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NEW INTERPRETATIONS OF THE NEOLITHISATION PROCESS IN SOUTH SCANDINAVIA DURING THE LATE 5TH AND EARLY 4TH MILLENNIUM BC – AN IDENTIFICATION OF THE SCOUTING, PIONEERING AND CONSOLIDATION PHASE

ABSTRAKT W artykule dyskutowana jest kwestia rozwoju rolnictwa w południowej w kontekście trzech faz: skautingu, pionierów oraz konsolidacji. Poszczególne fazy odbywały się w różnych okresach. Początek procesu określony jako skauting miał miejsce pod koniec piątego tysiąclecia. Faza pionierów rozpoczęła się około 4000 cal BC i trwała kilkaset lat kiedy około 3800/3700 cal BC przeszła w fazę konsolidacji.

Słowa kluczowe: Południowa Skandynawia, Neolit, Ertebølle, Funnel Beaker,

ABSTRACT In this paper it is argued, that the expansions of agrarian practices in southern Scandinavia were associated with three specific phases: a scouting, pioneering and consolidation phase. The scouting phase was initiated by neighbouring agrarian societies in Central Europe during the late 5th millennium BC in order to identify future settlement grounds in South Scandinavia. The scouts initiated social gift relations with indigenous hunter-gatherers, which resulted in novel changes within the material culture together with the earliest evidence of domesticated animals and plants. These scouts laid the foundations for a migration of pioneering farmers beginning around 4000 cal BC, which were related to the Michelsberg Culture. These incoming pioneering farmers can be associated with some fundamental changes, as they settled on easy arable soils, thus demonstrating the introduction of an agrarian subsistence together with a new material culture and symbolic behaviour in South Scandinavia. The migration of pioneering farmers swiftly changed the material culture within the indigenous populations, thus supporting the theory of integrationism between the early farmers and local hunter-gatherers. Contemporary evidence from 4000 to 3700 cal BC also indicate a variable degree of continuity within the material culture and subsistence strategies, thus suggesting a population duality consisting of farmers living on easy arable soils and indigenous hunter-gatherers experimenting with agrarian practices, who settled the coastal zone. The continuous engagement and social interaction between the farming societies living in the inland and the hunter-gatherers in the coastal zones resulted in a consolidation phase from 3800 cal BC onwards, which is characterized by a fully integrated and developed agrarian society, which were interconnected with a larger European network.

Keywords: South Scandinavia, neolithisation, Late Ertebølle, Early Funnel Beaker, agrarian evidences, network

Introduction

The purpose of this article is to investigate the evidence for change and continuity within the neolithisation process in South Scandinavia in order to discuss how, when and why agrarian societies spread during the late 5th and early 4th millennium BC, as no consensus has been reached (Becker 1947; Troels-Smith 1954; Zvelebil & Rowley-Conwy 1984; Jennbert 1984; Nielsen 1987; Madsen 1987; Fischer 2002; Klassen 2004; Sørensen 2005; Hartz et al., 2007; Andersen 2008; Hallgren 2008; Rudebeck 2010; Larsson 2013; Sørensen & Karg 2014; Sørensen 2014; Price 2016; Andersson et al. 2016, Gron & Sørensen 2018) (Fig. 1). A new identification of a scouting, pioneering and consolidation phases is presented and combined with the

analysis of important artifacts in order to discuss a new hypothesis of the neolithisation process in South Scandinavia.

The current neolithisation debate

The reasons for the adoption of agrarian practices in South Scandinavia revolve around on population growth, resource availability caused by climate changes and social changes within societies, or a combination of all three (Sørensen 2014). Most researchers tend to prefer one explanation over another, but currently no dominant reason is preferred. The perception of who were the primary carriers of agrarian knowledge and practices also varies with each of the proposed hypotheses. These hypotheses

have concentrated on: migrationism, indigenism and integrationism. The migration hypothesis argues that agriculture was introduced by a swift process of a smaller or larger migration lasting only a few generations. Here it is the migrating farmers, who are the primary carriers of agrarian technologies. The hypothesis of indigenism on the other hand argues that the introduction of agrarian technologies is a gradual process, lasting several hundred years. Here the hunter-gatherers are the primary carriers of agrarian technologies, which spread as an idea between humans. Supporters of the integration hypothesis is a combination of the first two hypotheses, but here there is still no agreement about who introduced agrarian practices, and how big a role the local hunter-gatherers played in this spread of agrarian technologies. In all these discussions a cardinal question has been overlooked, which concentrates on how easy or difficult it is to learn the agrarian technologies during the late 5th and early 4th millennium BC.

