from or were connected with the people of the Michelsberg culture. The hypothesis will be tested by investigating the criteria for migrations, as suggested by Anthony (1990). The push factors of the Michelsberg culture may have been related to a more intensive use of the landscape. This is particularly clear from Belgium, where Linearbandkeramik sites are located in small clusters and the Michelsberg sites continue to be located in the same concentrations, but also fill in the areas in between the clusters (Vanmontfort et al. 2008) (Fig. V.177). Such a settlement pattern would have increased the possibility of territorial conflicts, resulting in the construction of causewayed enclosures from the beginning of the Michelsberg culture around 4400 cal BC. The construction of long barrows during the transition between the 5th and 4th millennium BC may also have been associated with the desire to use these monumental burial structures as visible markers of territories in the landscape. The continued conflicts over territorial claims may have resulted in the leapfrog migration of small groups of pioneering farmers towards regions they already had sporadic contacts with, in connection with scouting expeditions to both the British Isles and South Scandinavia (Fig. V.178). Evidence of these scouting expeditions may include some of the few jade axes found in the British Isles and South Scandinavia, together with the rare agrarian evidence, such as the domesticated cattle at Ferriters Grove in Ireland, the sheep and

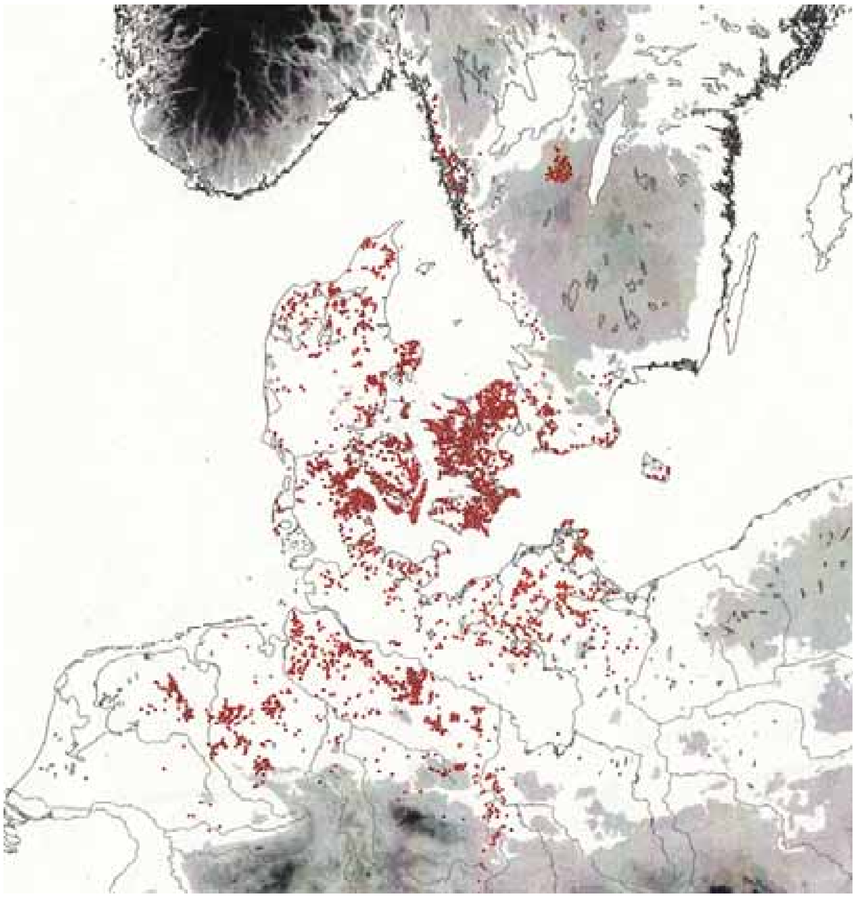


Fig. V. 175. Distribution of megaliths in Northern Europe. After Fritsch et al. 2010.

Fig. V. 176. Distribution of megaliths in Europe. After Fischer 1979; Kaul 1998a.

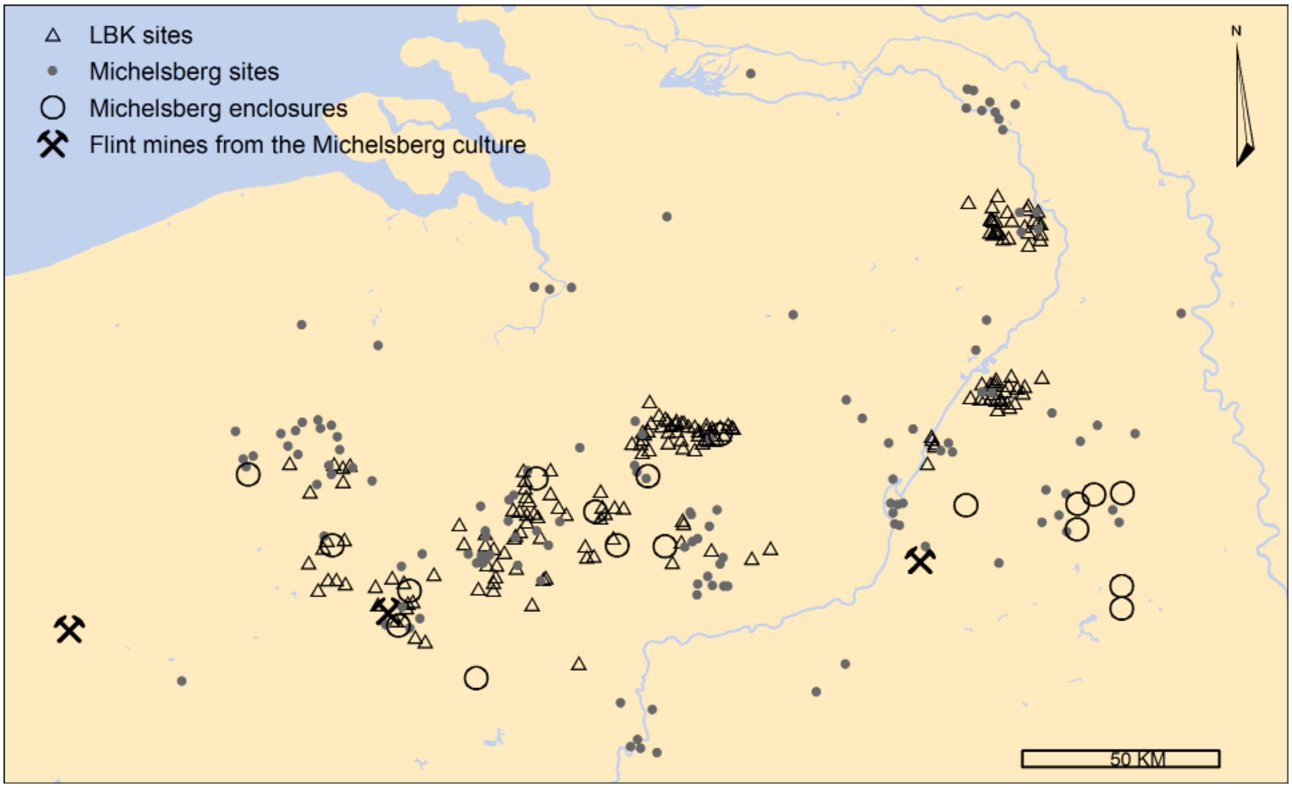


Fig. V. 177. Distribution of sites from the Linearbandkeramik culture and sites, causewayed enclosures and flint mines from the Michelsberg culture. After Vanmontfort et al. 2008.

goat bones from Wangels and the cereal grain impressions on Ertebølle sherds from Löddesborg and Vik in Scania (Jennbert 1984; Hartz & Lübke 2004; Sheridan 2010). The purpose of the scouting expeditions was to find areas with a significant pull effect. In general, the migrants were probably looking for areas which were similar to the regions they originally came from. One of the most important factors was an abundance of easily worked arable land, as well as regions that were sparsely populated with indigenous hunter-gatherers. Furthermore, the abundance of salt deposits in Central Germany and flint sources in South Scandinavia seem to have been of crucial importance. In particular, the establishment of flint mines and the production of flint axes is likely to have served both economic and symbolic purposes, as these objects were used to clear the forests, but were also systematically deposited in an unused condition at both settlement sites and especially in wetland areas. Furthermore, the axes may have been used to create an exchange network between the pioneering societies, which also established themselves in regions lacking in flint deposits. It is precisely at the ideal locations that pointed-butted axes are concentrated, where there are easily worked arable soils, a low density of Late Mesolithic sites and an abundance of flint deposits. The concentrations can be described as small "enclaves or colonies" of pioneering farmers, which demonstrate an agrarian expansion all the way up to the boundary between the boreonemoral and southern/middle boreal zones.

The methods of transportation may have included dugout canoes, as agrarian societies rapidly inhabited Bornholm, Gotland and Central Sweden during the Early Neolithic (Österholm 1989; Nielsen 2009; Rowley-Conwy 2011). Remains of Early Neolithic dugout canoes have been found in South Scandinavia which bear many similarities to those from the Mesolithic period (Christensen 1990) (Fig. V.179 and Table 68). However, new construction details have been observed in the dugout canoes of the

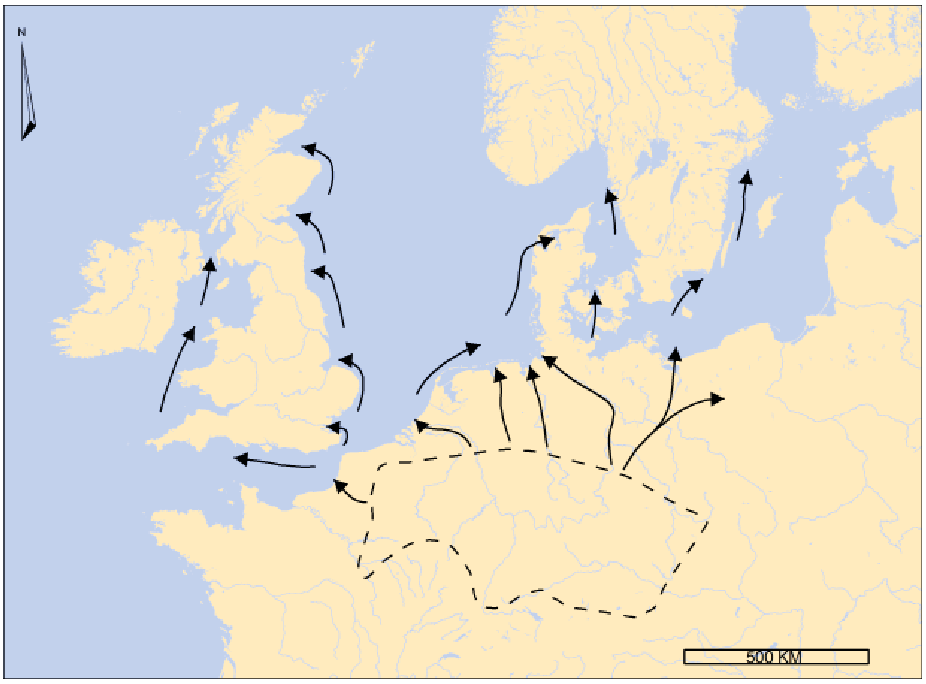


Fig. V. 178. The expansion of the Michelsberg culture towards the British Isles and South Scandinavia around the transition between the late 5th and early 4th millennium BC. After Sheridan 2010.

Funnel Beaker culture, which consist of regularly-placed holes along the gunwales of the vessels. The holes could have been used to attach strakes along the sides of the canoes, so that they could carry a heavier cargo. However, dugout canoes are unsuitable for carrying large amounts of cargo and living animals, especially in the case of heavy cargos or cattle, which make them unstable in the water. Alternatively, some of the animals may have been dragged through water, but this would only have been an appropriate method for shorter journeys, as the animals would have needed water at least once a day (Rowley-Conwy 2011). Calculations have shown that forty colonizing humans would have needed five to ten breeding pairs of each animal species and at least 250 kg of grain in order to establish an agrarian economy in foreign territories (Broodbank & Strasser 1991, 241; Rowley-Conwy 2011). Such a cargo would have weighed between 15 and 20 tons, which would have required many dugout canoes. However, if these agrarian farmers had the necessary technological skills to construct two-aisled houses, then it is also likely that they could produce plank-built boats similar to the ones found at Ferriby and Dover from the Early Bronze Age (Wright 1990; O. T. P. Roberts 2006). It has been questioned whether these plank-built boats with a flat base could have been seagoing vessels. But a recent study of the Ferriby 1 boat revealed a sweeping rocker, thus indicating that these boats had seagoing capabilities (O. T. P. Roberts 2006, 73). Unfortunately, no dugout canoes or plank-built boats have been found at Early Neolithic coastal sites in South Scandinavia. But a long, pointed paddle has been found at the Middle Neolithic coastal site of Spodsbjerg on Langeland, which could have been used in a seagoing vessel (Rieck & Crumlin-Pedersen 1988, 40; Sørensen 1998). The emergence of such plank-built boats may have made the transportation of living animals easier, as observed in historical records from the Stockholm archipelago, where cattle were transported back and forth between the many islands (Fig. V.180). These plank-built boats would have been of vital importance in connection with the expansion of agrarian societies to remote regions or islands in Scandinavia. The ideal time for such colonizing voyages would have been during the late summer months, after the harvest and before the winter (Rowley-Conwy 2011). In areas covered in snow during the winter period it would have been possible to use skis or sledges for transportation, as examples of these have been ^{14}C dated to the beginning of the 4th millennium BC (Baudou 1995; Naskali 1999; Kuokkanen 2000) (Table 68).

Using boats as means of transportation, these immigrating pioneer farmers brought with them a complete set of agrarian knowledge and material culture, which rapidly changed the material culture of the Late Ertebølle period. The rapid change and lack of any transitional forms in the pottery and lithic assemblages may indicate that the indigenous populations engaged themselves in learning processes and communities of practice, in order to learn the practices of a new material culture and agrarian techniques. The degree of involvement in these communities of practice would alter power relations between people, together with their identity, from which new agrarian societies would emerge. Perhaps it was of crucial importance for the immigrating farmers to involve the indigenous people in the project of becoming farmers, as they may have depended on the hunter-gatherers when they first arrived. In addition, clearing the forest was a time-consuming task, which would have been difficult if the immigrating farmers only consisted of a few people. The amount of engagement in these communities of practice also reflected the amount of knowledge gained about agrarian practices. The most difficult task to learn would have been the cultivation of crops. The lack of evidence of cultivation or crop processing activities at many of the coastal sites could indicate that they were inhabited by the indigenous population. But the inhabitants of the coastal sites did experiment with animal husbandry, as domesticated animals have been found at many of these sites. It is not before the late EN I and EN II that cultivation and animal husbandry activities are observed at the coastal sites. However, the agrarian inland sites had since the early EN I been located on easily worked arable soils, and expanded further into more marginal areas from around 3800 cal BC. The expansion may have been caused by a probable combination of population growth and the emergence of the plough, which may have resulted in periods of stress, and increased the need to establish territorial markers in the landscape and gathering places of refuge, as shown by the construction of long barrows and causewayed enclosures. Construction details indicate that the first pioneering farmers and their descendants were part of a larger European agrarian network, as is shown by the emergence of these structures in times of stress and the many exotic artefacts of jade and copper found in South Scandinavia. The fact that the meaning behind these artefacts was not lost, is shown by the numerous imitations of these objects. If the immigrating pioneer farmers came from the Michelsberg culture, then it should be possible to identify a return migration to the place of origin, which could be represented by artefacts of South Scandinavia origin found in Central Europe at the beginning of the 4th millennium BC. A fragment of an amber bead has been found at Bad Buchau in southern Germany in layers dating from 4000 to 3800 cal BC (Heumüller 2009). The pointed-butted axes of the types Glis-weisweil and Zug are concentrated in this area, as discussed in section 9.6, which may suggest a connection with this particular region. But the amber bead could just as well have originated in Poland, which means that it is generally difficult to find any objects from southern Scandinavia in Central Europe. The flint axes could also have been part of a return of material, but provenance analysis makes it difficult to trace their exact origin, as discussed in section 3.12. It is particularly difficult when the material culture is very similar over a large area, as it is the case with the short-necked funnel beakers or the pointed-butted axes. At present, it is not possible to identify any return migrations back to the place of origin between South Scandinavia and Central Europe during the early 4th millennium BC. However, if the push factors were still present at the place of origin, then no return migrations would have occurred (Anthony 1990).

11.1. The similarities between the lithic and faunal assemblages of the Michelsberg and Early Funnel Beaker cultures

When investigating the typical Michelsberg sites, many similarities with Early Funnel Beaker sites located on easily worked arable soils become apparent. The Michelsberg sites in Belgium are located on clayey sand subsoils. The sites are associated with a small number of pits containing objects from the Michelsberg culture, including short-necked funnel beakers, pointed-butted axes, flake axes, ordinary blades, disc-shaped flake scrapers, transverse arrowheads and flake perforators, thus showing many similarities with Early Neolithic Funnel Beaker assemblages from South Scandinavia (Nielsen 1985; Vermeersch 1988; Vanmontfort

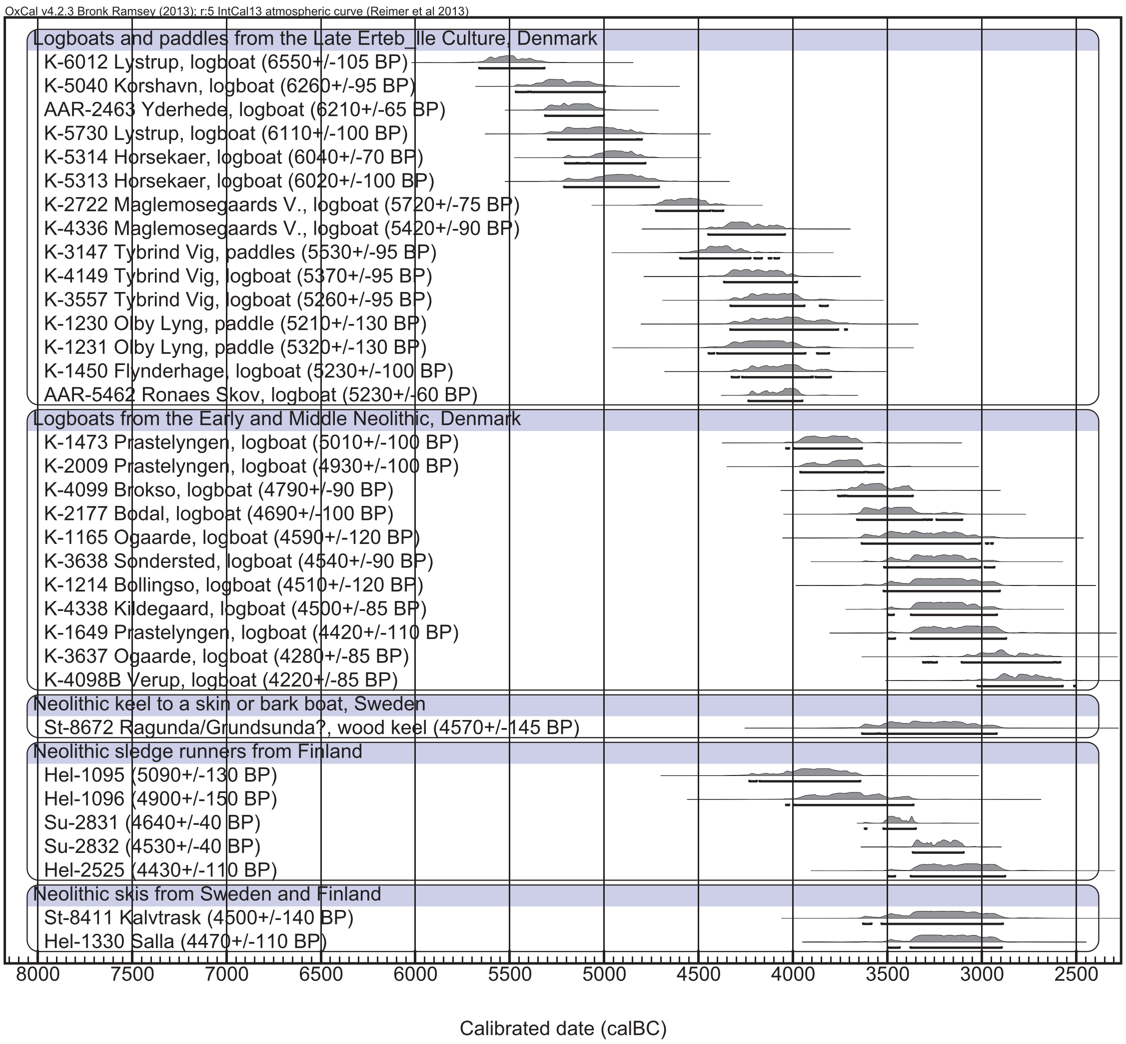


Fig. V. 179. [14]C dates of paddles, dugout canoes, sledge runners and skies from the Late Ertebølle culture and Early Neolithic in Scandinavia. After Rieck & Crumlin-Pedersen 1988; Christensen 1990; Dencker 1992; Baudou 1995; Nilsson 1995; Andersen 1996; 2009; Christensen 1997; Naskali 1999; Kuokkanen 2000; Louwe Kooijmans 2001; Hartz 2004; Labes 2004; Skaarup & Grøn 2004; Price & Gebauer 2005; S. H. Andersen 2009; Skriver & Borup 2012. Data after Table 68.

et al. 2008). However, flint assemblages from the Early Neolithic in South Scandinavia have been used to argue for a continuity with the Late Ertebølle culture (Nielsen 1985; Stafford 1999). It has been stated that flake axes and blade knapping technology are typical features of Ertebølle culture. But flake axes are also very common in the Michelsberg culture, which is the case in some of the French assemblages from Cerny and Chasséen septentrional. Polished flake axes of the Havnelev type have even been found at the Michelsberg sites of Schorisse-Bosstraat and Thieusies in Belgium, in contexts [14]C dated to between the late 5th and early 4th millennium BC (Mathiassen 1940; P. O. Nielsen 1985; 1994; Breuning 1987, 194; Vermeersch 1988, 19; Vermeersch et al. 1991, 205) (Figs. V.181-182). Furthermore, polished flake axes of the Havnelev type have also been identified from South Scandinavia in pits at the site at Almhov, which have been [14]C dated to between 4000 and 3800 cal BC (Rudebeck 2010) (Fig. V.183 and Table 32). It is therefore clear that the tradition of polishing flake axes may have come from the pioneering agrarian societies that originated from the Michelsberg culture.

Fig. V. 180. Fischer-farmers transporting cows in small boats between the smaller islands in the Stockholm archipelago in the beginning of the 20th century. Photo. Ivar Oman, Stockholm 1902.

A comparison of the lithic assemblages from Michelsberg, Late Ertebølle and Early Funnel Beaker inland sites of the late 5th and early 4th millennium BC was undertaken in order to investigate similarities and differences (Tables 33-34). This comparison showed that the Michelsberg and Early Funnel Beaker assemblages are very similar, whilst the assemblages from the Late Ertebølle culture differ. The assemblages from the Michelsberg and Early Funnel Beaker cultures contain significant numbers of tools produced from flakes and smaller numbers of blade tools, whilst the Late Ertebølle assemblages are dominated by blade tools. Furthermore, the assemblages from both the Michelsberg and Early Funnel Beaker cultures contain transverse arrowheads, flake axes and pointed-butted axes. The perforators made from flakes also show morphological similarities between the two cultures. One exception is the triangular arrowheads of the Michelsberg culture, which are not found in the assemblages from South Scandinavia (Figs. V.184-185). However, if the founders of the first agrarian societies in South Scandinavia did not use triangular arrowheads, then the tradition of making them was abandoned (Anthony 1990). The lithic assemblages of the Ertebølle sites have a different content, dominated by transverse arrowheads and a limited number of flake tools compared to both the Michelsberg and Early Funnel Beaker sites. In general, the lithic assemblages therefore show more similarities between the Michelsberg and the Early Funnel Beaker cultures, and little continuity with the Late Ertebølle assemblages.