Cultural epoch	cal BC
Late Ertebølle	4500-4000
Early Neolithic Ia	4000-3800
Early Neolithic Ib	3800-3500
Early Neolithic II	3500-3300
Middle Neolithic I-II	3300-3000

Fig. 1. Chronology of the Mesolithic and Neolithic transition in southern Scandinavia.

Learning agrarian practices

The management of stockbreeding practices is probably the least difficult technology to be adopted by a hunter-gatherer society, as documented in several ethnographical studies (Nicolaisen 1975; Gregg 1988; Xavier et al., 2008; Sadr 2013). Animal husbandry practices could have spread, without any significant exchange of knowledge between hunter-gatherers and farmers, where domesticated animals could have been received in exchange, stolen or escaped from farmers. 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 (Mackenzie 1980; Perry 1984; Gregg 1988).

Crop cultivation is a more difficult agrarian activity to master than animal husbandry, which is documented in several ethnographical and experimental studies (Steensberg 1979; Nicolaisen 1975;

Lee 1979; Yin 2006; Freeman 2012). 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. Especially the fertility of the soil is a problem, when cereals are grown repeatedly in the same place, therefore exhausting the soil of nutrients. 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). One solution could be to supply the soils with nitrogen oxides, by implementing a manuring strategy from the domesticated animals. The manuring method is most efficient when combined with a fallow strategy, which allows the soil to regenerate the organic content of the soil. The grass fallow is of shorter duration lasting a few years, while bush fallow lasts less than a decade, whereas the forest fallow can last up to several decades. Generally the use and implementation of these agrarian technologies requires the ability to plan several years ahead, which means that the learning processes could last for decades.

Agriculture is a very complex technology, which takes a long time to learn, thus making it very difficult for agrarian practices to spread as an idea, especially if the practices are associated with many told and especially untold practices. The code of the untold actions 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. Instead, based on a detailed survey of primary agrarian evidence (direct 14C dates of cereals and domesticated animals) and secondary evidence of material culture (polished axes and pottery), it is claimed that the expansions of agrarian practices in southern Scandinavia are associated with the migration of farmers. The 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 hypothesis of both migrationism and integrationism.

Structures of migration

Migrations and the processes behind them are subject to certain rules and structures that can be characterized as part of a larger process in which migration is a type of behavior carried out by a subgroup within a group (Anthony 1990). It is possible