There are also similarities between the faunal assemblages of the Michelsberg and Early Funnel Beaker inland sites, as both are dominated by domesticated animals, with limited quantities of wild fauna (Fig. V.186 and Table 35). All these archaeological evidences confirm the migration patterns, thus supporting the argument that the primary carriers of agrarian practices and societies were immigrating farmers, who originated from or had close relations to the Michelsberg culture. However, the speed with which the forest was cleared and the indigenous population was fully engaged varied from region to region, which will be investigated and discussed in the following section.

12. REGIONAL INVESTIGATIONS OF SETTLEMENT CHANGES BETWEEN THE LATE ERTEBØLLE CULTURE AND THE EARLY FUNNEL BEAKER CULTURE

Detailed regional investigations, integrating all stray finds, sites and structures from the Late Ertebølle and Early Funnel Beaker cultures, may show different pictures of the agrarian expansion.

It is thus possible to investigate and discuss the complexity of the Neolithisation process, which is examined in selected regions of South Scandinavia (Note 1) (Plate 10).

12.1. Northern Germany and Poland

In northern Germany and Poland the evidence of agrarian practices has been attributed to the Late Ertebølle and the Early Funnel Beaker culture coastal sites, and these practices are interpreted as being introduced in steps (Hartz et al. 2007, 567ff; Czekaj-Zastawny et al. 2011a, 43ff). Generally, it is argued that the first domesticated animals (sheep, goats and cattle) are found during the Late Ertebølle and Early Funnel Beaker cultures, whereas cereals appear as impressions on pottery from the beginning of the Funnel Beaker culture, thus refuting the idea of a "Neolithic package". It is also argued that the adoption of agrarian practices in steps was not associated with any climatic events or decline in resources, but can be interpreted in terms of exchange relations and possibly a de-

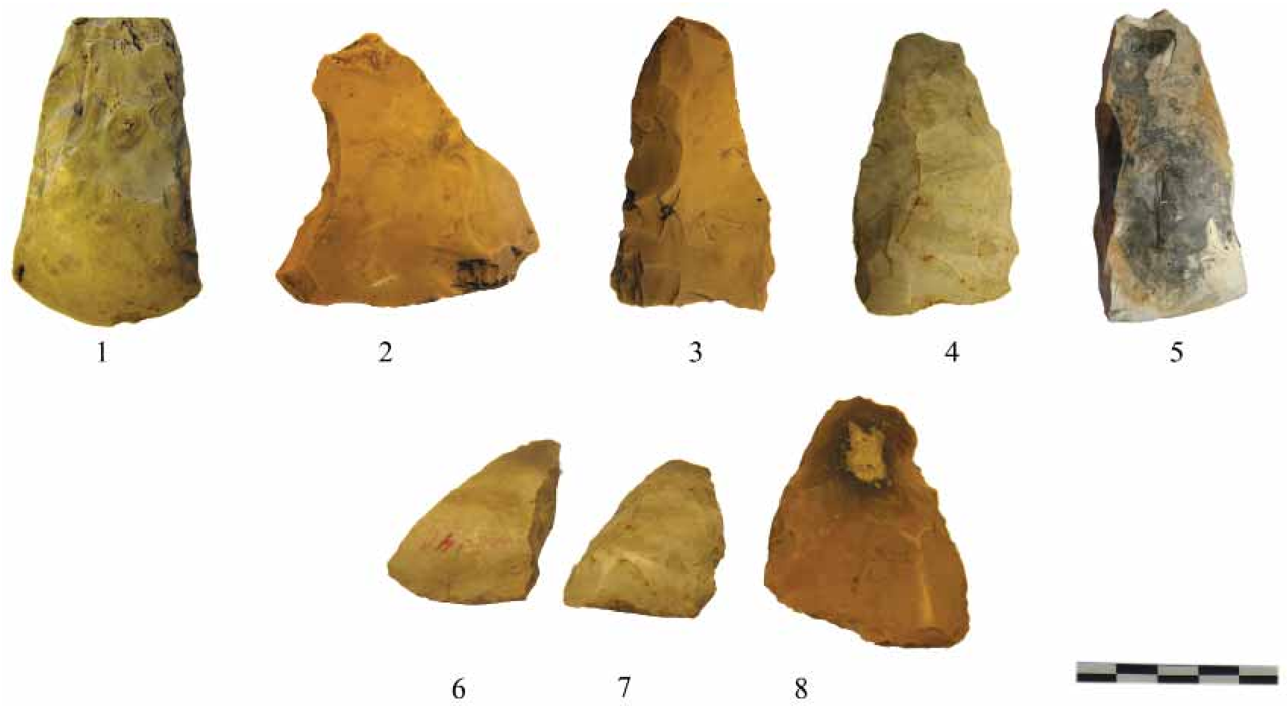


Fig. V. 181. Polished flake axes from South Scandinavia. 1. Almhov, Scania (A19049), 2. Almhov, Scania (A19049), 3. Almhov, Scania (A32422), 4. Torna, Scania (LUHM 14096), 5. Oringe, south Zealand, 6. Oxie, Scania (LHUM 17600), 7. Fru Alsted, Scania (LUHM 1367:9), 8. Skytts, Scania (LUHM 18656).

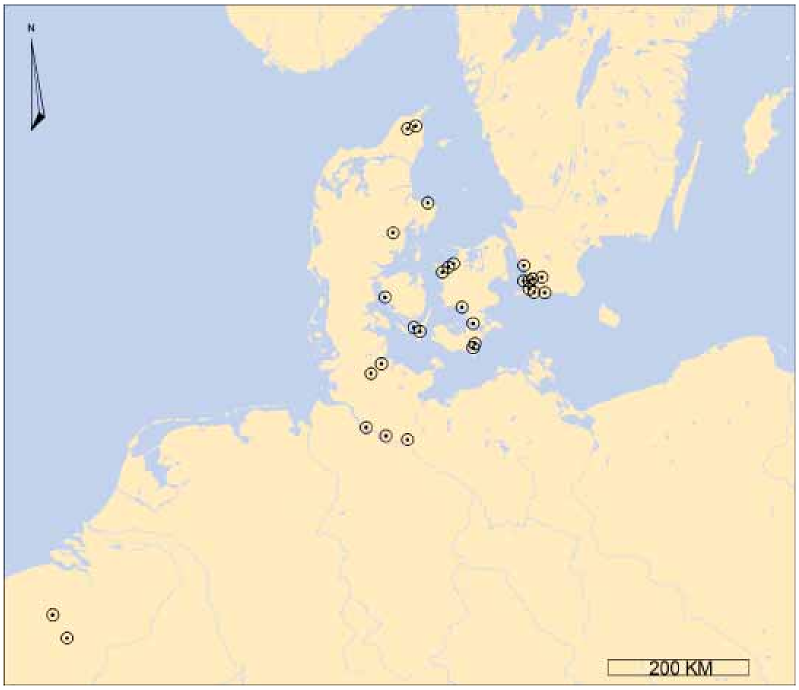


Fig. V. 182. Distribution of polished flake axes in Northern Europe. After Rydbeck 1916; Kersten 1951; Becker 1954; Schindler 1961; Ahrens 1966; Salomonsson 1970; Skaarup 1985; Breuning 1987; Vermeersch et al. 1991; Hedges et al. 1995; Rudebeck 2010. Data after Table 32.

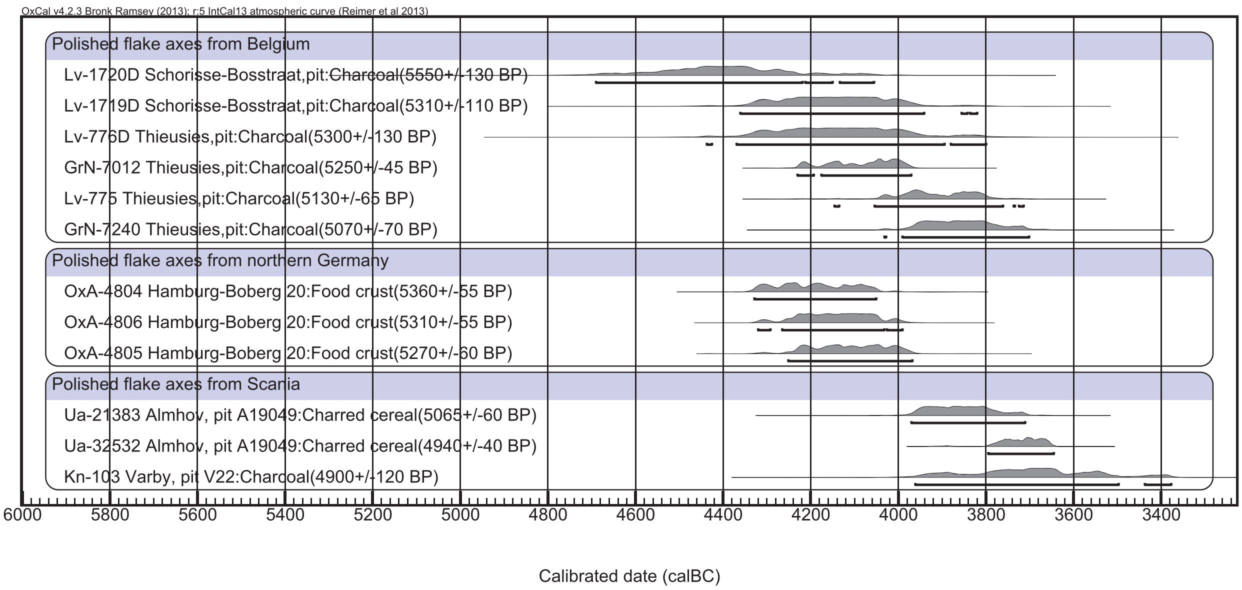


Fig. V. 183. ^{14}C dates of organic material found in contexts containing polished flake axes from sites belonging to the Michelsberg culture and the early Funnel Beaker culture. After Salomonsson 1970; Breuning 1987; Vermeersch et al. 1991; Hedges et al. 1995; Rudebeck 2010 Data after Table 32.

gree of integration with neighbouring agrarian societies. However, all these coastal sites do not contain any transitional layers, as transgressions have created mixed cultural layers at sites like Siggeneben-Süd (Meurers-Balke 1983), Wangels (Hartz 1999a), Rosenhof (Hartz 1999b), Neustadt (Glykou 2011), Baabe (Hirsch et al. 2008) and Dąbki (Czekaj-Zastawny et al. 2011b, 55ff). It is therefore difficult to document that the agrarian impulses actually came in steps. Instead, the few pieces of evidence of domesticated animals from the Late Ertebølle culture may be interpreted as the result of scouting expeditions. Such expeditions could have been undertaken by immigrating farmers, who were seeking new alliances and areas in which to establish new agrarian societies, as part of an expansion of the Michelsberg culture at the end of the 5th and beginning of the 4th millennium BC (Klassen 2004; Hartz et al. 2007).

A few inland sites, like Flintbek (Zich 1993) and Brunn 17 (Vogt 2009), have produced pottery assemblages showing similarities with pottery from the Michelsberg culture, which may indicate that they represented whole agrarian societies, consisting of men, women and children (Lüning 1968). These inland sites probably represent the first pioneering farmers, thus supporting the theory of increasing influence of agrarian Michelsberg groups on the hunter-gatherers living at the lake shore or coastal sites along the Baltic coast. At present, there is still only very limited knowledge about these inland sites located on workable arable soils and their density. However, the investigations of stray finds of pointed-butted axes demonstrate a scattered and widespread distribution within the inland area, which could be interpreted as settlement of the first pioneering farmers. Pointed-butted axes have also been found at the lake shore and coastal sites, thus showing that the indigenous hunter-gatherers were involved in the transformation process (Fig. V.187). The rapid change in material culture at the coastal and lake shore sites, and the lack of any transitional forms, indicate that the indigenous hunter-gatherers were involved in communities of practice with the pioneering farmers. At the site of Wangels, cereal grain impressions on funnel beakers and clay discs have been identified, thus showing beginning of cultivation practices (Hartz 1999a, 30). Alternatively, the coastal and lake shore sites could also be interpreted as seasonal fishing and hunting camps, which were used by farmers commuting between the coastal and inland zone. However, the question is difficult to resolve, because very few Early Neolithic coastal sites from the

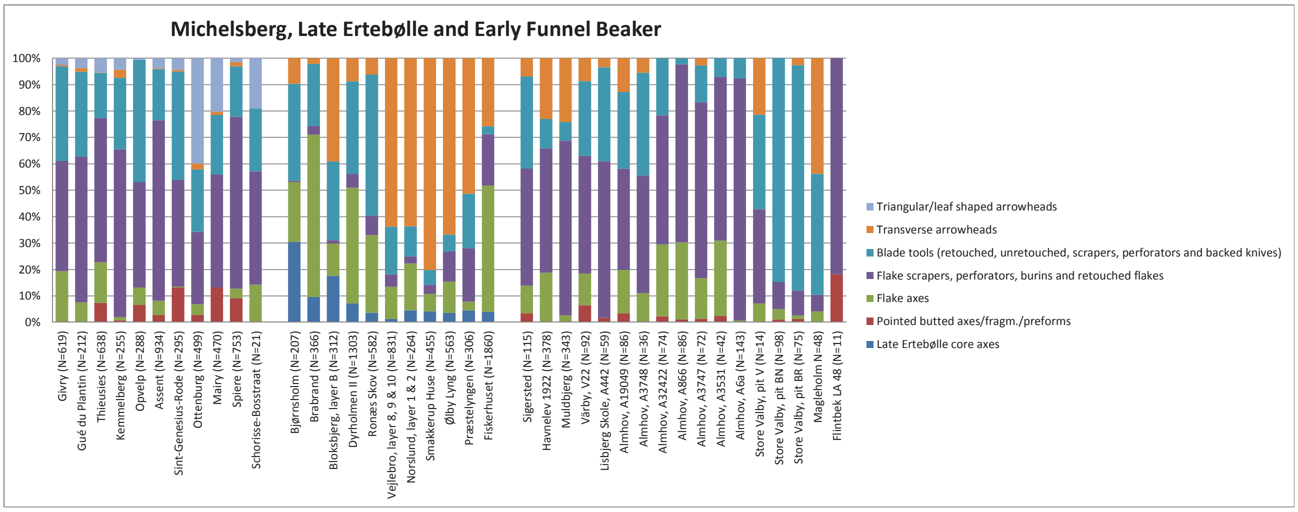


Fig. V. 184. Flint assemblages from different Central European Michelsberg sites dated to the transition between the 5th and 4th millennium BC, which is compared with southern Scandinavian assemblages from Late Ertebølle and Early Neolithic phase I sites. After Becker 1954; Salomonsson 1970; P. O. Nielsen 1985; 1994; Vermeersch 1988; Vermeersch et al. 1991; Zich 1993; Stafford 1999; Andreasen 2002; Juel 2004; Price & Gebauer 2005; Skousen 2008; Rudebeck 2010. Data after Tables 33 and 34.

late EN I and EN II phases of the Funnel Beaker culture have been excavated in Schleswig-Holstein (Hartz et al. 2007). Furthermore, it is difficult to separate the Early Funnel Beaker layers from one another at these coastal settlements. Nevertheless, it is clear, based on the distribution of pointed-butted axes, that the early EN I phase can be characterized as a pioneering stage, in which the focus was to establish an agrarian society in this region. The distribution of thin-butted axes during the following late EN I and EN II phases shows a much more dense concentration of axes in the inland zone, which could be interpreted as a stage of consolidation and expansion of these agrarian societies (Tode 1935; Lüth 2011) (Figs. V.188-189). The increased activities in the inland zone during the late EN I and EN II have also been confirmed by pollen analysis of material from sites in the southern parts of Schleswig-Holstein (Feeser et al. 2012, 170f). The distribution of pointed-butted axes and short-necked funnel beakers shows clear concentrations in Binnenland, located in Mecklenburg-Vorpommeren, which may have contained pioneering bridgeheads to regions like Scania (Brauer 1999; Moore 2001; Vogt 2009) (Fig. V.105). In this case the transportation of animals, people and material culture by boats was of fundamental importance. People could have sailed to southern Scandinavia along coastlines and larger streams and rivers, thus spreading new ideas and technology, whilst still maintaining contact with their places of origin (Rowley-Conwy 2011).

Further to the east, at the site of Dąbki 9 in northern Poland, pottery has been found which is associated the agrarian Hungarian Bodrogkeresztúr culture dated to the late 5th and early 4th millennium BC. But whether these sherds result from immigration, or from direct or indirect exchange with indigenous Ertebølle hunter-gatherers, remains unanswered (Czekaj-Zastawny et al. 2011a, 43ff). It was previously thought that the Funnel Beaker culture originated in the Polish Plain (Becker 1947; Gabałówna 1970; Lichardus 1976; Wilak 1982; Midgley 1992; Persson 1999). However, short necked funnel beakers found in pits ^{14}C dated from 4000 to 3800 cal BC at the site Redecz Krukowy 20 (Wstępne 2012, 216) support a large-scale synchronic introduction of material culture and long barrows by the agrarian Michelsberg culture in many parts of northern Europe between the 5th and 4th millennium BC (Höhn 2002; Klassen 2004; Hallgren 2008; Sheridan 2010; Rassmann 2011; Rowley-Conwy 2011; Rzepecki 2011; Pétrequin et al. 2012a).

12.2. Northern Jutland

An example of a regional investigation is Søren H Andersen's important excavations in northern Jutland of

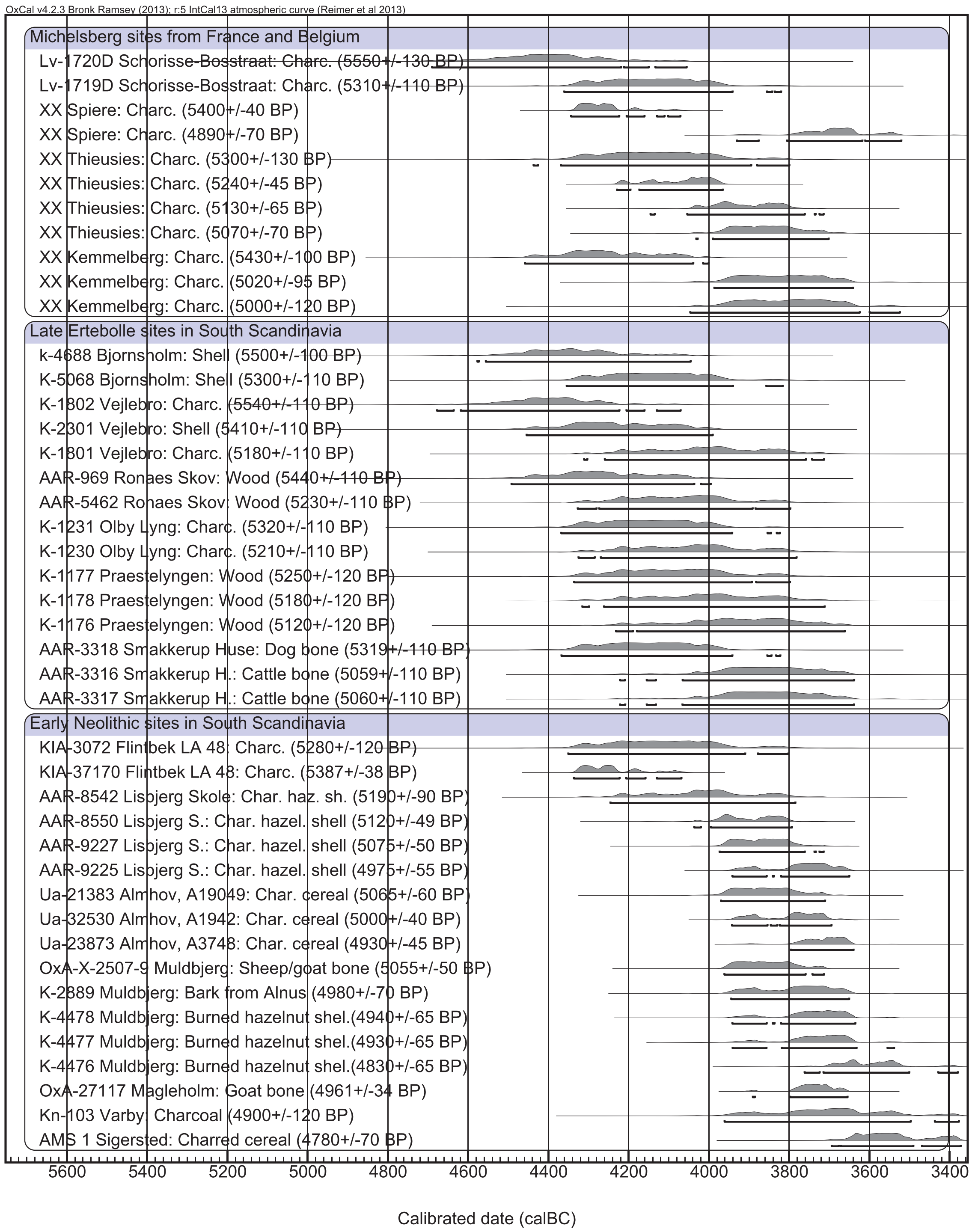


Fig. V. 185. [14]C dates of organic material found in contexts containing the presented lithic assemblages from Central European Michelsberg sites, Late Ertebølle and Early Neolithic sites in South Scandinavia. After Andersen & Malmros 1966; 1981; Brinch Petersen 1970; Salomonsson 1970; Malmros 1975; P. O. Nielsen 1985; 1994; Vermeersch 1988; Vermeersch et al. 1991; Vermeersch & Burnez-Lanotte 1998; Zich 1993; Stafford 1999; Andreasen 2002; Price & Gebauer 2005; Skousen 2008; Vanmontfort et al. 2008; S. H. Andersen 2009; Rudebeck 2010. Data after Tables 33 and 34.

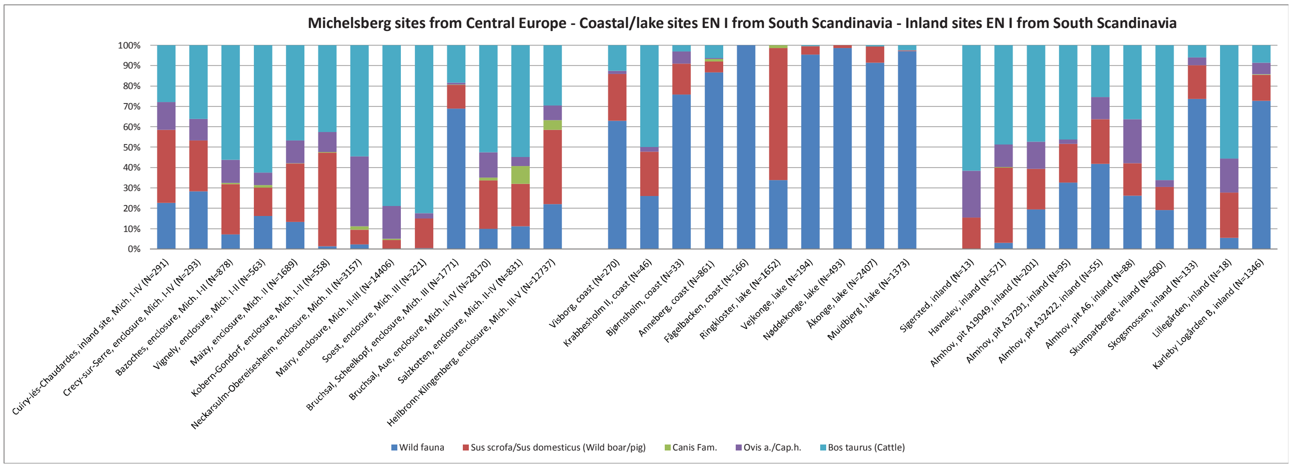


Fig. V. 186. Faunal assemblages from coastal, lake shore and inland sites dated to EN I in southern Scandinavia, which are shown together with faunal data from various Michelsberg sites in Central Europe. After Nielsen 1985; Bratlund 1993; Noe-Nygaard 1995; Lekberg 1997; Gotfredsen 1998; Koch 1998; Segerberg 1999; Sjögren 2003; Hallgren 2008; Welinder et al. 2009; Enghoff 2011; Hachem 2011; Höltkemeier 2011. Data after Table 35.

kitchen middens containing layers from the Late Ertebølle and the Early Funnel Beaker cultures (Andersen 2008a). Andersen favours a slow transition, based on the coastal orientation of many funnel beaker sites and the absence of large inland sites in northern Jutland. Furthermore, in his excavations of the Early Neolithic kitchen middens in northern Jutland (Norsminde, Bjørnsholm, Visborg, Krabbesholm and Havnø) Andersen has not found any evidence of large-scale cultivation or animal husbandry. The limited agrarian activities have led to researchers arguing that these were short-term seasonal catching sites, with the actual agrarian settlement sites located further inland (Madsen 1982; Skaarup 1982; Nielsen 1985). However, Andersen states that the distinction between coastal and inland sites is artificial. He interprets the majority of Early Neolithic sites as oriented towards the coast and in a few cases along streams and lakes, where the main activity was foraging. Andersen describes these people as fisher-farmers, but acknowledges that the changes in material culture were rapid, whilst the introduction of the agrarian way of life was a long process, thus supporting the availability model (Rowley-Conwy & Zvelebil 1984). The hypothesis can be tested by examining the distribution of sites and stray finds from the Late Ertebølle and Early Funnel Beaker cultures.

During the Late Ertebølle period the sites and finds are concentrated in coastal zones, with very limited activity in inland zones. In the Early Funnel Beaker period pointed-butted axes have been found in the coastal zone along the Limfjord, but there are also concentrations of axes in the inland zone in the districts of Vendsyssel and Thy. Even if the sea level was nine metres higher, as was the case during the late 5th millennium BC, these Early Neolithic settlements would still have been located in the inland zone (Jensen 2001; Andersen 2008a) (Fig. V.190). These new concentrations can be interpreted as evidence of the first immigrating pioneer farmers settling in areas associated with limited activities of the Late Ertebølle culture, an abundance of easily worked arable soils and flint sources. Local exploitation of flint has already been discussed in relation to the flint mines at Hov and Bjerrre. But local flint sources have also been exploited in Vendsyssel, as 22 of the 50 pointed-butted axes are made from Danien flint (Table 59). We are perhaps dealing with two settlement systems during the Early Funnel Beaker culture, in which immigrating pioneering farmers were clearing the inland zone in order to cultivate new areas, while the coastal zone was inhabited by the indigenous population. The indigenous population had adopted animal husbandry practices and a new material culture from immigrating farmers. Rare finds of cereal grains and pollen have been recovered at sites like Visborg and Bjørnsholm, thus indicating that experiments in crop cultivation may have occurred at these sites as early as the early EN I phase (Andersen 2008a). It is therefore clear that the indigenous populations engaged themselves in communities of practice with pioneering farmers in order to learn agrarian practices. But it is not before the late

EN I and EN II that quern stones and clay discs demonstrate a growing focus on agricultural practices at these coastal sites (Andersen 2008a). It is also at this time that expansion into the interior parts of Himmerland can be observed, as shown by the distribution of long barrows and megaliths (Kristensen 1991; Ebbesen 2011) (Figs. V.191-192).

Alternatively, it could be argued that the coastal sites were inhabited by commuting farmers during the early EN I and that the real agrarian inland was located in some distance from the coast. The commuting theory could be tested by investigating the seasonal indicators present at the coastal kitchen midden sites from the Early Neolithic, which should reflect short durations. But unfortunately no such seasonal data is currently available from the Early Neolithic kitchen middens. However, the occupation layers in the kitchen middens show the same thickness for the Late Ertebølle and Early Funnel Beaker cultures, which challenge the idea of commuting farmers (Andersen 2008a). If there were agrarian inland sites located along the Limfjord, these would be revealed by the distribution of pointed-butted flint axes. But the inland zone of Himmerland has not produced many pointed-butted axes, thus indicating that the main sites were in fact located along the coast. The delayed exploitation of the inland zone of Himmerland may have been related to continued habitation of coastal areas, meaning that there was no immediate need to move further inland. In the Early Neolithic period the coastal region of the Limfjord area was characterized by an uplifting of land associated with easily worked arable sandy soils. The ideal areas for cultivation activities were therefore located in the vicinity of the coastal sites. Furthermore, the interior of Himmerland consists of several fjords, which could have been important for hunting, thus making it difficult for the first pioneering farmers to take up agrarian activities in this area.

12.3. Western Jutland

Western Jutland may also have been a region that pioneering farmers from Central Europe could have inhabited when sailing along the coast of Jutland. But characteristic behaviour in long-distance migration is to pass by large geographical areas without settling there and instead to choose to settle further away, which may have been determined by scouting expeditions. In general, the region of West Jutland had a very low density of occupation in the Late Ertebølle period, which seems to have been one of the more decisive factors in choosing new regions for habitation. However, the region is characterized by almost no flint sources and poor arable soils, which may have been the main reasons why western Jutland was rejected as a destination by the first pioneering farmers during the early EN I phase. But pointed-butted axes and battle axes do show a scattered distribution, with clustering occurring on the sandy hilltops, suggesting very sparse habitation during the early EN I. These sandy hilltops were very suitable for arable exploitation (Buchardt 2006; Møller 2011) (Fig. V.193). Nonetheless, it is not until the late EN I and EN II that the region shows a higher density of occupation, as indicated by the distribution of long barrows and megaliths, which are concentrated on the major hilltops (Thomsen 1977; Ebbesen 1979). Recently a causewayed enclosure has also been found near Filsø, thus showing the potential for discovering new sites and megaliths in this region (Andresen 2013). Perhaps the increased settlement in these areas of western Jutland during the later part of the Early Neolithic period could have been the result of new cultivation methods associated with the introduction of the plough. It may also have been due to increased territorial conflicts in neighbouring regions of South Scandinavia, which led to the exploitation of more marginal areas. A third possibility could have involved a later migration of agrarian societies from Central Europe.

12.4. North-West Zealand

The region of North-West Zealand has played a major role in the Neolithisation debate in South Scandinavia (Becker 1947; Troels-Smith 1954; 1957; Noe-Nygaard 1995; Koch 1998; Stafford 1999; Persson 1999; Fischer 2002; Price & Gebauer 2005; Fischer & Gotfredsen 2006; Brinch Petersen & Egeberg 2009; Schülke 2009a; 2009b; Craig et al. 2011; Sørensen & Karg 2012). The region is particularly important because it contains lake shore sites with organic materials located in the Åmose basin and because Therkel Mathiassen undertook a complete registration of structures and stray finds from all periods of the prehistory (Mathiassen 1959; Gotfredsen 1998) (Fig. V.194). Increasing focus has been placed upon excavations of lake shore sites in and near the Åmose basin (Troels-Smith 1957; Fischer 2002). On the basis of his excavations of sites in the Åmose area, Anders Fischer has created a new model to explain how the adoption of agriculture took place, in which the concept of a "Neo-

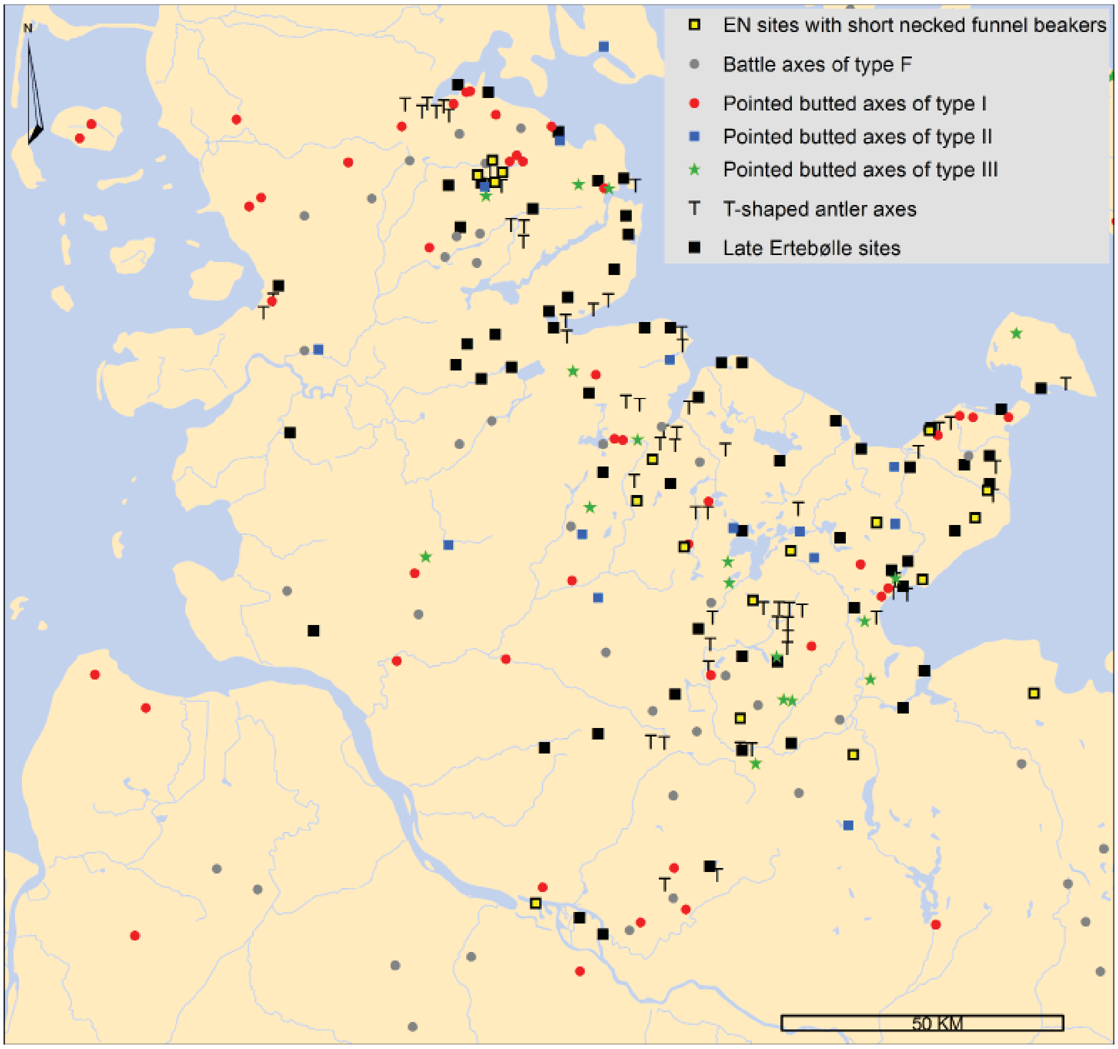


Fig. V. 187. Distribution of stray finds and sites from the Late Ertebølle and early Funnel Beaker culture in Schleswig-Holstein. After Zápotocký 1992; Zich 1993; Hartz et al. 2007; Sönke Hartz pers. comm. Data after Tables 59, 62 and Plate 4.

lithic package" is rejected. Instead, he argues that the introduction of agrarian practices was related to certain individuals, specialists or a small group of farmers, who transferred agrarian knowledge to specific groups of Ertebølle hunter-gatherers, thus increasing their prestige. The transitional lake shore sites in the Åmose basin could, according to Fischer, have been amongst the first locations where such an introduction of agrarian practices took place. The theory is supported by some of the earliest radiocarbon dates for cattle, sheep, goats and food residues on short-necked funnel beakers in southern Scandinavia. Furthermore, the lithic material apparently shows continuation of the production of core axes with specialized edges and many sites also include assemblages of both Ertebølle pottery and funnel beakers (Stafford 1999; Fischer 2002, 351). A transitional phase, characterized by a combination of both Ertebølle and funnel beaker traits, has also been suggested in connection with the excavations of the coastal site of Smakkerup Huse in North-West Zealand (Price & Gebauer 2005). However, there are problems with using the lake shore Åmose sites and coastal sites like Smakkerup Huse, as they involve intermixed layers from continuous occupation during the Late Ertebølle and Early Funnel Beaker cultures, as

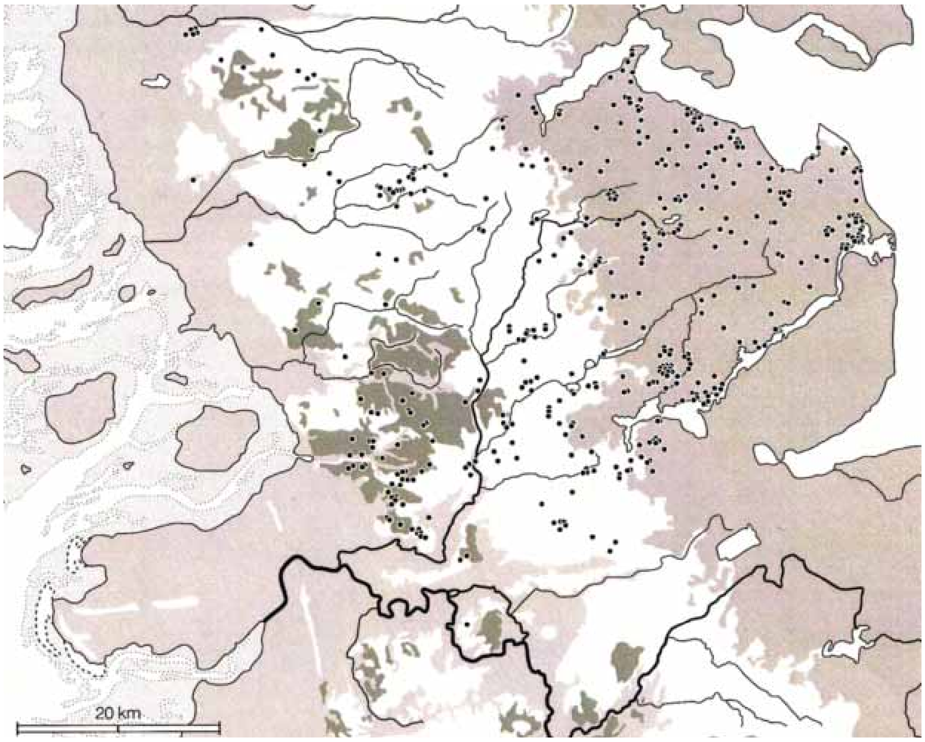


Fig. V. 188. Distribution of thin-butted flint axes of type I, II, III and IV from the late EN I and EN II in the southern parts of Schleswig-Holstein. After Lüth 2011.

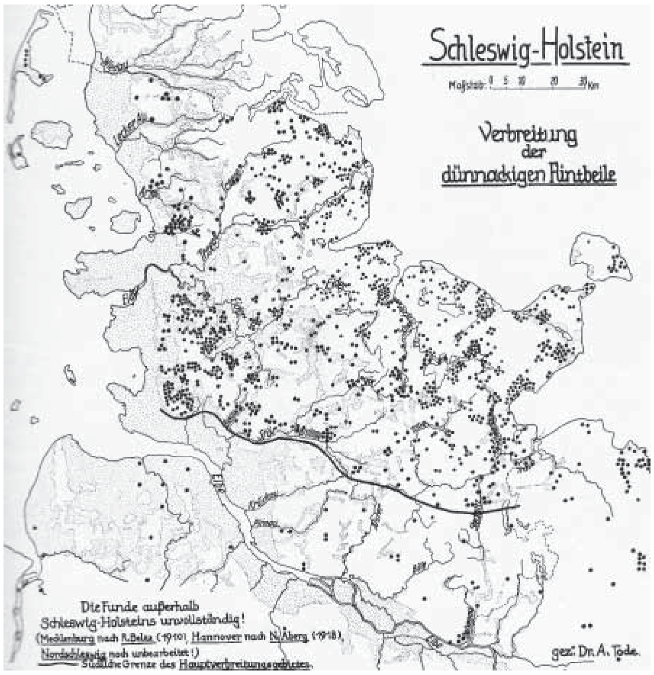


Fig. V. 189. Distribution of thin-butted axes from the Early Neolithic and Middle Neolithic in Schleswig-Holstein. After Tode 1935.

opposed to constituting actual transitional sites. Nevertheless, migrationism is maintained in Fischer's hypothesis, which is characterized by small groups of farmers, who become assimilated in a kind of symbiosis with the indigenous hunter-gatherers, thus also supporting the argument of integrationism. The hypothesis is supported by the Early Neolithic burial of a male at Dragsholm (Brinch Petersen 1974).

The grave of the male at Dragsholm was located near a double grave containing two females. The isotope values revealed marked differences; whereas the man had eaten a terrestrial diet, the two females had eaten a marine diet. It was originally suggested that there could have been a relationship between the male grave and the double female grave. However, recent radiocarbon dates have now concluded that the double grave belongs to the middle part of the Ertebølle culture, whereas the male grave is from the Early Funnel Beaker culture (Price et al. 2007). The burial of the Dragsholm man contained some significant finds, including a short-necked funnel beaker (Oxie/type 1) (Koch 1998), a polygonal battle axe of type F III (Zápotocký 1992), teardrop-shaped amber beads, flint blades and a wrist guard (Fig. V.195). The Dragsholm man has been interpreted in a number of ways, including as a shaman (Strassburg 2000, 356) and an archer or warrior (Brinch Petersen 2008). Recently, Brinch Petersen and Egeberg (2009) have interpreted the Dragsholm man as an individual who could promote a Neolithic way of life and a founder of an agrarian society, who thus was an exponent of an expansion, therefore supporting the hypothesis proposed by Fischer (2002). However this interpretation has recently been criticized by Midgley (2011, 124), who argues that the Dragsholm man was an average hunter and farmer, as he was not buried in a long barrow or long dolmen. Instead, he was buried in or near a kitchen midden, which was constantly exposed to transgressions during storms. However, the radiocarbon dates of the Dragsholm man are concentrated to around 4000-3800 cal BC (5102±37 BP, 3973-3798 cal BC, AAR-7416) (5090±65 BP, 4035-3712 cal BC, AAR-7418), when long barrows are rare in South Scandinavia. Some long barrows in South Scandinavia are associated with radiocarbon dates of around 4000 to 3800 cal BC, but these dates are unreliable, as earlier occupation is found stratigraphically beneath the barrows (Madsen 1975; Skaarup 1975; Madsen & Petersen 1984; Liversage 1981; 1992; Larsson 2002; Rudebeck 2002; Beck 2009; Hansen 2009). Moreover, we do not know whether or not the Dragsholm grave was originally covered by a visible mound. If this was the case it could have been destroyed by later transgressions (Price et al. 2007, 208). The Dragsholm burial also contained a polygonal battle axe, which was one of the most prestigious weapons of the Early Funnel Beaker culture, thus connecting the man with status and power (Zápotocký 1992; Ebbesen 1998; Hallgren 2008).

The Dragsholm man is therefore an important piece of evidence in the discussion of the expansion of agrarian societies and the adoption of a new ideology. The grave goods and terrestrial isotope values support the theory that he could have been one of the pioneering farmers, who during the early EN I phase tried to establish new agrarian societies at specific places in South Scandinavia. He may represent an example of a "Big man" who had the competences and ability to disseminate information about agrarian practices. The fact that he was buried as a warrior at a coastal site could indicate that he and other immigrating farmers were engaged in a community of practice, together with the indigenous population in this region. He and his fellow farmers could thus be interpreted as the primary carriers of agrarian practices and ideology, who laid the foundations for an agrarian society in north-western Zealand. The distribution of Late Ertebølle sites and pointed-butted axes indicate that changes did occur during the early EN I phase in north-western Zealand. Late Ertebølle sites are concentrated along the coast and around the larger lakes, whereas the majority of the pointed-butted axes have been found on easily worked arable soils in the higher terrain between the lakes and coastal area (Mathiassen 1959) (Fig. V.194). The pointed-butted axes may represent the distribution of these Early Neolithic sites, but unfortunately not many of these inland settlements have been excavated in north-western Zealand. Nevertheless, around 50% of the pointed-butted axes in North-West Zealand have been used, thus indicating that they have been found near an actual settlement site. Some pointed-butted axes have also been found at the coastal and lake shore sites, thus indicating a continuity in the settlement pattern during the Early Neolithic period.

Are we, as was the case in North Jutland, dealing with two settlement systems during the transitional phase in the Early Neolithic? This may have taken the form of two populations, consisting of immigrating farmers from

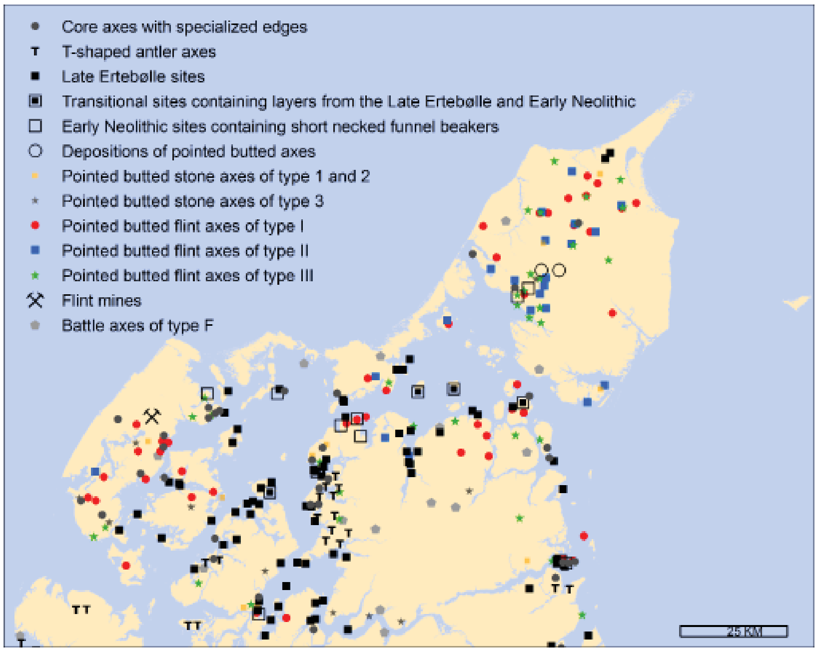


Fig. V. 190. Distribution of stray finds and sites from the Late Ertebølle and early Funnel Beaker culture in northern Jutland, where the sea level on the map is shown nine metres higher, which was the case during the late 5th millennium BC. After Nielsen 1977; Zápotocký 1992; Becker 1993; Ebbesen 1998; Jensen 2001; Haack Olsen 2003a; Andersen 2008a; 2008b; Per Lysdahl pers. comm. Data after Tables 54, 55, 56, 59, 63 and Plate 4.

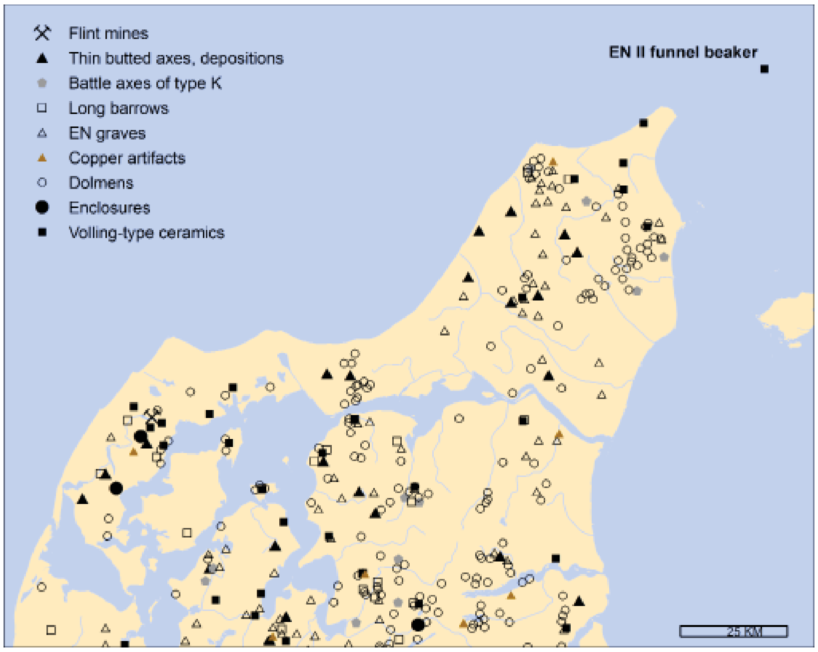


Fig. V. 191. Distribution of stray finds and sites from the late EN I, EN II and early Middle Neolithic in northern Jutland. After Nielsen 1977; 2004; Zápotocký 1992; Becker 1993; Ebbesen 1998; 2011; Andersen 2008a; Hansen 2010. Volling ceramics in North Jutland based on data from Madsen & Petersen 1984; Kristensen 1991; Becker 1993; Ebbesen 1994; Overgård 1996; 1997; Jensen 1998; Mikkelsen 2002; Jensen & Overgård 2002; Beck 2002; Haack Olsen 1997; 2002; 2003b; Andersen 2002; 2005; Rudebeck 2002; Nielsen 2004; Hansen 2009; Inge Kjær Kristensen pers. comm.; Per Lysdahl pers. comm. Data after Tables 60, 61, 63, 29, 30, 67 and Plate 4.