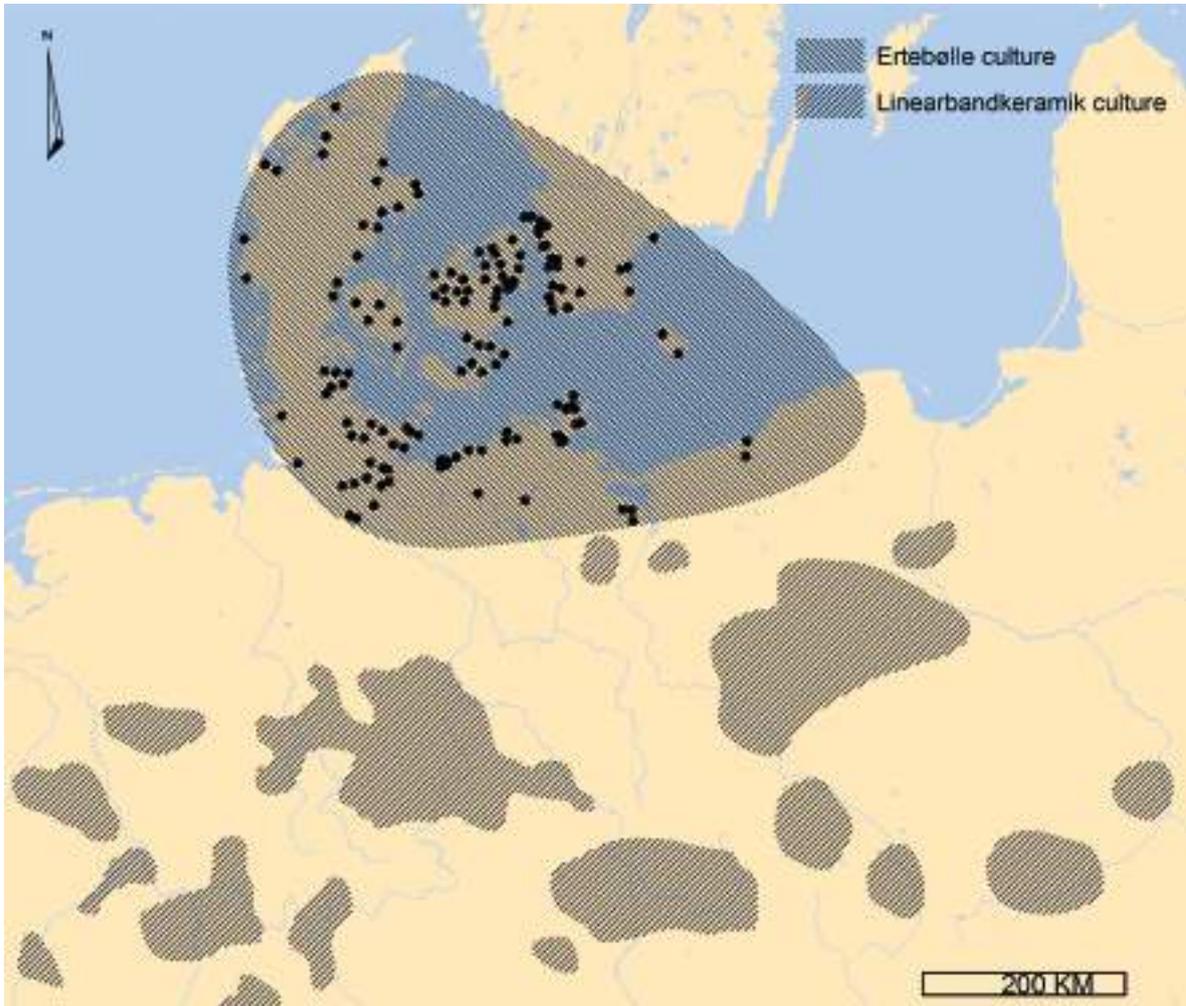


Fig. 2. The distribution of the Linearbandkeramik Culture and the Ertebølle Culture. After Hartz et al. 2007

that some hunter-gatherers from South Scandinavia could have migrated south and visited farming societies and learned the different agrarian practices. However, such a situation would have required a stay of longer duration within a farming society lasting several years and perhaps decades before the knowledge exchange of the agrarian practices would have been complete. If such a scenario was the case during the Ertebølle Culture, then we should expect to see more convincing and permanent evidence of agrarian practices in South Scandinavia before 4000 cal BC. However, this is not the case (Sørensen & Karg 2014). Instead there seems to be a standstill of the agrarian expansion in Northern Europe lasting from 5500 to 4000 cal BC, where no significant knowledge exchange involving any permanent agrarian practices occurred (Fig. 2). The reason for the standstill could be caused by the hunter-gatherer network in South Scandinavia, which is orientated towards the eastern Baltic, Finland and the Russian plains during the 7th to the 5th millennium cal BC, based on the pointed-based pottery in the Ertebølle Culture (Hallgren 2008; Gronenborn 2009; Hartz 2011; Müller 2011). The standstill and sudden

expansion around 4000 cal BC strongly suggests that it could have been internal social or economic changes within the Central European agrarian societies, which are the driving factors behind the different phases in these migrations.

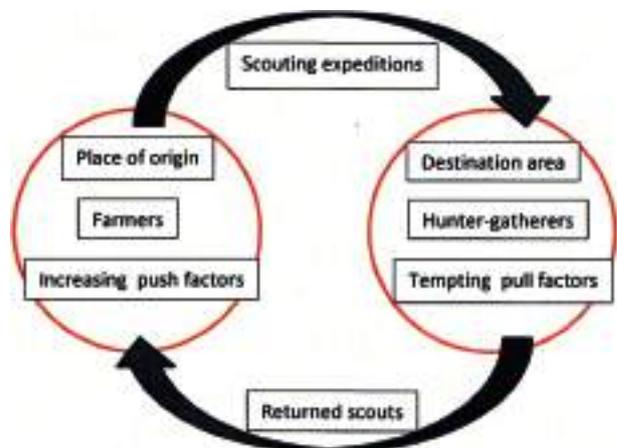


Fig. 3. The first phase of migrations would include several scouting expeditions to possible destination areas, which could be contemporary with the appearance of push factors at the place of origin

Following the theoretical structure of migrations then 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 in these central European agrarian societies. 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 (fig. 3).