Fig. V. 192. Funnel beaker with horizontal belly lines (Koch's (1998) type IV) dated to the EN II recovered in the sea around five to seven nautical miles north of Skagen, at a depth of 120 metres. Bangsbo Museum no. 29529. After Ax 2007.

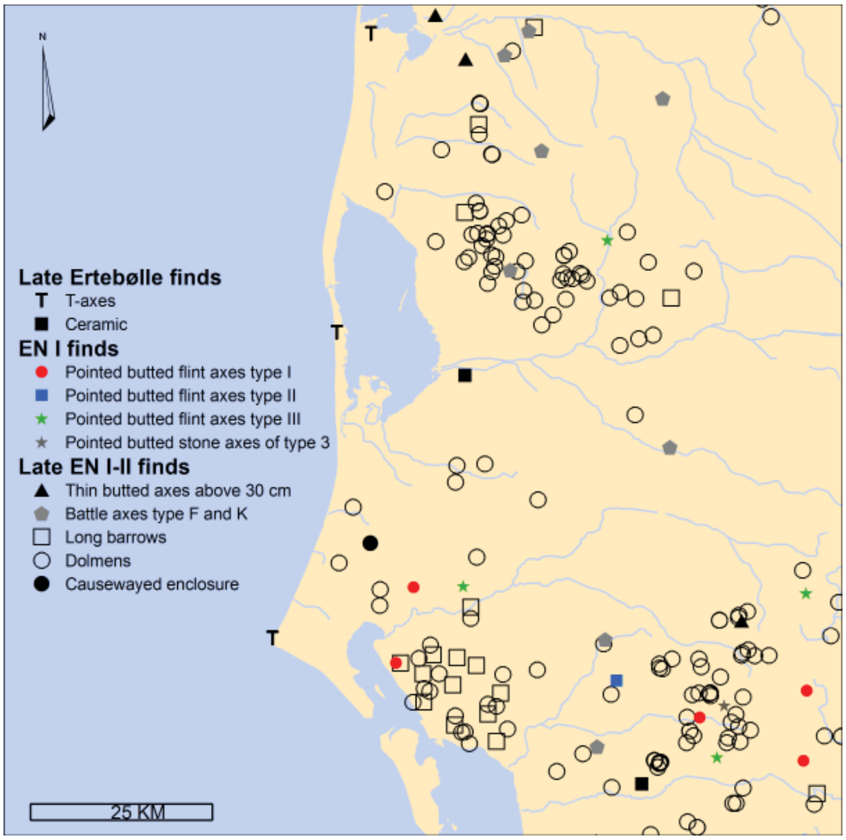


Fig. V. 193. Distribution of stray finds and sites from the Late Ertebølle and early Funnel Beaker culture in western Jutland. After Mathiassen 1948; Thomsen 1977; P. O. Nielsen 1977; 1994; 2004; Vang Petersen 1984; Ebbesen 1994; 2011; Andersen 1998a; 1998b; Hansen 2010; Andresen 2013. Data after Tables 54, 55, 56, 59, 60, 63, 29, 30, 67 and Plate 4.

Central Europe clearing the inland in order to cultivate new areas and of local hunter-gatherers in the coastal or lake shore zones, who wanted to adopt agrarian practices. Or are we dealing with one population of commuting farmers, who had their main habitation sites on easily worked arable soils and their seasonal camps on the coast or at lake shore sites? Once again, the lack of quern stones, clay discs and charred cereals from the lake shore sites in the Åmose basin indicates a corresponding lack of cultivation practices, thus supporting the idea of two populations exploiting their own part of the landscape (Troels-Smith 1957; Fischer 2002).

However, the seasonal aspects of the Early Neolithic lake shore sites in the Åmose basin indicate habitation from late spring to early autumn, suggesting that they were only occupied for short periods, which supports the commuting hypothesis (Fig. V.35). The emergence of a group of commuting farmers in the early EN I could suggest that the transition towards an agrarian society and the integration of the local hunter-gatherers was a swift process in this region. One of the reasons for the swift transition may have been that it is unlikely that any crop cultivation could have taken place on the lake shore sites of the Åmose basin, as they would have been located on soils that were too wet for cultivation. Instead, the area would have obviously been suitable for the grazing of cattle, sheep and goats, together with foraging activities during the warmer times of the year. The timing of these foraging activities could also have been combined with cultivation activities, with sowing taking place in the early spring. But a seasonal presence at the lake shore sites during the summer months would have conflicted with managing the fields and harvesting activities, unless these early farmers commuted between their fields and the lake shore sites. Alternatively, there could have been gender-related work divisions within these agrarian societies, with people simultaneously engaged in different activities in various areas of a local region. Foraging activities in particular may have served as an important supplement to agrarian food resources. It is therefore possible that early farmers from the Funnel Beaker culture commuted between lake shore sites and the more permanent inland sites located on workable arable soils. It is possible that the commuting also included the coastal region, but we currently do not have any seasonal data from Early Neolithic coastal sites in north-western Zealand. However, the burial of the Dragsholm man indicates that the coastal areas were being settled by the first farmers in the region. The exploitation of the landscape follows the same pattern of development as is observed in other regions of South Scandinavia. The pioneering phase involving small clusters of habitation during the early EN I is followed by an expansion, with most of the landscape showing signs of activity during the late EN I phase, which is reflected by dense concentrations of thin-butted axes, long barrows and later on megaliths (Fig. V.196).

12.5. Scania

Scania is a region where the transition towards an agrarian way of life was rapid and where a fully established agrarian society was present by the early EN I phase (Sørensen & Karg 2012). The Late Ertebølle sites and stray finds are concentrated along the coast and near the larger lakes in the interior zones of Scania (Jennbert 1984) (Fig. V.197). But the usage of the landscape changed rapidly during the early EN I phase (Hernek 1988) (Fig. V.198). A major change in the use of the landscape was also confirmed by the results of the Ystad project (Berglund 1991; Larsson 1992). The project involved a complete registration of prehistoric finds in the region near Ystad, which documented that the Ertebølle sites were located near the coast, but during the Early Neolithic period the settlement pattern changed, as several Early Funnel Beaker sites were found further inland, where they were located on easily worked arable soils (Fig. V.202). This pattern of the exploitation of the landscape was also confirmed by pollen analysis of samples taken from small lakes and bogs in the area surrounding Ystad (Berglund 1991). Normally, a pioneering stage can be documented in many regions of South Scandinavia, which is characterized by small concentrations of pointed-butted axes (Sørensen 2012a). The pioneering phase is then followed by a consolidation and expansion phase, in which the exploitation of the landscape becomes more intensive in a greater number of regional areas during the late EN I phase, as has been observed in Schleswig-Holstein, western Jutland, northern Jutland and North-West Zealand (Figs. V.200-201). However, this pioneering stage seems to have been skipped in Scania, which is shown by the very dense and widespread distribution of pointed-butted axes of type 1 by as early as the early EN I phase (Hernek 1988; Karsten 1994; Sørensen 2012a).

In particular, the area near the flint mines at Sallerup could have been one of the localities where pioneering

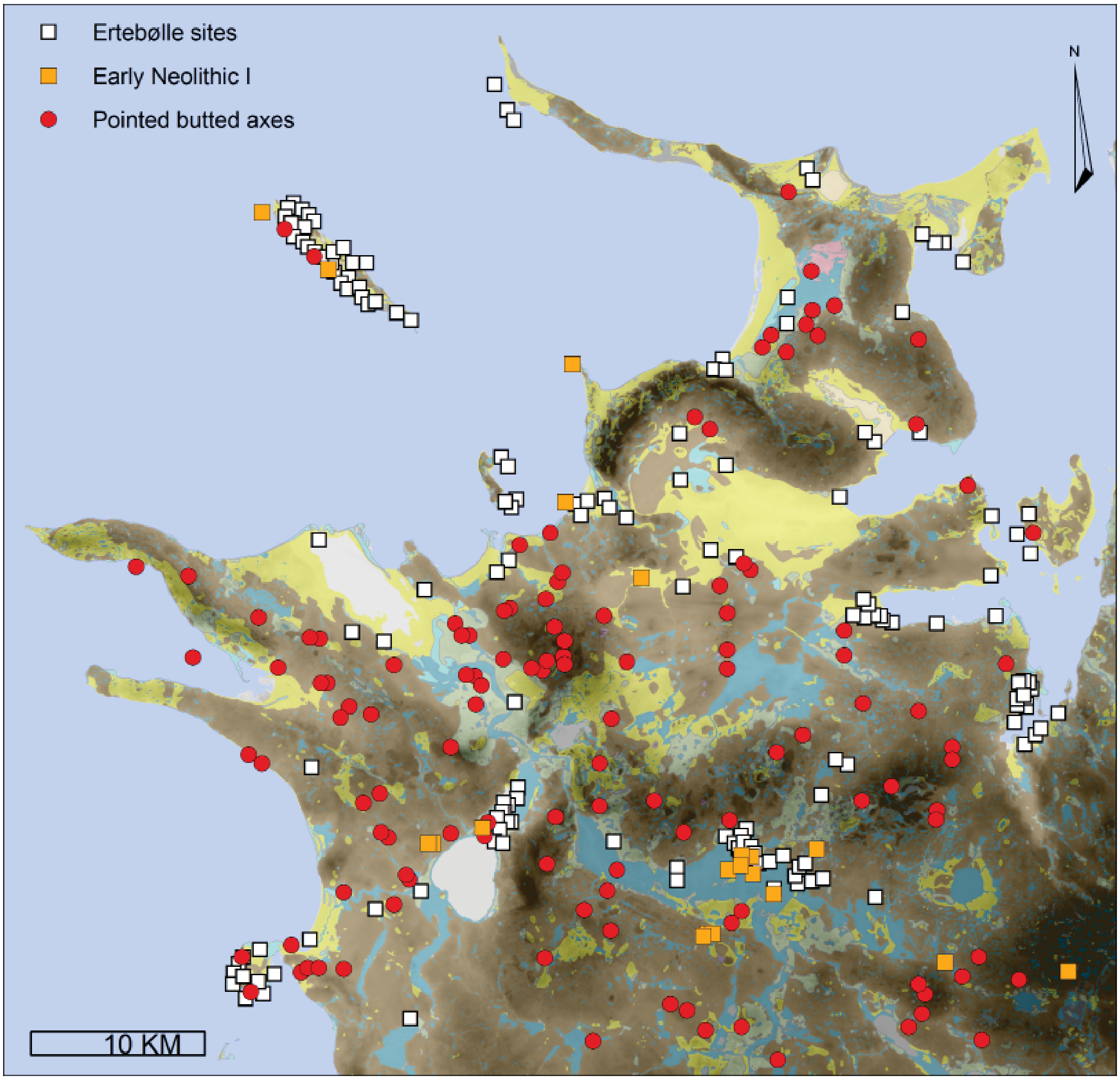


Fig. V. 194. Distribution of Ertebølle sites and possible Early Neolithic sites shown by plotting pointed-butted axes of type 1 and 2 in northwestern Zealand. After Mathiassen 1959. Data after Plate 4.

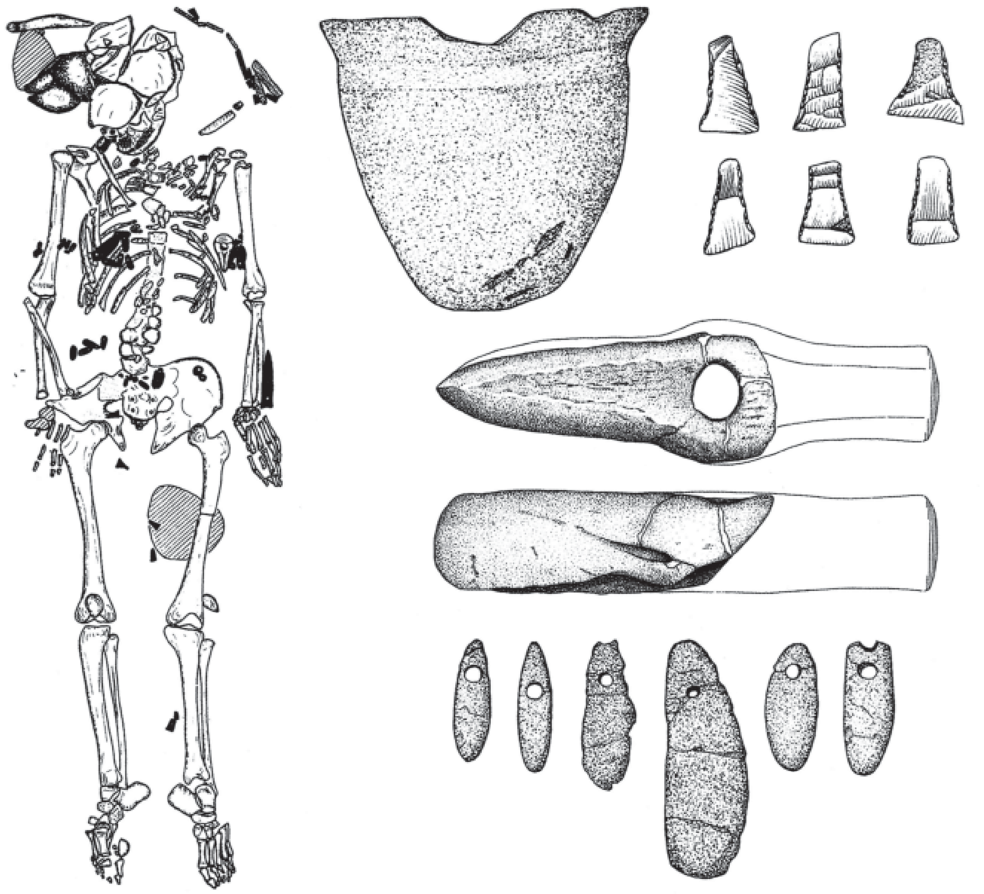


Fig. V. 195. The burial of the Dragsholm man containing a short necked funnel beaker, a polygonal battle axe, teardrop-shaped amber beads, transverse arrowheads, flint blades and a wrist guard. After Brinch Petersen 1974; 2008.

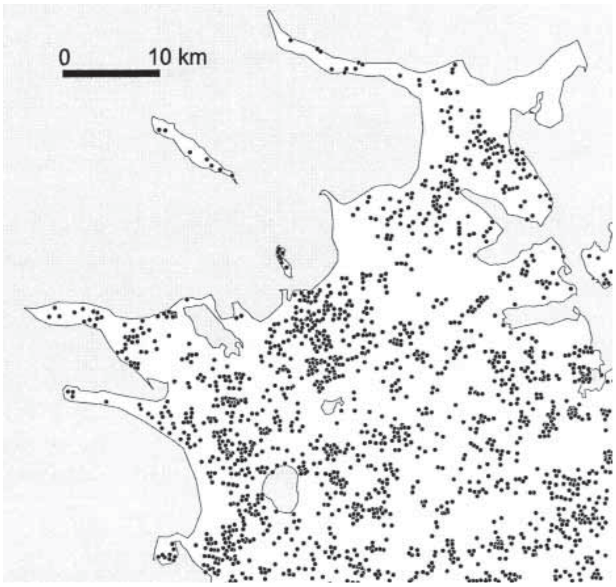


Fig. V. 196. Distribution of thin-butted flint axes from the Early Neolithic in northwestern Zealand. After Mathiassen 1959; Persson 1999.

farmers settled in small colonies, as the area is associated with an abundance of easily worked arable land and flint sources, which were of vital importance to these agrarian societies, as discussed in section 9.8 (Olausson et al. 1980). ^{14}C dates have confirmed that the establishment of flint mines and larger agrarian sites with a number of pits can be dated to the early EN I phase in Scania (4000-3800 cal BC) (Fig. V.199). Furthermore, systematic crop cultivation and the subsequent change to a more open landscape is also observed from 4000 cal BC in some pollen diagrams from Scania (Berglund 1991; Engelmark & Viklund 1990; Engelmark 1992; Regnell 1998; Regnell & Sjögren 2006; Lagerås 2008) (Table 9). The speed of the transition towards an agrarian society and the lack of any major pioneering phases could indicate that Scania was being settled by immigrating farmers, who were directly or indirectly linked with the Michelsberg culture. The hypothesis is supported by grain impressions found on Late Ertebølle pottery sherds from the coastal sites of Löddesborg and Vik in Scania, which could be the result of scouting expeditions initiated by agrarian societies in Central Europe, that were searching for new regions to populate. Furthermore, the establishment of flint mines at Sallerup, and the emergence of systematic production sites at sites like Almhov, show similarities with the flint procurement and manufacturing practices for axes associated with the Michelsberg culture (Hubert 1969; 1980; Olausson et al. 1980; Collet et al. 2004, 152; Rudebeck 2010; Manolakakis & Giligny 2011). Connections with Central European agrarian societies, and their depositional practices of sacrificing many unused axes, can also be observed in the many hoards of pointed-butted axes concentrated in Scania (Karsten 1994). Furthermore, the concentrations of imitations of jade axes and polished flake axes may suggest connections to the Michelsberg culture, which could be the place of origin for the first pioneering farmers in Scania (see section 9.6 to 9.9). Such a hypothesis may explain the lack of any major pioneering stage. During the late EN I and EN II the settlement pattern more or less continues in the same way, and is concentrated in the same areas, as during the early EN I (Fig. V.201).

12.6. Bornholm and Gotland

The establishment of agrarian societies was also a rapid process on the islands of Bornholm and Gotland located in the Baltic Sea, as shown by the distribution of flint pointed-butted axes in the early EN I phase (Lang 1985; Österholm 1989; Nielsen 2009). All the Neolithic flint axes that have been found on these islands have been imported from regions with an abundance of flint deposits, as it is impossible to find nodules of such size and quality on these islands (Casati & Sørensen 2006). Generally, a very low density of Late Ertebølle sites can be observed on Bornholm, which are concentrated in the coastal area, whereas the Early Funnel Beaker sites on both Bornholm and Gotland are concentrated on workable arable soils in the interiors of the islands (Fig. V.203). Again, it appears that the regions with a very low density of indigenous population were preferred as areas for the pioneering farmers to settle in. Immigrating pioneering farmers could have settled without many conflicts regarding territorial claims over land on these two islands. The fact that these islands were located over 30 km from the mainland also proves that expansions involved voyages over open water, with livestock and imported flint (Lindqvist & Possnert 1997; Nielsen 2009). The seafaring travels were not always successful, as the finds of three Early Neolithic lugged vessels in deep waters near the coast of Bornholm suggest (Nielsen & Nielsen 1990) (Fig. V.204).

The boats used for the seagoing voyages could have been dugout canoes and plank-built boats, as discussed in section 11. A sheep or goat found on Gotland has been ^{14}C dated to 5070±75 (4037-3698 cal BC, Ua-4952), thus showing that at least small domesticated animals were being transported over open sea during the early EN I phase. The pioneering farmers settling these islands may have originated in neighbouring agrarian societies in Scania, Mecklenburg-Vorpommern or Central Sweden. However, the occurrence of the pointed-butted copper axes found at Vester Bedegadegård, near Klemensker on Bornholm, indicates that these early agrarian societies were very well connected and part of a larger European network (Klassen 2000). The same phenomenon may apply to Gotland. Here, some of the pointed-butted stone axes made of local diabase and porphyry are of considerable length and have splayed edges; the axes are therefore perhaps imitations of jade axes of the types Rarogne and St. Michel (Fig. V.91). The knowledge of how to make such close imitations indicates that these pioneering farmers may have been of Central European origin. Furthermore, the majority of these imitations of jade axes were unused, which means that depositional practices travelled alongside these expanding agrarian societies. During the following late EN I and EN II phases habitation becomes more widespread on both Bornholm and Gotland as shown by the distribution of thin-butted axes, thus following the same pattern of changes observed in the other regions of South Scandinavia (Lang 1985; Österholm 1989; Nielsen 2009) (Figs. V.205-206).

12.7. Central Sweden

Stray finds of pointed-butted axes and polygonal battle axes, together with a few excavated sites, have since the 1950s shown that major Early Funnel Beaker settlements were present in Central Sweden (S. Florin 1958). Stig Welinder argued in 1980 that the first agrarian practices were introduced to Central Sweden by immigrating groups. Since then, several excavations of Early Funnel Beaker sites have confirmed the existence of fully agrarian societies in Central Sweden from 4000 cal BC, which have been documented by several ^{14}C dates for domesticated animals and cereals (Sundström 2003; Hallgren 2008; Sjögren 2012). The Funnel Beaker sites in Central Sweden also constitute the boundary of the Funnel Beaker culture, which reaches its limits in the border zone between the boreonemoral and southern/middle boreal zones. Further north the landscape is characterized by poorer conditions for agrarian activities, as discussed in section 2.1 (Moen 1999, 98ff). The discovery of the northernmost Funnel Beaker sites proves that the agrarian expansion reached Central Sweden at the same time as it reached Denmark and southern parts of Sweden. The rapid expansion around 4000 cal BC may have been associated with migrating pioneering farmers using boats as a means of transportation, which could explain why the spread of agriculture went so fast (Rowley-Conwy 2011). However, many Swedish researchers emphasise the importance of the indigenous population and suggest that their role in the spread of agrarian practices was equally significant. Such a scenario has been proposed for Scania (Larsson 1987; 2013) and Central Sweden (Sundström 2003; Hallgren 2008), this taking the form of a process of creolisation, where the indigenous hunter-gatherers and immigrating farmers actively blend together elements of different cultures, creating new cultures characterized by specific regional characteristics. In Central Sweden such creolisation processes could have resulted in the rejection of typical aspects of Funnel Beaker culture, such as the building long barrows, causewayed enclosures and megaliths in eastern parts of Central Sweden (Hallgren 2008). On the other hand, there may have been an acceptance of the megaliths in the western parts (Persson & Sjögren 2001) (Fig. V.175). Nevertheless, when investigating the distribution of all the stray finds of pointed-butted flint and stone axes, it is clear that these objects are concentrated in Södermanland, Östergötland and Västergötland (Blomqvist 1990; Sørensen 2012a) (Fig. V.207). These three areas are characterized by an abundance of workable arable soils and rather scattered habitation during the Late Mesolithic, thus showing the same pattern as in the rest of South Scandinavia (Oldeberg 1952). However, the people settling in these regions would have been dependent upon gaining access to flint sources, as the flint found in these areas was of limited size and poor quality (Welinder 1999). But they did receive huge quantities of both pointed- and later thin-butted axes, thus showing a widespread network between settled regions in Scania and Denmark, which existed by the early EN I phase (Oldeberg 1952; Blomqvist 1990; Sørensen 2012a). The importation was so consistent that around 50% of the pointed-butted axes were deposited in an unused condition in wetland areas, thus demonstrating the same pattern as in southern Sweden and Denmark (Fig. V.106). The pioneering farmers in Central Sweden also produced pointed-butted stone axes, with a particularly dense concentration apparent in Södermanland. Most of the production of stone axes was probably local, but larger production sites have also been identified at sites in Mälardalen (Hallgren 2008; Larsson & Broström 2011).