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 newly established agrarian societies, thus improving the possibilities of creating more permanent settlements on easy arable soils. If the strategy succeeded then the transition would, in theory, 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. On the other hand a more slow process could also be anticipated, with a swift change of material culture and a more gradual integration of agrarian practices, thus resulting in a period with a population duality of farmers and hunter-gatherers (fig. 4).

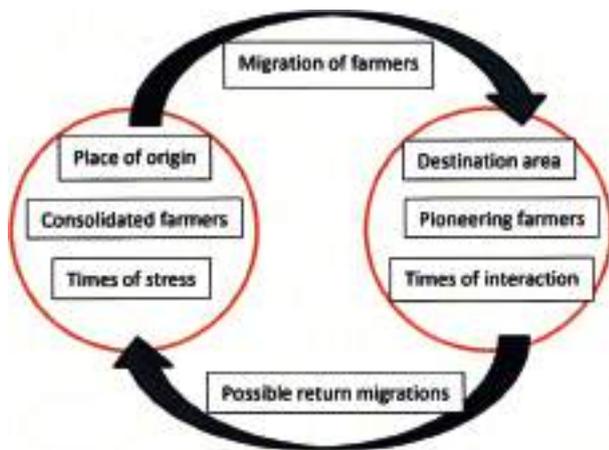


Fig. 4. The second phase of migrations would be an actual immigration of pioneering farmers of men, which could be followed by return migrations to the place of origin

The third phase can be characterized as a consolidation stage, in which the pioneering farmers became fully integrated with the indigenous hunter-gatherers, thus resulting in expanding territories

and settlements in more marginal areas in various regions. Such regional expansions may have resulted from population growth, assimilation of local hunter-gatherers 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 (fig. 5).

These three phases will be investigated and discussed by studying the changes and continuity of the archaeological data during the transition between the 5th and 4th millennium BC in South Scandinavia.

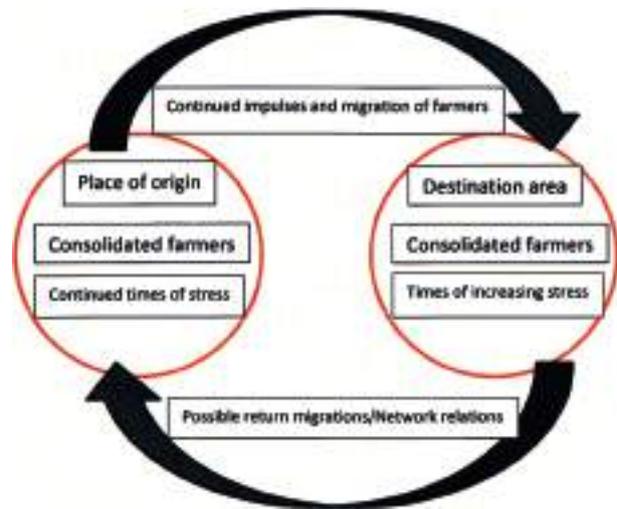


Fig. 5. The third phase of migrations can be characterized as a consolidation stage, in which the pioneering farmers expanded their territories and continued to receive impulses and possible immigration of farmers from the place of origin

The scouting phase

The first example from a possible scouting expedition could be associated with the finds from the inland site of Flintbek in Schleswig-Holstein. Here a pit was filled with short necked funnel beakers, flake cores and scrapers (Zich 1993). Charcoal pieces from the pit were 14C dated between 4300 and 3900 cal BC, making it one of the earliest discoveries of funnel beaker ceramic in northern Germany. Signs of direct or indirect contact between agrarian scouts and coastal hunter-gatherers could also be interpreted in connection with the few bones from domesticated animals found on contemporary Late Ertebølle coastal sites at Wangels and Neustadt, which were located approximate 30 kilometers from Flintbek. The second example is from the inland site of Oxie 50: 1 in Scania, which consisted of a pit, where some undiagnostic

Neolithic sherds and a fragment of a polished axe were found together with several charred cereals. One of the cereals was 14C dated between 4200 and 4000 cal BC, which indicates that the material in the pit could be evidence from agrarian scouts (Brusling 2003). In Scania there are also signs of contact between these scouts and local hunter-gatherers, which is expressed in the finds of grain impression on Ertebølle ceramics from the sites of Löddeborg and Vik (Jennbert 1984) (Fig. 6). A third example can be observed within the earliest axe deposition in South Scandinavia, which consists of two shoe-last axes and a pointed-butted axe all made of amphibolite found at Udstolpe on Lolland (Lomborg 1962) (Fig. 7). Such axe deposits are usually observed in Central European agrarian societies and could represent a symbolic offering made by scouts searching for new lands in the North. A fourth example is the appearance of jadeite axes, which also could represent similar deposits made by Central European agrarian scouts (Klassen 2004) (Fig. 8). These scouting expeditions would lay the foundations for the following pioneering phase, involving the travelling of whole tribes with dug-out canoes, which followed the water routes towards The North

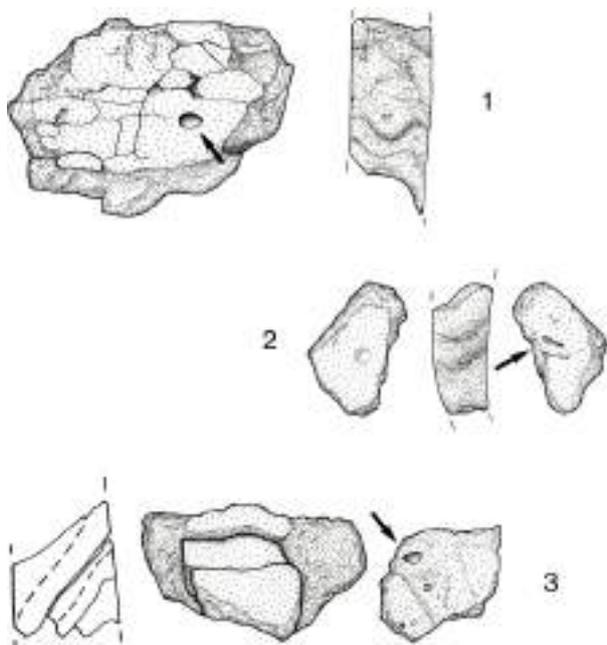


Fig. 6. Drawings of Ertebølle sherds with grain impressions from the settlements of Vik and Löddeborg in Scania.
 1. Sherd with impressions of wheat (*Triticum compactum*).
 2. Sherds with impressions of a grain of barley (*Hordeum*).
 3. Sherd with impression of einkorn wheat (*Triticum monococcum*).
 After Jennbert 1984; Koch 1998



Fig. 7. Deposition of two shoe-last axes and one pointed-butted stone axe of amphibolite from Udstolpe, Lolland. After Lomborg 1962

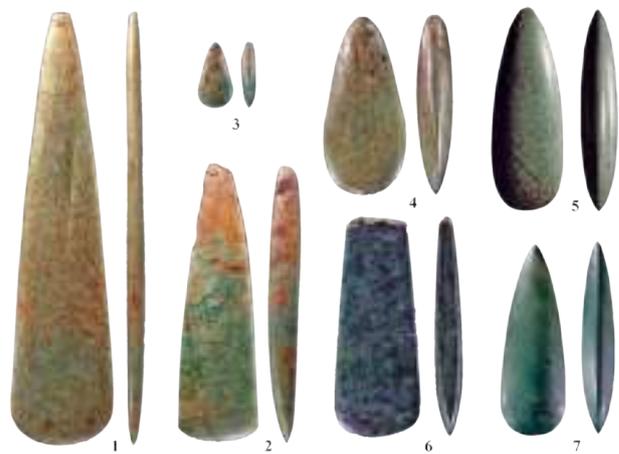


Fig. 8. Axes of Alpine jade from South Scandinavia.
 1, 2. Zealand, unknown find location,
 3. Højgård, Tulstrup parish, eastern Jutland,
 4. Danmark, unknown find location,
 5. Lolland-Falster, unknown find location,
 6. South Funen, unknown find location,
 7. possibly south-western Scania, unknown 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

The pioneering phase

The immigration of these pioneering farmers had a swift impact on the settlement pattern, which changed during the transition from the Late Ertebølle Culture and the Early Funnel Beaker Culture, because a new type of inland site located on easy arable soils emerges. It is on these sites, where the first evidences of agrarian practices