In Central Sweden some of the pointed-butted stone axes may also be interpreted as imitations of jade axes. Again, some of these locally produced axes imitate specific jade axe types, such as Chenoise and St. Michel, which indicates contact with Central European agrarian societies (Figs. V.92-93). It is particularly interesting to compare the distribution of pointed- and thin-butted flint axes with one another, which generally seem to be concentrated in the same areas (Oldeberg 1952) (Fig. V.208). Study of the pointed- and thin-butted flint axes shows no indications of any major expansions during the late EN I phase in Central Sweden. The lack of large expansions during the late EN I could have resulted in less territorial demands, thus explaining the lack of long barrows and causewayed enclosures. Nevertheless, the construction of megaliths in western parts of Central Sweden does show the emergence of increasing territorial demands in that area (Blomqvist 1990; Persson & Sjögren 2001). The absence of territorial markers in the eastern part of Central

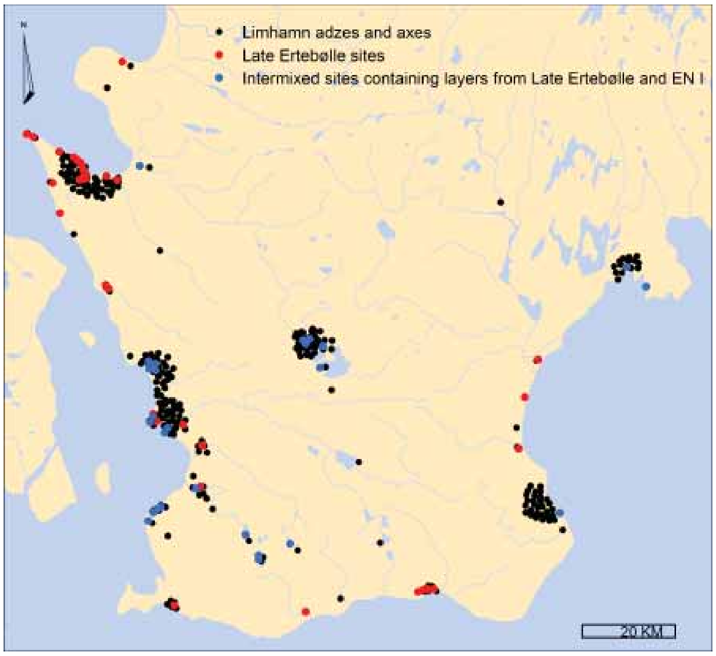


Fig. V. 197. Distribution of stray finds and sites from the Late Ertebølle culture and intermixed sites containing layers from the Late Ertebølle culture and the early Funnel Beaker culture in Scania. After Jennbert 1984. Data after Tables 53, 54, 55 and Plates 1 and 4.

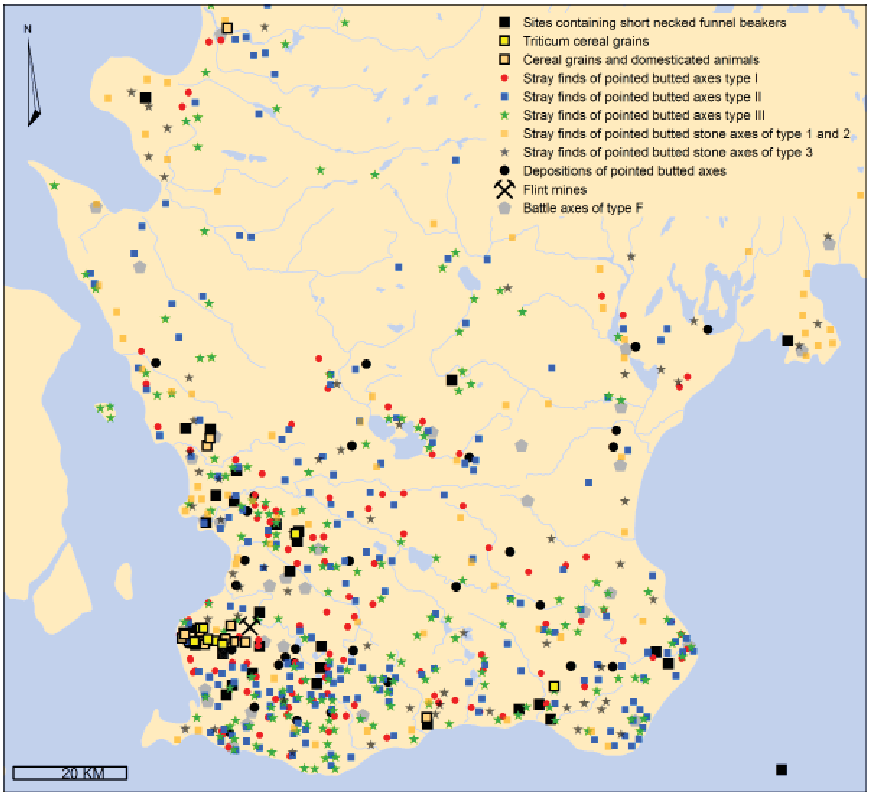


Fig. V. 198. Distribution of stray finds, sites and localities showing agrarian evidences from the EN I in Scania. After Nielsen 1977; Olausson et al. 1980; Larsson 1984; 1992; Rudebeck 1986; Hernek 1988; Berglund 1991; Zápotocký 1992; Karsten 1994; Hallgren 2008; Lagerås 2008; Rudebeck 2010. Data after Tables 56, 59, 63 and Plates 1 and 4.

Fig. V. 199. Preform of a burned pointed-butted flint axe of type 1, deposited in the pit A19049 at the site of Almhov, Scania. After Rudebeck 2010. Data after Table 15.

Sweden could be interpreted as due to an unwillingness to adopt new elements from the Funnel Beaker culture, and instead to absorb more local ideological practices and material culture from the north Scandinavian slate complex, which probably resulted in the emergence of the Pitted Ware culture around the late 4th millenium BC (Bakka 1976; Taffinder 1998; Strinnholm 2001; Larsson 2004; Hallgren 2008; Larsson 2009; Iversen 2010; 2014). The emergence of the Pitted Ware culture may be described as involving a "Neolithic creolisation", based on migration and the integration of different cultures (Zvelebil 1996). Creolisation is therefore perceived as an active process, which involves the transmission of cultural traditions between human groups connected within communities of practice (Lave & Wenger 1991; Cohen & Toninato 2010).

12.8. Southern and western Norway

The current discussion regarding the adoption of agricultural practices in southern and western parts of Norway is concentrated on whether or not there were any agrarian societies in this region during the Early and Middle Neolithic (Olsen 1992; Prescott 1996; Hjelle et al. 2006; Østmo 2007; Glørstad 2010; Bergsvik & Østmo 2011). Researchers like Østmo (1988), Solberg (1989) and Olsen (1992) have all argued that agrarian practices were utilised in southern and western parts of Norway, as a result of small-scale immigration of farmers from Denmark or western parts of Sweden during the late EN I, EN II and MN I phases. Their argument is primarily based on the importation of thin-butted flint axes (Hinsch 1955), funnel beakers with twisted cord impressions (Østmo 2007), the appearance of megaliths in Øst- and Vestfold (Østmo 2012) and cereal pollen in various pollen diagrams (Fig. V.209 and Table 9). However, the pollen evidence has been criticized (Prescott 1995; 1996; Rowley-Conwy 1999; Sørensen 2013b; 2014). The main reason why caution should be exercised regarding the pollen that have been claimed to be from cereals, is that such pollen are similar to that from certain grass types, thus making misidentification likely, as discussed in section 6.4. Furthermore, no charred cereal grains or imprints of cereals on the ceramics assemblages have been found at any of the Funnel Beaker sites in Norway (Soltvedt 1995). In addition, no domesticated animals from the Early Neolithic have been found in Norway (Hufthammer 1992; 1995). However, the claims regarding the possible misidentification of Cerealia pollen have, in the case of Kotedalen, been refuted (Hjelle 2012).

The existence of agrarian practices and societies during the Early and Middle Neolithic is thus still an uncertain and debated subject (Østmo 2010; Glørstad 2010; Solheim 2012; Wieckowska-Lüth et al. 2013). Recently Håkon Glørstad (2010) and Steinar Solheim (2012) have argued that the indigenous populations of southern Norway were part of a Funnel Beaker exchange network during the EN I and EN II, which resulted in the appearance of prestige artefacts, such as thin-butted flint axes from southern Scandinavia (Hinsch 1955). Fredrik Hallgren (2008) has argued that these networks could also have included Central Sweden, based on similarities between Vrå ceramics and pottery assemblages from southern and western Norway. However, participation in these networks did not explain the lack of agrarian evidence,

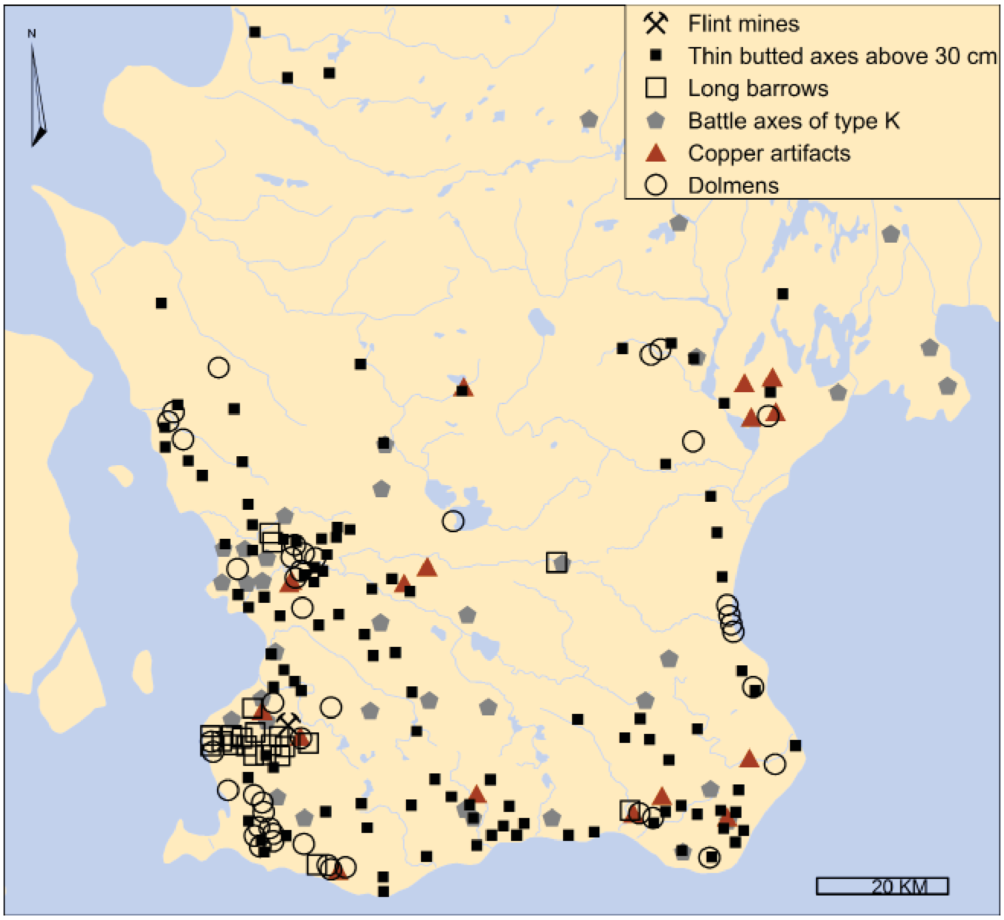


Fig. V. 200. Distribution of stray finds, sites and burials from the late EN I, EN II and MN I in Scania. After Nielsen 1977; Olausson et al. 1980; Larsson 1984; 1992; Zápotocký 1992; Rudebeck 2002; Karsten 1994; Hallgren 2008; Rudebeck 2010. Data after Tables 60, 61, 63, 29, 30, 67 and Plates 1 and 4.

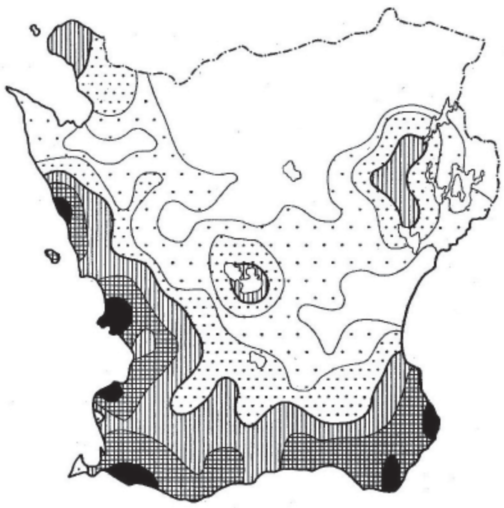


Fig. V. 201. Distribution of around 4500 thin-butted axes in Scania. After Malmer 2002.

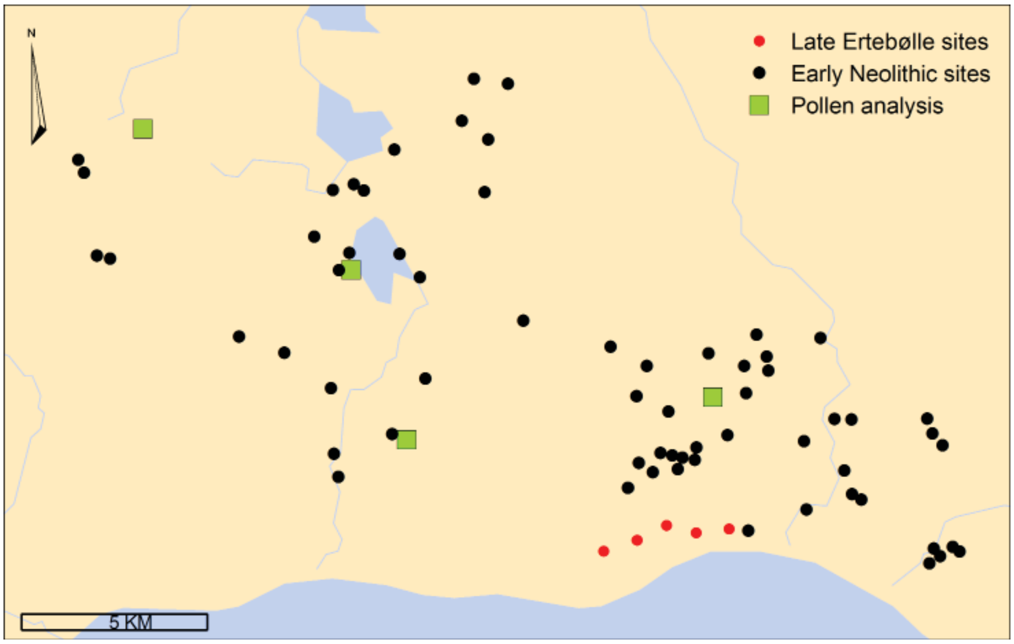


Fig. V. 202. Distribution of Late Ertebølle and early Funnel Beaker sites shown together with localities, where pollen analysis have been taken in connection with the Ystad project in Scania. After Berglund 1991; Engelmark 1992; Larsson 1992. Data after Plate 1.

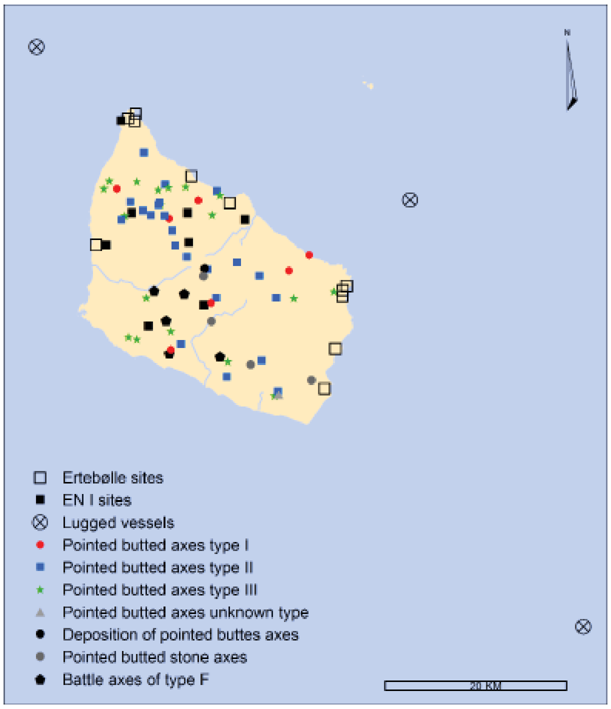


Fig. V. 203. Distribution of stray finds and sites from the Late Ertebølle culture and the EN I on Bornholm shown together with three lugged vessels found in deep waters around the island. After F. O. Nielsen 1988; 1994; Nielsen & Nielsen 1990; Casati & Sørensen 2006; Nielsen 2009. Data after Tables 53, 56, 59, 63 and Plate 4.

Fig. V. 204. A lugged vessel found 20 km northeast of Bornholm. After Nielsen & Nielsen 1990.

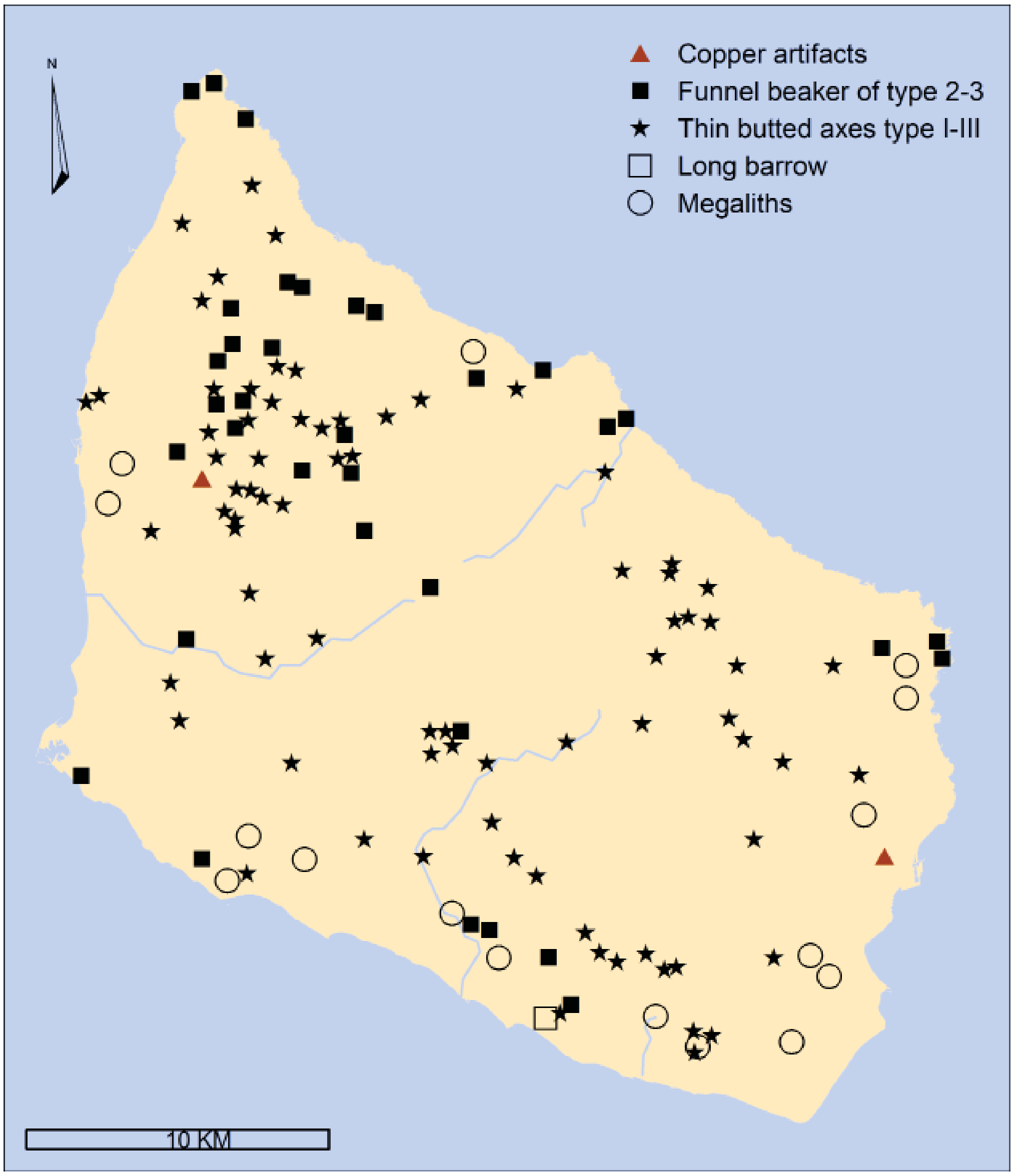


Fig. V. 205. Distribution of stray finds, sites and burials from the Late EN I, EN II and MN I on Bornholm. After Ebbesen 1974; 1985; Watt 1982; F. O. Nielsen 1994; Nielsen 2009. Data after Tables 60, 61, 63, 29, 30 and Plate 4.

until Glørstad (2010) proposed a "big game hunting hypothesis". Glørstad argues that participation in a Funnel Beaker network did not necessarily result in the adoption of agriculture, but rather of material culture, as ceramics were unknown in southern Norway before the Early Neolithic. Instead, he interprets big game hunting as more prestigious than agrarian subsistence strategies, thus resulting in a refusal to adopt agriculture, but not necessarily material culture, which could have given certain hunter-gatherers prestige, for instance, by owning an imported thin-butted flint axe. But a new pollen diagram from Skogtjern in Telemark, which involves very detailed counts, shows Cerealia and ribwort plantain pollen from 3600 cal BC, thus supporting the argument for cultivation practices during the late EN I and EN II (Wieckowska-Lüth et al. 2013) (Plate 1). Furthermore, certain finds show potentially direct contacts with the Funnel Beaker culture in southern Scandinavia. In particular, the pot-

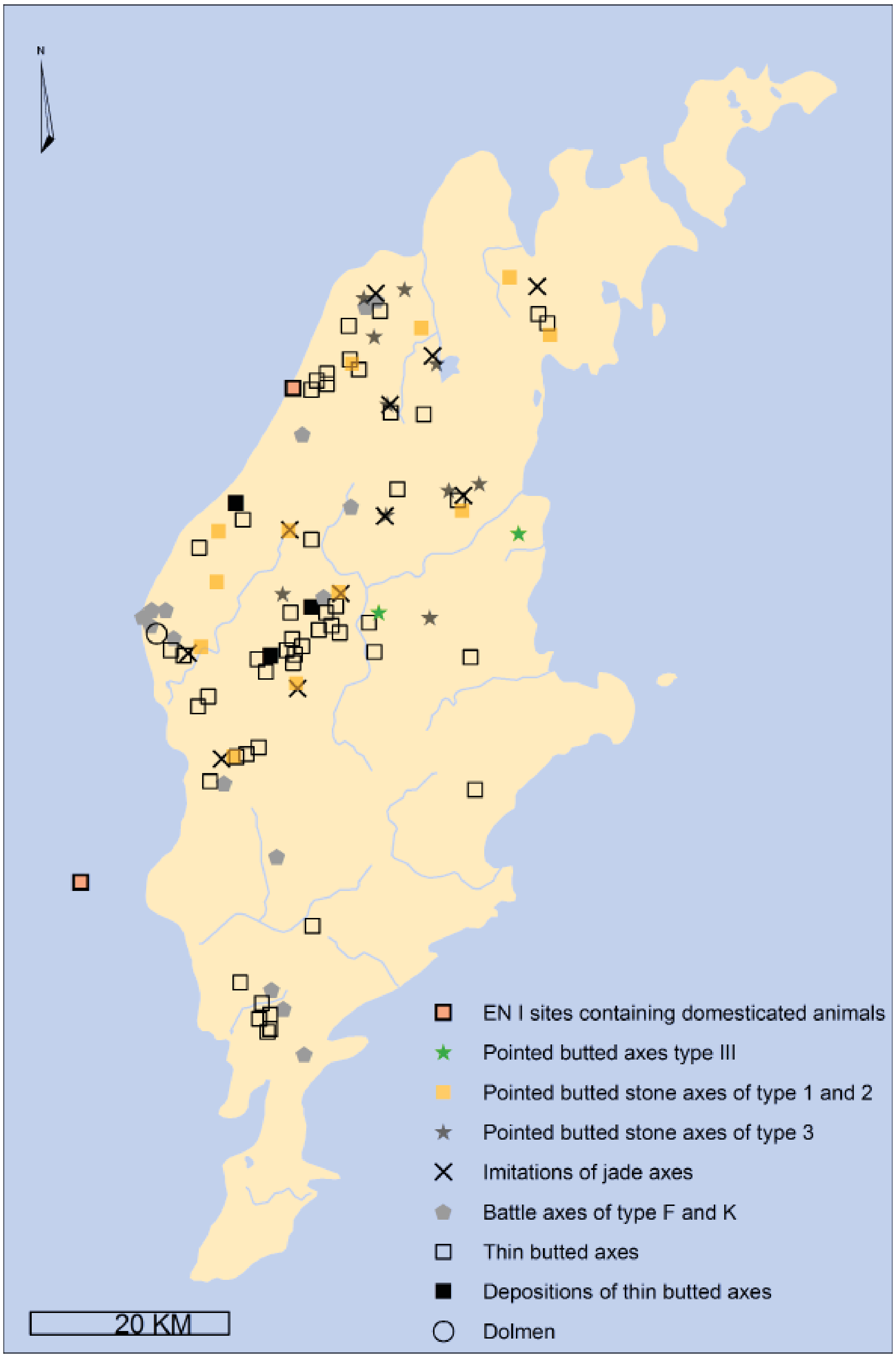
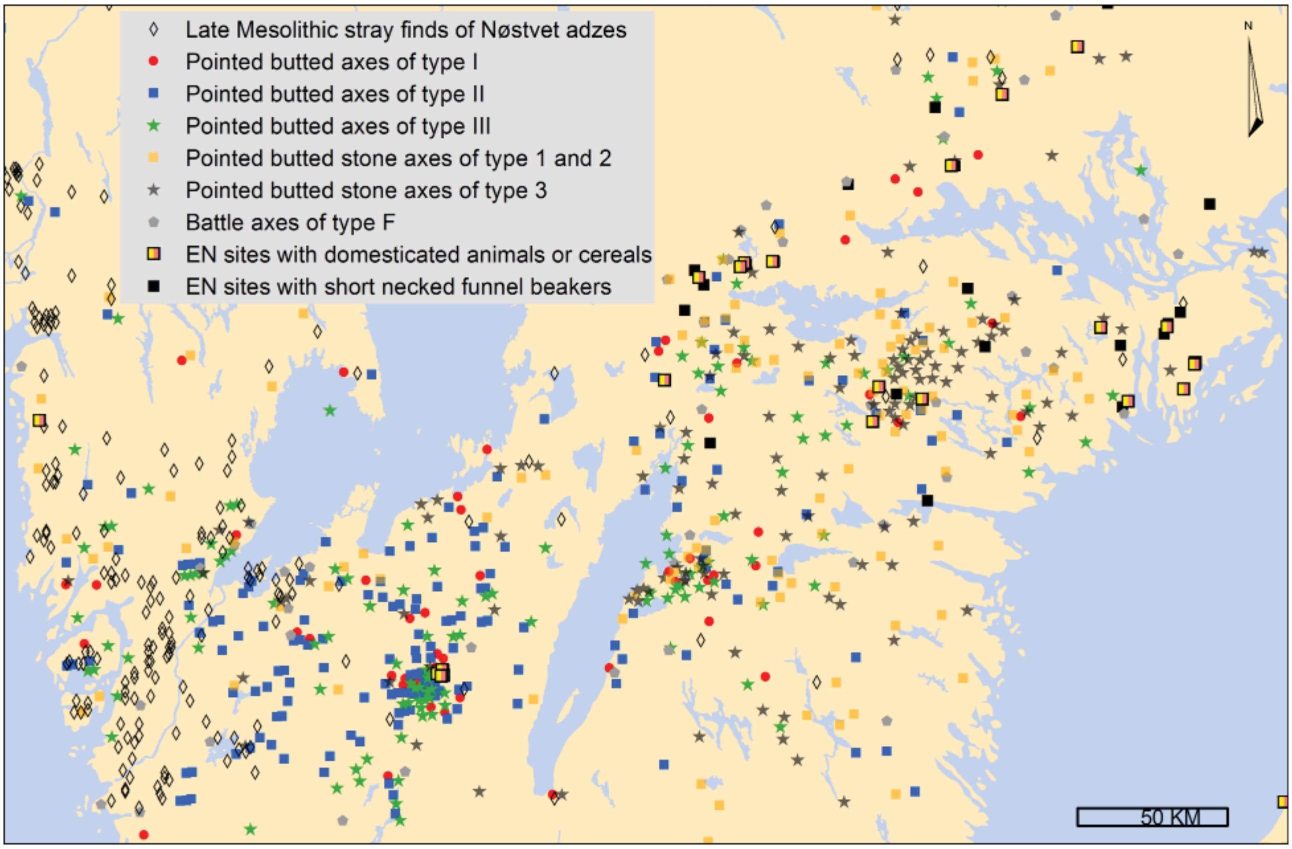


Fig. V. 206. Distribution of stray finds and burial sites from the EN I, EN II and MN I phases on the island of Gotland. After Nielsen 1977; Lang 1985; Österholm 1989; Martinsson-Wallin 2010. Data after Tables 56, 59, 60, 63, 29 and 30.

tery from a pit at Dønski shows similarities with beakers from the B group/type II-III in southern Scandinavia (Fig. V.210). The funnel beakers from Dønski are below 1 cm in thickness and contain temper below 5 mm in size, thus corresponding with South Scandinavia funnel beakers (Demuth & Simonsen 2010). A ^{14}C date from the Dønski pit dated its contents to 4850±50 BP (3761-3521 cal BC, T-19326), which supports the typological classification (Demuth & Simonsen 2010) (Fig. V.211).The funnel beakers from the pit at Vøyenenga were associated with a ^{14}C date of 4810±55 BP (3702-3382 cal BC, T-17864), which is almost contemporary with the finds from Dønski (Figs. V.212-213). The Vøyenenga assemblage also displays similarities with beakers of South Scandinavian origin in terms of temper and sherd thickness, but some sherds have vertical twisted cord impressions below the rim, which is rather unusual (Madsen & Petersen 1984; Koch 1998; Lagergren-Olsson 2003) (Table 36).

Close parallels for the Vøyenenga ceramics are apparently difficult to find, and they may belong to a specific regional style, although the twisted cord impressions suggest general similarities with the Volling and Svenstorp groups (Østmo & Skogstrand 2006). A survey of Volling ceramics from Jutland shows vertical twisted cord impressions below the rim on vessels from at least three sites. The first vessel is a Volling beaker found in the mineshaft 52 at Hov (Becker 1993). The second example is from the site at Rørgårdsvej in Smollerup parish (sms916a-x113) (Inge Kjær Kristensen pers. comm.) (Fig. V.214). The third vessel has been recorded as Volling ceramics and came from the causewayed enclosure of Liselund in the district of Thy (Lutz Klassen pers. comm.). A number of thin-walled and fine-tempered sherds with twisted cord impressions from the site of Kotedalen have also been associated with Volling ceramics from Jutland (Olsen 1992). These sherds were found in layers from which charcoal and hazelnut pieces were ^{14}C dated between 4960±80 BP (3951-3638 cal BC, T-7509) and 4860±60 BP (3781-3520 cal BC, T-7052), which is thus contemporary with the dates from Dønski and Vøyenenga. In addition, a flint axe hoard, consisting of three thin-butted flint axes and a raw nodule, has been found at Disen near Oslo, thus showing a depositional practice connected to agrarian societies (Glørstad 2012) (Fig. V.215). All this evidence could either represent pioneering farmers, who unsuccessfully tried to establish themselves in the border zone of the Funnel Beaker culture, or scouting expeditions initiated by farmers in South Scandinavia.

Evidence of the more permanent habitation of pioneering farmers can be observed with the appearance of megaliths during the EN II and MN I phases, which show the attempts of pioneering farmers to establish a more permanent agrarian society in the peripheral zone of the Funnel Beaker culture (Prescott 1996; Glørstad 2012; Østmo 2012). An even earlier example of permanent habitation might be suggested in connection with the discovery of the first enclosure-related site, located at Hamremoen, near Kristiansand, in southern Norway. The interpretation was based on a long ditch found at the site, with the ^{14}C dates of organic material from the structure clustering around 3800 to 3600 cal BC (Glørstad & Sundström 2014). The closest parallels with such structures are found in Jutland, at sites like Kildevang and Aalstrup (Skousen 2008; Madsen 2009; Ravn 2012). One of the earliest causewayed enclosures in Denmark is at Liselund, based on its associated Volling ceramics (Nielsen 2004). The unexpected appearance of such a structure at Hamremoen may suggest direct contacts with agrarian societies in North Jutland, as no enclosure- related sites have been found in Central Sweden. However, the funnel beakers from Hamremoen have clearly been locally produced, based on their coarse temper and thickness (Plate 11). Furthermore, some of the decoration shows similarities with the Vrå pottery (type IV) from Central Sweden (Hallgren 2008, 167). A particularly interesting decorative element on one of the Hamremoen sherds is a twisted cord impression in the shape of a loop. Parallels for loop-shaped twisted cord impressions under the vessel rim have been found as far away as the Funnel Beaker site of Osterwick in Westphalia (Raemaekers et al. 2012). Close parallels have also been reported from North Jutland at the site of Rørgårdsvej in Smollerup parish (sms916a-x113) (Inge Kjær Kristensen pers. comm.) and at the Early Neolithic site of Hallehög near Göteborg (Kihlstedt et al. 1997, 101, fig. 4:14) (Fig. V.214). Generally, the parallels with Volling ceramics at Hamremoen create the basis for a discussion regarding direct connections between North Jutland and the south Norwegian coast. Such connections may have involved pioneering farmers navigating across the Kattegat and Skagerrak at the time of the Funnel Beaker culture. Evidence of such voyages could include the rare find of a funnel beaker, which was recovered in the sea north of Skagen, at a depth of 120 metres (Ax 2007) (Fig. V.192).



Fig, V. 207. Distribution of stray finds and sites from the Late Mesolithic and the EN I phase in central Sweden. After Blomqvist 1990; Zápotocký 1992; Larsson et al. 1997; Lindgren & Nordqvist 1997; Welinder 1999; Sundström 2003; Hallgren 2008; Glørstad 2010; Sjögren 2012. Data after Tables 56, 59, 63 and Plate 4.

Other evidence of seafaring voyages may be associated with the discovery of oblique transverse arrowheads from the Early Neolithic on the island of Anholt, which is located in the Kattegat (Vang Petersen 2004; Johansson 2007). Similar arrowheads have been found at the coastal sites of Ängås and Lilleby near Göteborg, which have been dated to the Early Neolithic (Hallgren 2008, 244). These characteristic arrowheads have been found at several sites in southern Norway, but also along the Swedish west coast in Bohuslän and the Göteborg area, and thus are a characteristic type associated with the Kjeøy phase, dated from 4600 to 3800 cal BC (Andersson & Wigforss 2004; Glørstad 2004; 2010; Glørstad & Sundström 2014) (Fig. V.216). Recent studies have argued that better flint nodules of higher quality were increasingly preferred during the Kjeøy phase, but whether the flint was procured locally at the beach or through a contact network further south, along the west coast of Sweden, is still unresolved (Lotte Eigeland pers. comm.). But the finds of these oblique transeverse arrowheads on Anholt show that sailing expeditions were undertaken to this particular island, where high-quality flint is found in the moraines. The funnel beaker found in the Skagerrak and the oblique arrowheads on Anholt prove that people could have created and maintained social contacts by sailing across the Kattegat. It is therefore possible that pioneering farmers tried to establish agrarian societies in this peripheral zone of the Funnel Beaker culture. However, they seem to have been unsuccessful in establishing an agrarian society in southern and eastern Norway.

It has been argued that agrarian practices were introduced into both south-western and western Norway by indigenous hunter-fisher populations (Hjelle et al. 2006; Olsen 2012). However, as argued in section 5.1, it is very unlikely that agrarian practices could spread as an idea, as they depended on the migration of farmers with the right

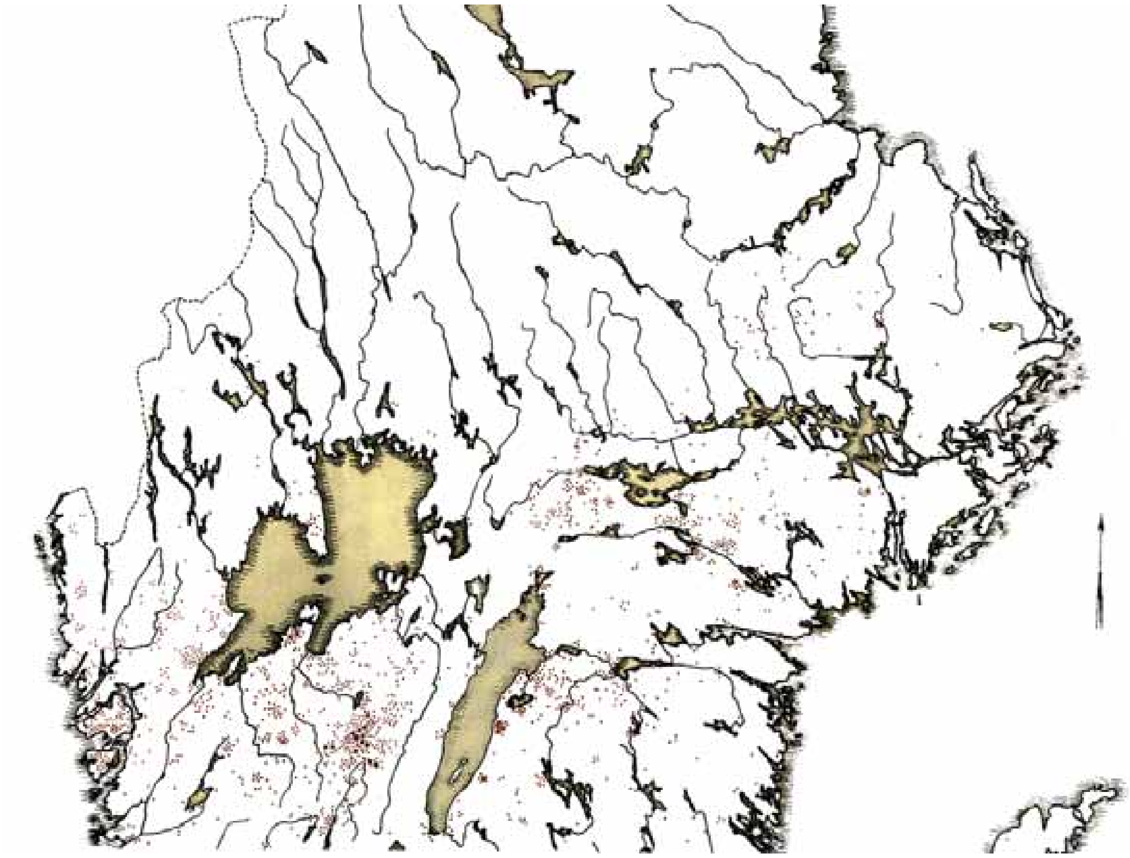


Fig. V. 208. Distribution of stray finds of thin-butted flint axes from central Sweden. After Oldeberg 1952.

competences, who wanted to settle in a region permanently. A few stray finds of polygonal battle axes, pointed- and thin-butted flint axes and imitations of flint axes in local raw materials concentrated in Lista and Jæren could support the idea that the region of south-western Norway had contacts with agrarian societies (Bergsvik & Østmo 2011). However, the question is whether the imported flint axes can be associated with a few pioneering or scouting farmers, who sailed the dangerous waters near the southern tip of Norway? Cereal pollen of barley has been recorded from one pollen diagram at Lista and another one at Jæren, thus indicating a limited amount of cereal cultivation (Prøsch-Danielsen 1996, 1997, 2012; Simonsen & Prøsch-Danielsen 2005; Høgestøl & Prøsch-Danielsen 2006). The hypothesis is further supported by a deforestation phase, which has been observed in some of the pollen diagrams in south-western Norway just after 4000 cal BC. The deforestation phase may indicate an economic strategy based upon animal husbandry and less upon the cultivation of cereals (Prøsch-Danielsen 2012). However, here we face the same identification problems in separating pollen of barley from various species of wild grasses, as discussed in section 6.4. Even if pioneering farmers did establish an agrarian society in south-western Norway, they did not stay there for a long period of time. If this had been the case, we would be able to observe more objects of South Scandinavian origin, because these farmers would have been part of a network if the harvest failed. Maintaining contacts within such a network would have been of critical importance, but perhaps would have been difficult due to the necessity of having to sail in dangerous waters. It is probably more likely that these imported objects found in south-western Norway should be interpreted as prestige axes, which were exchanged in a hunter-gatherer network along the Norwegian west coast. Such exchange networks could also explain the oc-

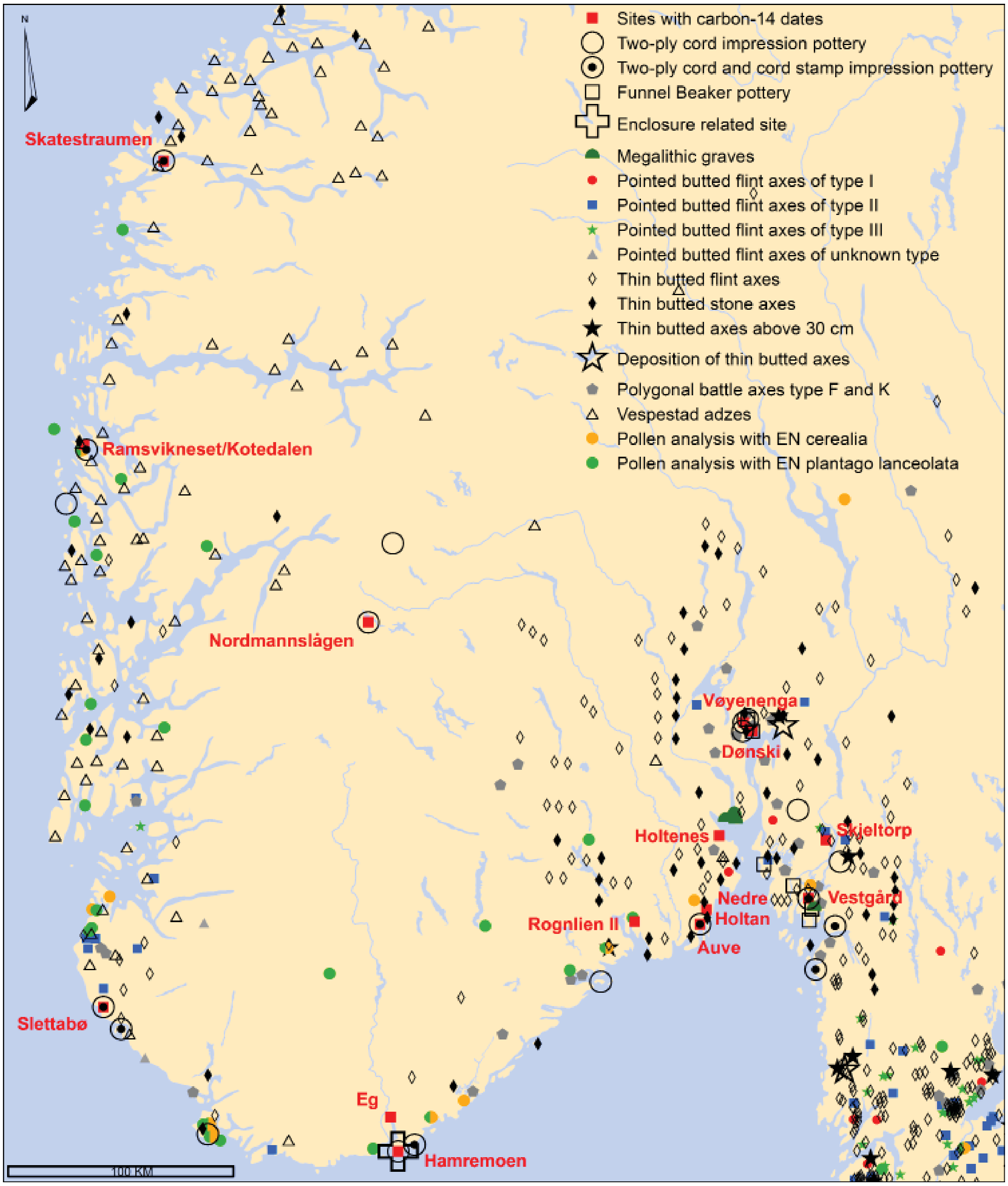


Fig. V. 209. Distribution of stray finds and sites together with localities showing signs of cerealia and ribwort plantain from the Early Neolithic in southern Norway. After Hinsch 1955; Olsen & Alsaker 1984; Østmo 1988; 2007; 2008; 2012; Solberg 1989; Olsen 1992; Hallgren 2008; Glørstad 2010; 2012; Demuth & Simonsen 2010; Bergsvik & Østmo 2011; Hjelle 2012; Prøsch-Danielsen 1997; 2012; Solberg 2012; Solheim 2012; Reitan 2012; 2013; Glørstad & Sundström 2014. Data after Tables 56, 59, 63, 36 and Plates 1 and 4.

Fig. V. 210. Funnel beakers from Dønski near Oslo showing similarities with beakers from the B-group. After Demuth & Simonsen 2010.

currences of pointed-butted axes and double-edged battle axes in northern Scandinavia (Østmo 1999; 2007; Ramstad 1999; Valen 2007; 2012) (Fig. VI.6).

It is important to state that many researchers argue that the indigenous population played an important role in the adoption of agrarian practices (Olsen & Alsaker 1984; Ramstad 1999; Bergsvik 2003; Bergsvik & Østmo 2011). But if this hypothesis is maintained, then the agrarian societies in western Norway would have been in retreat during major parts of the Early and Middle Neolithic, as there is no evidence of any agrarian activities at either Pitted Ware or Corded Ware sites in southern Norway (Østmo 2008; 2010). Such retreating societies would have had difficulties maintaining connections with larger networks, which seem to have been important to these Early and Middle Neolithic societies in South Scandinavia (Sørensen 2012a). However, the few finds of thin-butted flint axes and the more local adze types, such as the Vespestad or Vestland adzes, during the Early and Middle Neolithic in the western part of Norway could be interpreted as local imitations of the flint axes (Olsen & Alsaker 1984; Hallgren 2008, 248) (Fig. V. 217). These imitations may indicate that the indigenous population had contact with agrarian societies. But the Vespestad and Vestland objects are adzes, which means that they were hafted differently to axes and thus served a different function. Adzes are associated with scooping out wood during the construction of boats, whereas axes are suitable for cutting down trees (Bergsvik & Østmo 2011). Nevertheless, the appearance of the Vespestad adzes and the thin-butted axes seem to be contemporary with one another, as ^{14}C dates of contexts containing these adzes and axes start around 3800 cal BC (Sørensen 2012a) (Fig. V.218 and Table 37). The Vespestad axes are also contemporary with the appearance of the earliest funnel beakers in the region and are thus part of the emergence of a new material culture (Fig. V.211). Perhaps the Vespestad adzes, with their new design, and made by the indigenous population, expressed regional opposition to the new flint axes originating from the Funnel Beaker culture. Such behaviour could have been aimed at maintaining some of their own independent identity, which was materialized in the form Vespestad adzes. The hypothesis is supported by the fact that the Vespestad adzes were made at local quarries, which had

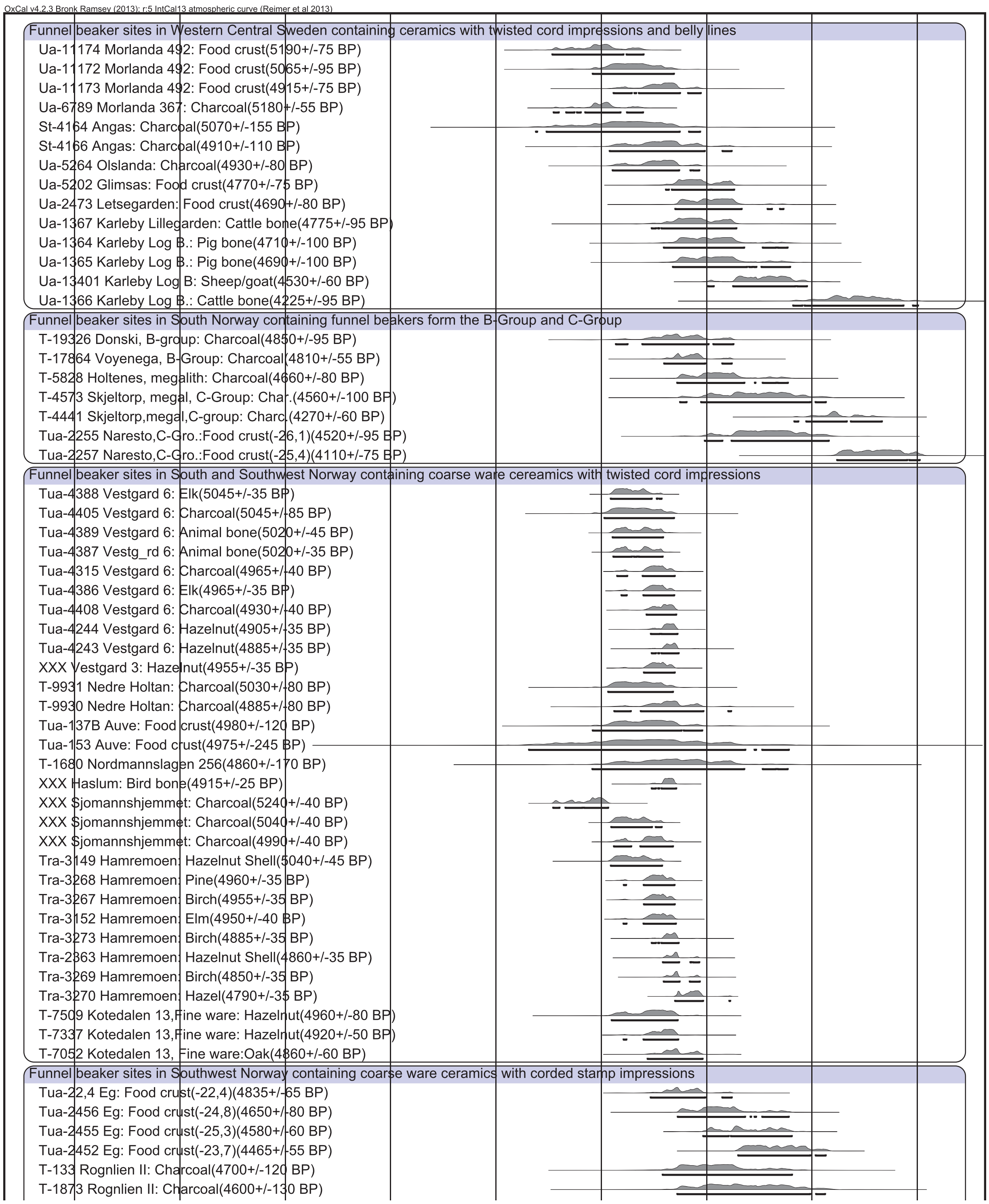


Fig. V. 211. [14]C dates of organic materials found in contexts containing funnel beakers with twisted cord impressions or corded stamp impressions in southern Norway. After Ingstad 1970; Skjølsvold 1977; Olsen 1992; Kihlstedt et al. 1997; Amundsen 2000; Persson & Sjögren 2001; Bergsvik 2002; Østmo & Skogstrand 2006; Østmo 2007; Hallgren 2008 (further ref.); Demuth & Simonsen 2010; Solheim 2012 (further ref.); Glørstad & Sundström 2014. Data after Table 36. *See next page.*

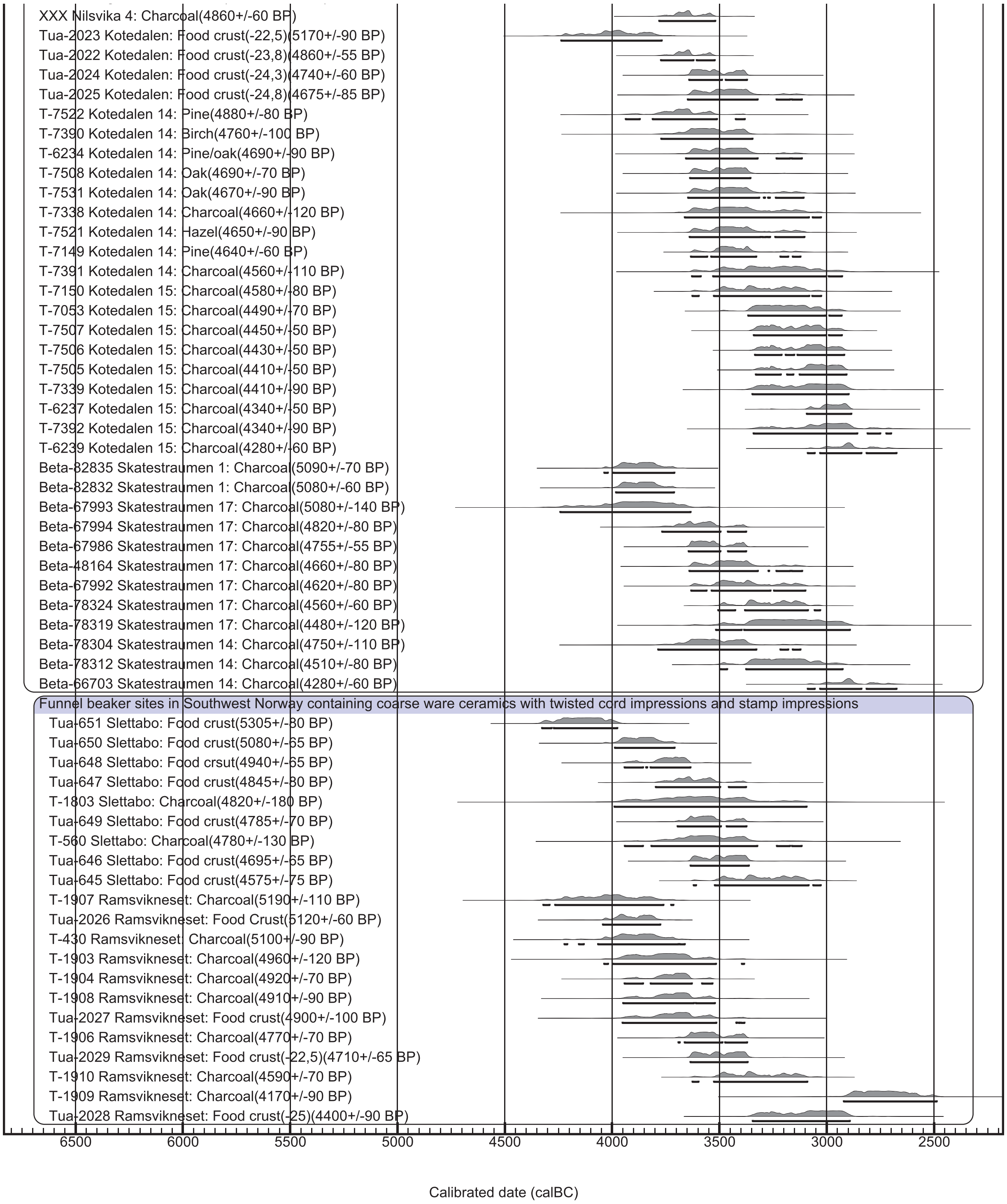


Fig. V. 211. *See previous page.*

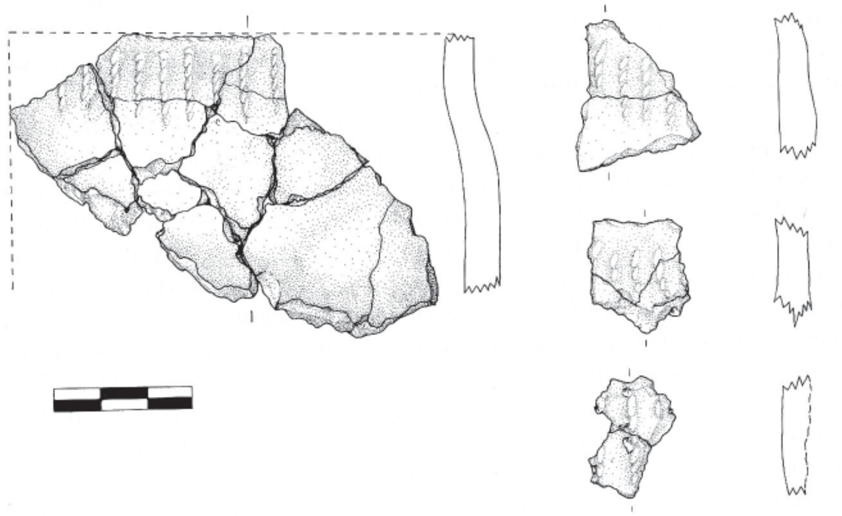


Fig. V. 212. Funnel beaker with twisted cord impressions from the Early Neolithic site Vøyenenga in Akershus, southern Norway. After Østmo & Skogstrand 2006. Drawing: Bjørn-Håkon Eketuft.

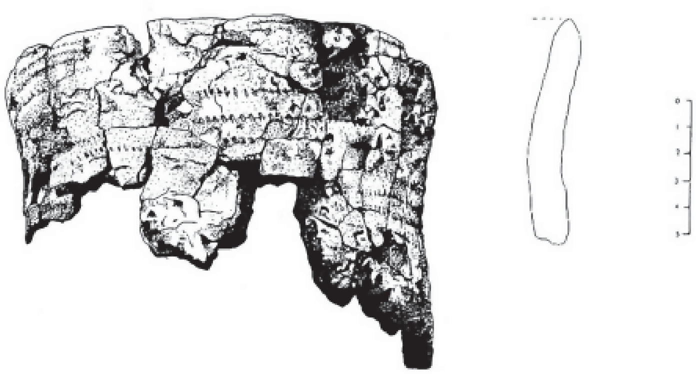


Fig. V. 213. Funnel beaker with corded stamp impressions from the Early and Middle Neolithic site of Ramsvikneset in Hordaland, western Norway. After Nærøy 1987.

been exploited since the Mesolithic, thus maintaining a connection with past generations. These adzes could have been of particular importance in a coastal environment in Norway, which again could have helped these people to maintain their own identity. The appearance of these adzes was therefore not necessarily connected to the emergence of an agrarian society.

13. AN OVERALL DISCUSSION OF THE AGRARIAN EXPANSION IN SOUTH SCANDINAVIA DURING THE EARLY 4TH MILLENNIUM BC

The results suggest that the immigration of pioneering farmers from Central Europe to South Scandinavia was initiated around 4000 cal BC, based upon the appearance of a complete agrarian technology and a quick expansion of farming activities all the way up to Central Sweden. The rapid speed of the process changed the material culture, thus supporting the argument that both the immigrating farmers and the indigenous population were involved in the creation of agrarian societies in South Scandinavia. The engagement of the indigenous population in agrarian communities of practice could explain the swift change of the material culture, as well as the emergence of new

Fig. V. 214. Funnel beaker decorated in Volling style (twisted cord impressions) from the site Rørgårdsvej (sms916a-x113), northern Jutland. After Inge Kjær Kristensen pers. comm. Photo. Skive Museum.

depositional practices at habitation sites and in wetland areas, during the early EN I of the Funnel Beaker culture. Involvement in these communities of practice would not only change the material culture, but also the habitus, identity, ideology, symbolic behaviour and power relations of the participating immigrating farmers and the indigenous hunter-gatherers, and in the process a new tribal agrarian society with increased hierarchy would evolve (Bourdieu 1986; 1991; Lave & Wenger 1991).

The investigations into the material culture and structures indicate that these immigrating farmers probably came from or were connected with the Michelsberg culture. The reasons for the expansion of the Michelsberg culture have been interpreted as a combination of population pressure and climatic change to drier conditions, meaning that better environments for crop growing were located in the Northern European plains, thus explaining both the push and pull effects, as natural resources for agricultural activities were unexploited in South Scandinavia (Leuschner et al. 2002, 703; Gronenborn 2007, 71; Shennan 2009, 339ff; Müller 2011a). The distribution of Michelsberg and Linearbandkeramik sites in Belgium shows interesting patterns (Vanmontfort et al. 2008). The Linearbandkeramik sites are clustered in areas with the best and thickest loess soils, whilst the Michelsberg settlement is concentrated in between and in former Linearbandkeramik areas, thus showing a more widespread exploitation of the landscape from around 4400 cal BC. Such a pattern may be explained by population growth or the emergence of new cultivation methods, which allowed people to exploit an increasing amount of land, including the more marginal areas. The consequence was increased territorial demands, thus leading to the construction of causewayed enclosures from around 4400 cal BC, which may have served as structures of refuge in times of stress and conflicts (Christensen 2004; Gronenborn 2010). Continuous conflicts in Michelsberg society over territorial rights and the struggle for arable land, could have served as a push effect, which may have led to a contemporary migration of pioneering farmers to both the British Isles and South Scandinavia around 4000 cal BC (Sheridan 2010; Rowley-Conwy 2011; Sørensen & Karg 2012).

Fig. V. 215. A hoard of thin-butted axes from the Early Neolithic at the site Disen, Akershus, southern Norway. After Glørstad 2012.

Fig. V. 216. Oblique transverse arrowheads from the enclosure-related site of Hamremoen, near Kristiansand, southern Norway. After Glørstad & Sundström 2014.

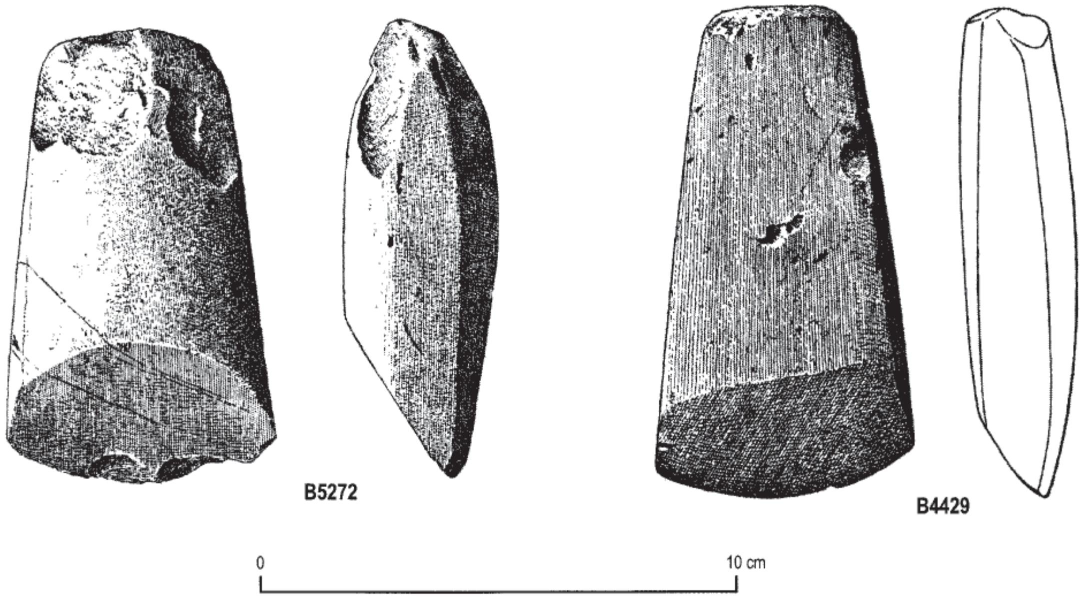


Fig. V. 217. Examples of a Vespestad adze (B5272) and a Vestland adze (B4429). After Brøgger 1907; Bergsvik & Østmo 2011.

The agrarian evidence associated with the Late Ertebølle Culture could, as argued above, be interpreted as the result of scouting expeditions initiated by the farmers from the Michelsberg culture. The aim of these scouting expeditions was to gather information and to find suitable areas for establishing agrarian societies in South Scandinavia, through the creation of social relations with the indigenous populations. The distribution of agrarian evidence and material culture from the early EN I phase reveals that these pioneering farmers focused on three major aspects in the regions they wanted to inhabit, which can be characterized as pull effects (Anthony 1990). Firstly, they searched for regions with a very limited population of indigenous hunter-gatherers, which could avoid territorial conflicts. Such a behaviour would be very rational, as clearing the forest and creating fields could lead to conflicts with the indigenous populations, because such cultivation activities would destroy important hunting grounds. However, it would also be an advantage if some indigenous hunter-gatherers were present in the region, as they could be engaged in agrarian practices and speed up the process of establishing a new agrarian society. Secondly, it was important that the region to be settled had an abundance of easily worked arable soils, which were similar to those in the migrants' place of origin, like the loess areas of Western Europe. The search for these areas could be difficult in a dense forest, thus suggesting that it was people with in-depth agrarian knowledge that conducted these scouting expeditions. Thirdly, the migrants needed to find a region with an abundance of flint sources, which the first agrarian society could exploit through deep mining and thus produce axes. The production of these axes was important for these early agrarian societies as axes were used for both economic and symbolic purposes. Furthermore, the axes were important agents in creating network alliances with neighbouring regions that lacked flint sources (Latour 1996a).

The establishment of tribal networks was also of critical importance to these early agrarian societies, as it was necessary to have access to agrarian resources if the harvest failed, or if the livestock died. Being part of a network could also enable access to new knowledge, ideas and prestigious objects, which could increase the power and status of the people involved in these alliances. Jade axes and copper objects indicate that the first agrarian societies in South Scandinavia were part of a larger European agrarian network (Klassen 2000; 2004; Klassen et al. 2012; Sørensen 2013a). These pioneering farmers probably consisted of small groups, which were interconnected with one another in both regional and large-scale networks. Recently Klassen (2004), Sheridan (2010) and Rowley-Conwy (2011) have suggested that

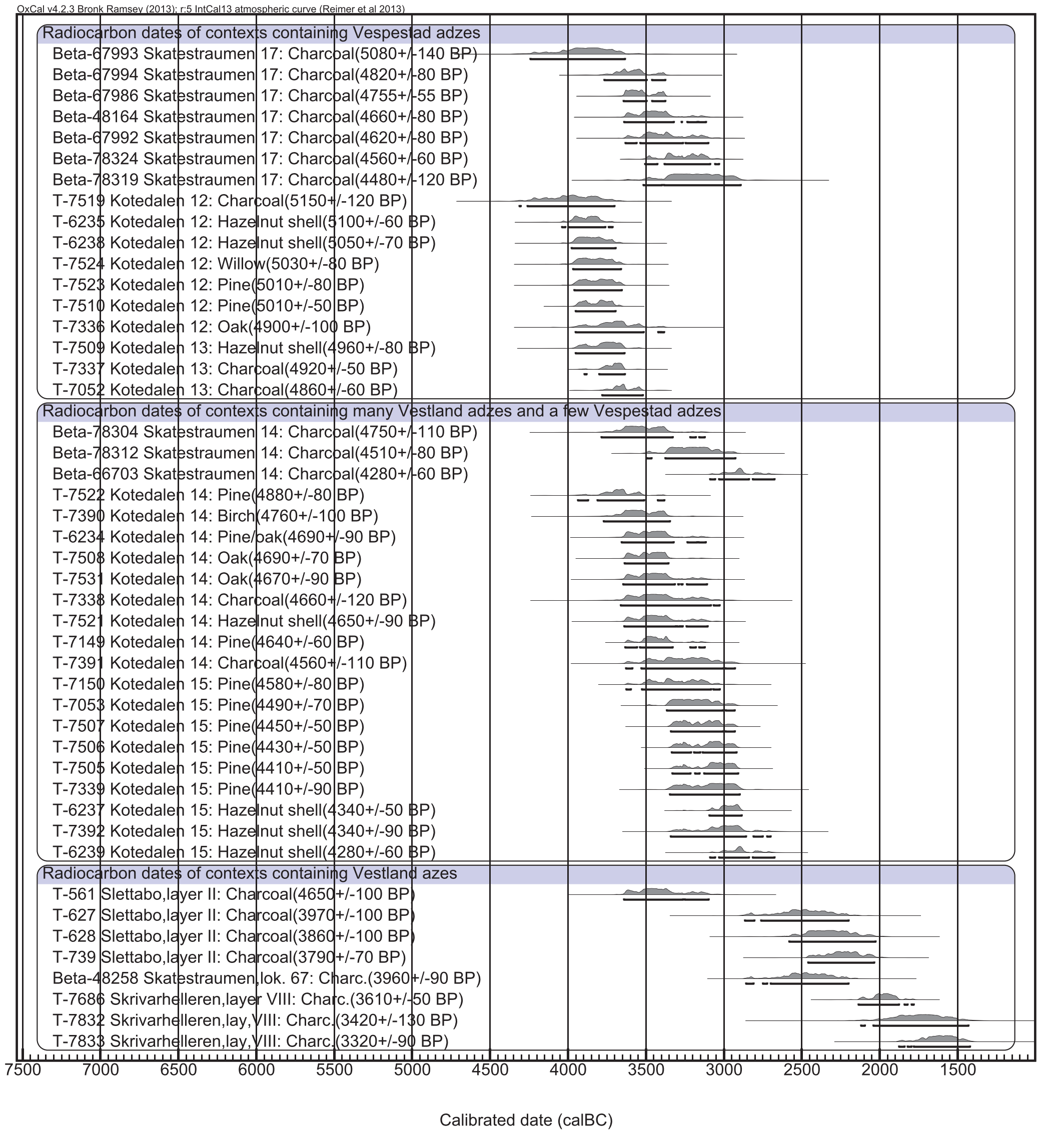


Fig. V. 218. [14]C dates of organic materials found in contexts containing Vespestad and Vestland adzes in western Norway. After Skjølsvold 1977; Prescott 1991; Olsen 1992; Bergsvik 2002. Data after Table 37.

farmers moved to the British Isles and South Scandinavia by leapfrog, punctuated or sporadic immigration (Moore 2001, 395ff) (Figs. V.219-221 and Tables 69-70). A similar model has been presented by Zilhão (2001, 14180ff), to explain a rapid Neolithic expansion in the Mediterranean. The expansion to Scandinavia happened so fast, and covered areas across both land and sea, that boats must have been used, as indicated by very Early Neolithic agrarian occupation on the islands of Bornholm and Gotland (Lindqvist & Possnert 1997; Casati & Sørensen 2006; Nielsen 2009). The identification of the patterns of behaviour behind the migrations, including establishing the place of origin, searching for push and pull effects, documenting small "islands of sites" and finding out the identity of the scouts, is of vital importance to arguments emphasising the role of migration in the expansion of agrarian societies. Another characteristic behavioural pattern involves return migrations from the destination area back to the place of origin, which means that there should be objects of South Scandinavian origin found at the sites of the Michelsberg culture. But only one amber bead and possibly a few pointed-butted flint axes made of "Nordic flint" fall into the category. The lack of return migration may have been due to the push effects still being present at the place of origin (Anthony 1990).

During the Early Neolithic period in South Scandinavia an agrarian way of life was practised at inland sites contemporaneously with hunting and fishing activities, which took place at sites near the coast, in fjords or by large inland lakes (Fig. V.222). Does this represent commuting farmers or cultural dualism? The regional investigations indicate some differences, thus showing the complexity of the adoption of the agrarian way of life. Coastal kitchen midden sites in parts of North Jutland were more permanent habitations and only a few finds of agrarian inland sites have been made. Whilst stray finds of pointed-butted axes cluster in Thy and Vendsyssel show small "enclaves" of inland oriented agrarian habitations of the first pioneering farmers, which could indicate a more dependence on agrarian subsistence strategies compared to the coastal sites. On the other hand, the lake shore sites near and in the Åmose basin were inhabited by commuting farmers, as pointed-butted axes have been found on workable arable soils between the coastal and lake shore areas. The interpretation is further supported by seasonal indicators from the faunal material, which suggest habitation during the warmer parts of the year. Generally, the few examples of evidence of the presence of cows, sheep and goats at the coastal or lake sites could be interpreted as initial herding activities by communities that still lived as hunters-gatherers or fishermen. This interpretation is supported by historical records from South Africa, where hunter-gatherers quickly adopted herding of sheep in particular, through contact and information exchange with neighbouring farmers, and not necessarily through integration with farming communities (Xavier et al. 2008, 1ff). However, if hunter-gatherers had started to keep domesticated animals all year round, they would have needed to collect huge amounts of winter fodder, thus changing their economic strategy and their way of life. The complexity of agricultural technologies and their application require long-term experience in order for success to be achieved (Lüning 2000, 174; Ehrmann et al. 2009, 44ff; Schier 2009, 15ff). If these Late Mesolithic/Early Neolithic hunter-gatherers wanted to succeed as farmers, they had to integrate into the agrarian societies in communities of practice (Lave & Wenger 1991). Recently, Kind (2010, 457) has proposed that the transition towards agriculture is determined by an intensified social interaction between local hunter-gatherers and pioneering farmers, who are characterized as the "managers of Neolithisation". These managers of agrarian knowledge could be people who had the necessary competences to teach and initiate these communities of practice with the indigenous population.

Proof of these communities in action would be actual evidence of cereal cultivation at coastal sites, which are presumed to have been inhabited by the indigenous hunter-gatherers. The Bjørnsholm kitchen midden (Fig. V.27) could be one of these sites, because pollen from barley and wheat was found under the neighbouring long barrow (Andersen & Johansen 1992, 38ff; Andersen 1992, 59ff). Visborg may be another example, as a burnt layer under the kitchen midden indicates the possible use of the slash-and-burn method (Andersen 2008a, 69ff), which was probably also applied to seashore vegetation (Karg & Harild 2009) (Fig. V.27). Another important example of an actor within a community of practice is the Dragsholm man, who was buried in a kitchen midden and equipped as a "Big man" warrior. He may have been a typical 'manager of Neolithisation' and founding participant in the establishment of an agrarian society in South Scandinavia (Brinch Petersen 2008, 33ff). One way of documenting the integration between indigenous hunter-gatherers and immigrating farmers is by using molecular genetic analysis of human bones. The burial site of Ostorf in northern Germany was originally interpreted as a hunter-gatherer enclave surrounded by agrarian societies, because the individuals had a high intake of aquatic resources (Lübke et al. 2009, 130ff; Schulting 2011, 21). However, three burials contained remains with Palaeolithic/Mesolithic haplogroups U5 and U5a, while four other burials contained Neolithic haplogroups J, K and T2e (Bramanti et al. 2009, 139). The individuals at Ostorf illustrate a rare example of hunter-gatherers and possible farmers who may have lived together.

The pioneering phase in South Scandinavia is characterized by the clustering of settlements in favourable areas with easily workable arable soils during the early EN I. In regions such as Scania, the habitation is so dense and widespread that this region could be characterized as one of the more important territories in the agrarian societies of South Scandinavia (Fig. V.223). The widespread exploitation of the landscape is first observed during the late EN I phase in many regions of South Scandinavia, resulting in increased territorial marking of the landscape through the construction of long barrows and causewayed enclosures. This could be interpreted as a period of local expansion and consolidation. The lack of such territorial markers, especially in the eastern part of Central Sweden, could show the limited expansion during the late EN I and EN II phases, based on the distribution of pointed and thin-butted axes. It is therefore probable that the region did not have any major problems with territorial claims or that these conflicts were solved in a different way than further south. Furthermore, the region of East Central Sweden was located in the boundary zone of the Funnel Beaker culture, which may have resulted in its societies having a different social structure, leading to the emergence of the Pitted Ware culture.

In southern and western Norway it is still very questionable whether there was an agrarian society present at all during the Early Funnel Beaker culture. The rather dense distribution of imported thin-butted flint axes could suggest the presence of an agrarian society (Fig. V.224). But to date no domesticated animals or charred cereals remains have been found at any Early or Middle Neolithic sites in Norway. The main evidence consists of identified Cerealia pollen and an increase in ribwort plantain, which are problematic evidence to use in argumentation for agrarian practices. The Cerealia pollen can be misidentified, as they resemble various grasses. The majority of the pollen analysis has been undertaken in areas near the sea, which are open environments and therefore do not necessarily have anything to do with agrarian practices. Nevertheless, it is possible that scouting expeditions, or even migrations of pioneering farmers, may have tried to establish an agrarian society in southern or western Norway during the Early Neolithic. Such evidence can be observed as early as the late EN I phase with the establishment of an enclosure-related site at Hamremoen, which shows parallels with similar structures in Jutland (Skousen 2008; Madsen 2009; Ravn 2012; Glørtsad & Sundström 2014). The presence of possible South Scandinavia ceramics, based on vessel thickness and tempering materials, has been observed at sites such as Dønski, Vøyenenga and Kotedalen, which have been dated to between 3800 and 3500 cal BC (Olsen 1992; Østmo & Skogstrand 2006; Demuth & Simonsen 2010). Furthermore, the presence of a hoard of thin-butted axes at Disen also supports the argument for South Scandinavian connections during the late EN I. These pioneering farmers could have tried to settle in southern Norway by sailing across the Skagerrak, as indicated by a funnel beaker found at a depth of 120 metres in the sea near Skagen and the presence of oblique triangular arrowheads belonging to the Kjeøy phase, which were found on Anholt. In addition, the megaliths in southern Norway are also evidence of agrarian societies attempting to settle in this region. However, it seems as if these attempts to establish agrarian societies were unsuccessful, as it may have been difficult for such societies to maintain regular social relations and participate in the agrarian network, as they were located in the border zone of the Funnel Beaker culture.

The combination of a shorter growing season, lower population density and the limited areas of easily worked arable soils may have been some of the reasons why the agrarian expansion stopped in southern Norway and north of Mälardalen (Fig. V.224). The limit of the expansion can be observed in the distribution of the material culture of the Funnel Beaker culture, which also represents the border between the boreonemoral and southern/middle boreal vegetation zones, as discussed in section 2.1. Nevertheless, we should not rule out the possibility that pioneering farmers may have reached certain favourable agrarian areas of southern and western Norway during the Early Neolithic. It is also important to accept that the agrarian expansion was not just one occurrence, but several, in which pioneering farmers probably tried continuously to expand into new territories. In addition, it is important to acknowledge that the agrarian impulses probably became even more limited during the subsequent Pitted Ware culture, which appeared from as early as around 3300 cal BC in Central Sweden (Strinnhom 2001; Østmo 2008; Larsson 2009).

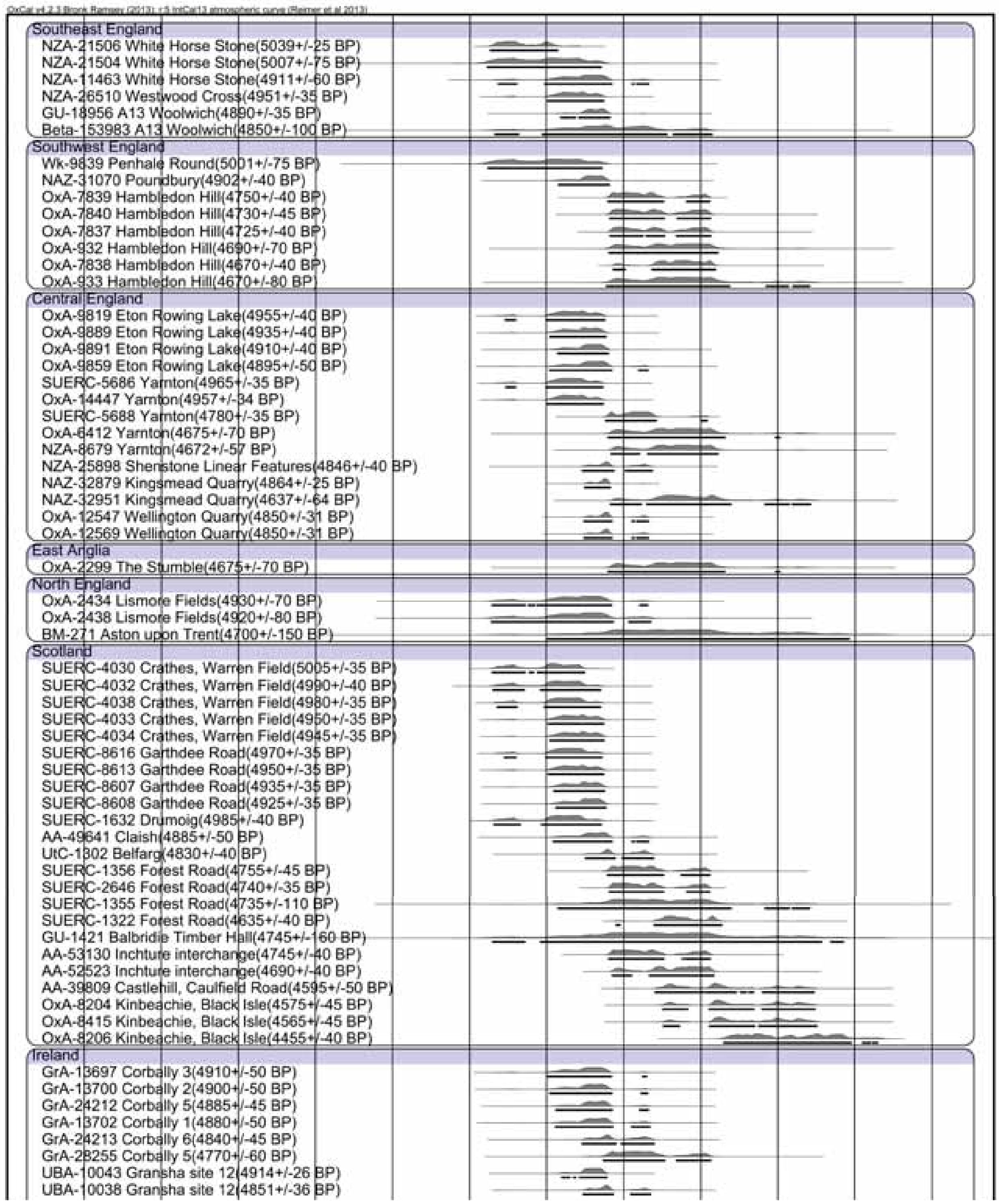


Fig. V. 219. [14]C dated cereals from Early Neolithic sites on the British Isles. After Stevens & Fuller 2012. Data after Table 69.

See next page.

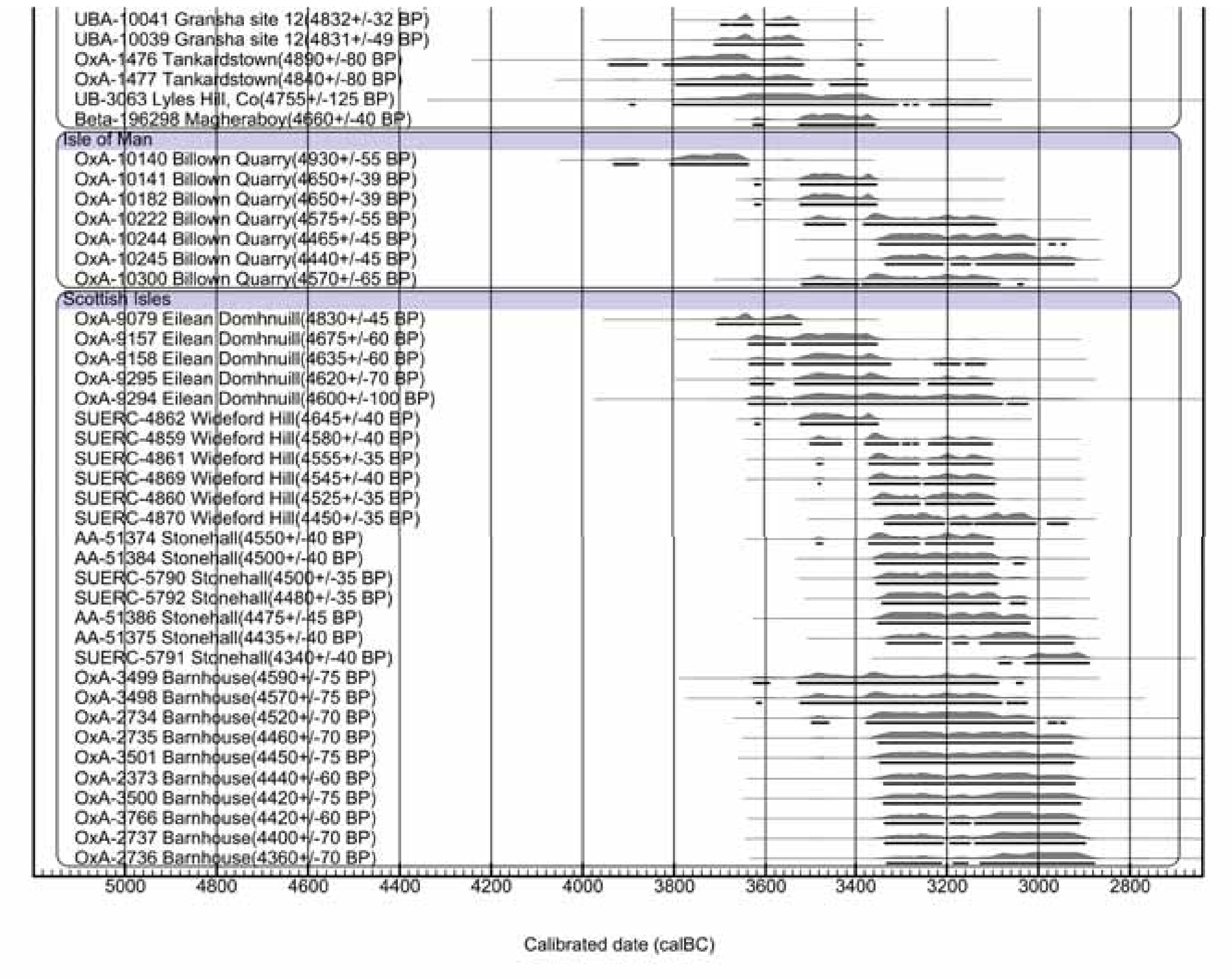


Fig. V. 219. *See previous page.*

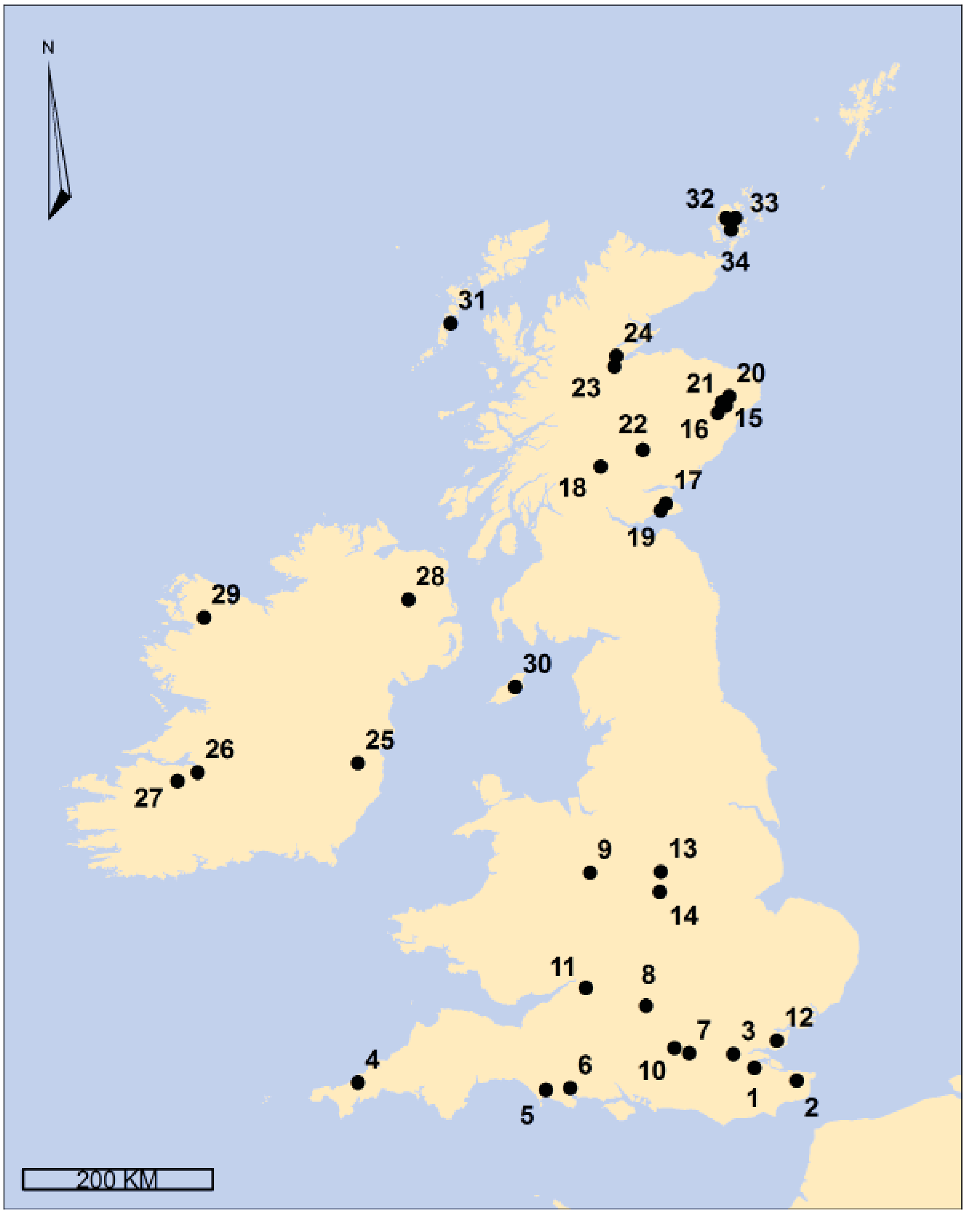


Fig. V. 220. [14]C dated cereals from the Early Neolithic in Great Britain and Ireland: 1. White Horse Stone, 2. Westwood Cross, 3. A13 Woolwich, 4. Penhale Round, 5. Poundbury, 6. Hambledon Hill, 7. Eton Rowing Lake, 8. Yarnton, 9. Shenstone Linear Features, 10. Kingsmead Quarry, 11. Wellington Quarry, 12. The Stumble, 13. Lismore Fields, 14. Aston upon Trent, 15. Crathes, Warren Field, 16. Garthdee Road, 17. Drumoig, 18. Claish, 19. Belfarg, 20. Forest Road, 21. Balbridie Timber Hall, 22. Inchture interchange, 23. Castlehill, Caulfield Road, 24. Kinbeachie, Black Isle, 25. Corbally, 26. Gransha site 12, 27. Tankardstown, 28. Lyles Hill, 29. Magheraboy, 30. Billown Quarry, 31. Eilean Dòmhnuill, 32. Wideford Hill, 33. Stonehall and 34. Barnhouse. After Stevens & Fuller 2012.

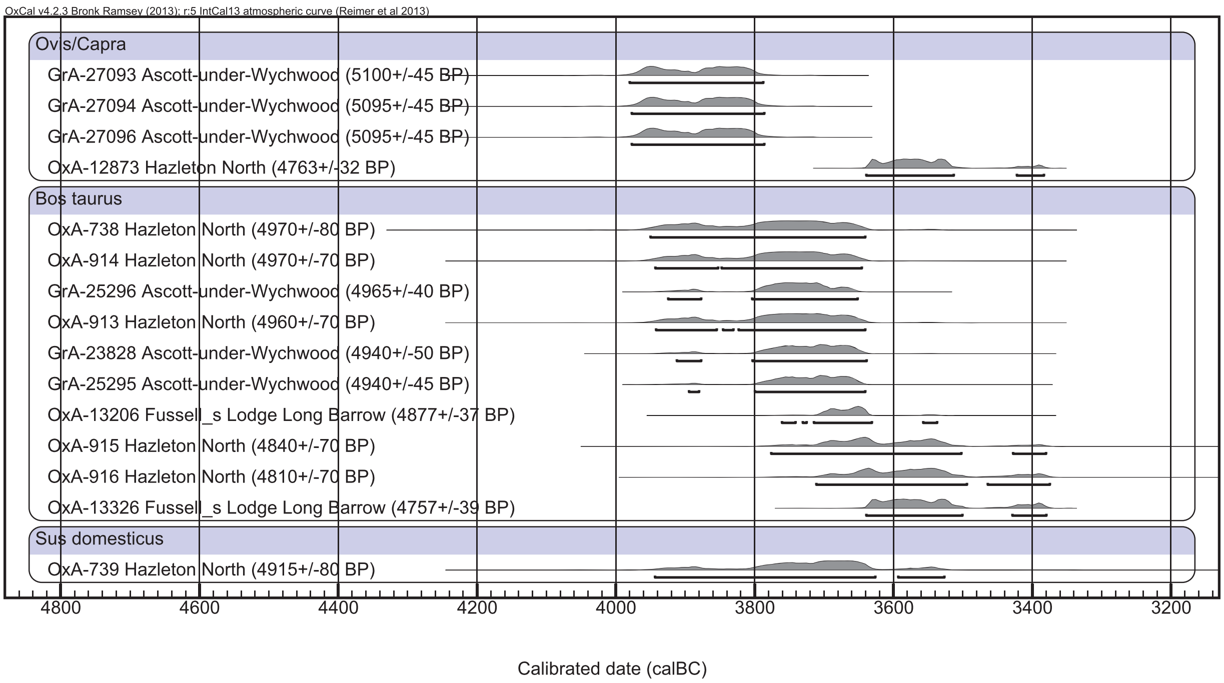


Fig. V. 221. ^{14}C dated domesticated animals from some Early Neolithic sites in England. After Bayliss & Whittle 2007. Data after Table 70.

Cultural phases: Middle Ertebølle culture-Late Ertebølle culture--------------------------------------early EN I-------late EN I--------- EN II------------------------MN--------------

Pollen zones: Atlantic-- Subboreal------(Ulmus fall)--------(Landnam)--------------------------------------

cal BC		5000	4900	4800	4700	4600	4500	4400	4300	4200	4100	4000	3900	3800	3700	3600	3500	3400	3300	3200
Wiggles		xxxx								xxxx	xxxx	xxxx	xxxx	xxxx					xxxx	xxxx
Site topography	Kitchenmiddens	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	------	------	------	------	------
	Lake shore sites	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	------	------	------	------	------
	Inland sites on arable soil											xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
Subsistence strategies	Hunting,fishing,gathering	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	------	------	------	------
	Husbandry									------	------	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Cultivation											xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
Agrarian evidences	Sheep/goat, Ovis/capra									xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Cows, Bos taurus											xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Pigs, Sus domesticus				------	------						xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Cereals/threshing waste										------	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Quern stones											xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Ard/plough marks												------	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
Cerealia pollen	North Germany											------	------	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Denmark												------	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Scania											xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Cent. Sweden/S. Norway												------	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
Isotopic values (Meso)	^{13}C >-17‰, ^{15}N >+12‰	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	------	------	------	------	------				
Isotopic values (Neo)	^{13}C <-17‰, ^{15}N <+10‰										------	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
Burials	Ertebølle flat burials	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	------	------	------									
	EN flat burials/bogs											xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	EN long barrows													xxxx	xxxx	xxxx	xxxx	------	------	
	Megaliths															------	xxxx	xxxx	xxxx	xxxx
Structures	Huts (Meso/Neo)	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Two-aisled houses											------	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Pits (paired pits)										------	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Flint mines											xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Enclosure related sites													xxxx	xxxx	xxxx	xxxx			
	Causewayed enclosures														------	xxxx	xxxx	xxxx	xxxx	xxxx
Material cul. Ertebølle	Shoe-last axes			------	------	------	xxxx	xxxx	xxxx	xxxx	xxxx									
	Limhamn adzes/axes				------	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx									
	Pointed based ceramics				xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx									
Material culture EN	Funnel beakers										------	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Pointed butted axes										------	xxxx	xxxx	xxxx	xxxx	xxxx	------	------		
	Battle axes											xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Thin butted axes													xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
	Copper artifacts											------	------	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
Depositional practices	Ceramics/axes in wetland											xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
Cal BC		5000	4900	4800	4700	4600	4500	4400	4300	4200	4100	4000	3900	3800	3700	3600	3500	3400	3300	3200

Transition towards an agrarian society: Primarily indirect contact with agrarian societies in Central Europe---Pioneering phase-Consolidation phase--Expansion to marginal areas---------

Forms of contact/social relations: Very fragmented--Integration--------Becoming part of a larger agrarian network------------------

Fig. V. 222. Archaeological evidence from the late 5th to the early 4th millennium BC showing a swift transition towards an agrarian society and continuation of certain foraging practices. Crosses mark certain evidence, whereas a dotted line marks uncertain evidence. Data after evidence of material culture, radiocarbon dates, pollen data, faunal materials and macrofossils investigated in this thesis.

Fig. V. 223. The agrarian expansion during the Early Neolithic I (4000-3800 cal BC) in Scandinavia, which is based upon compiled evidence of material culture, radiocarbon dates, pollen data, faunal materials and macrofossils.

Fig. V. 224. The agrarian expansion during the late EN I to EN II (3800-3300 cal BC) in Scandinavia, which is based upon compiled evidence of material culture, radiocarbon dates, pollen data, faunal materials and macrofossils.

SAXO INSTITUTE, UNIVERSITY OF COPENHAGEN
DEPARTMENT OF ARCHAEOLOGY