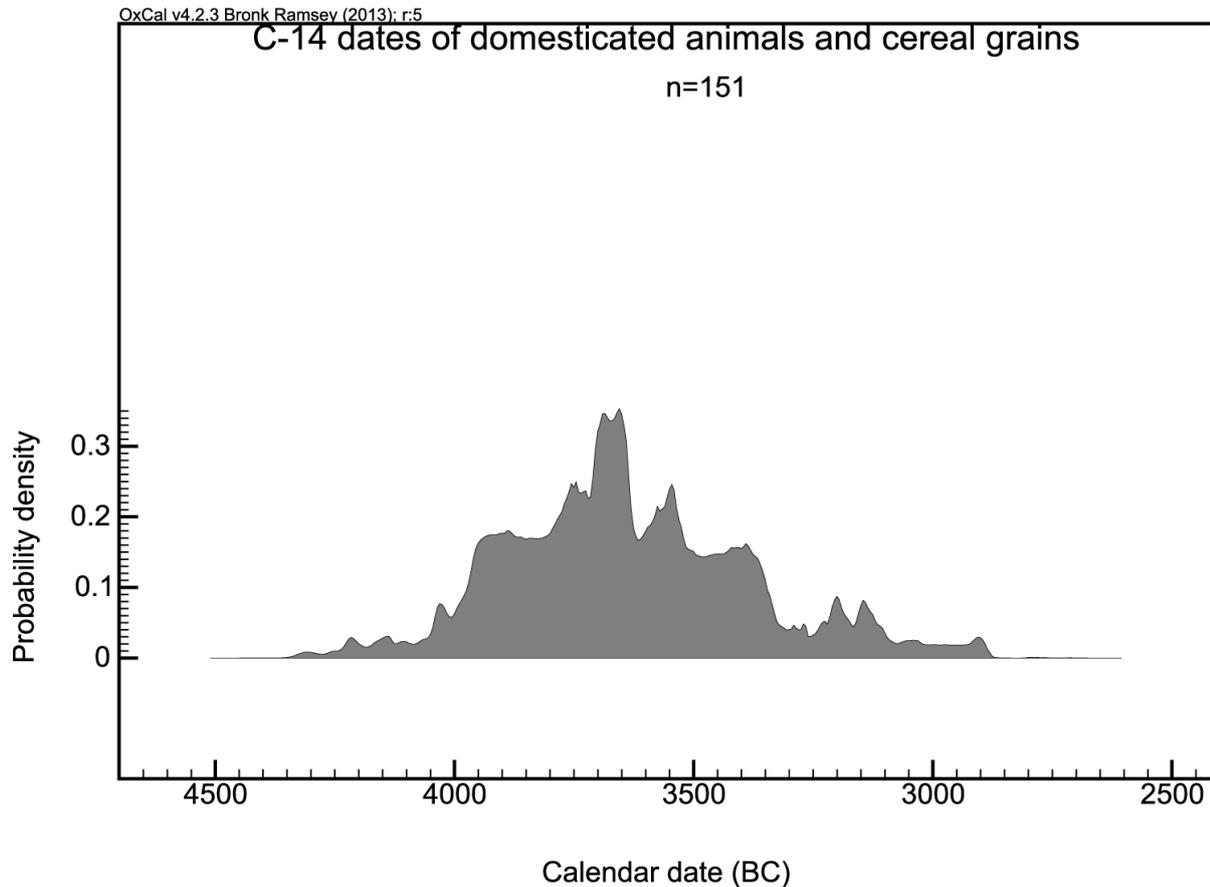


Fig. 9. Graph showing distribution of all ^{14}C dates of charred cereals and domesticated animals from the Early Neolithic in South Scandinavia. After Sørensen 2014

have been documented in a broader scale from 4000 cal BC onwards. These evidences is recognized by investigating all the known ^{14}C dates of charred cereals and domesticated animals in South Scandinavia from Denmark to Mählerdalen in Sweden (Fig. 9). A recent survey after pointed-butted axes dated from 4000 to 3700 cal BC also reflects the early expansion of pioneering agrarian sites in South Scandinavia (Sørensen 2014) (Fig. 10). Their distribution clearly illustrates that the agrarian scouts did manage to find suitable areas for initiating smaller colonies of pioneering agrarian societies in areas characterized by easy arable soils (Fig. 11). These areas are also characterized by containing a relatively limited habitation from the Late Ertebølle Culture. Such a pattern can be interpreted as if the pioneering agrarian societies established their colonies in areas, where they could expect the least possible conflict with local hunter-gatherers. Some of the most obvious concentrations of pioneering colonies are also located in the vicinity of flint-rich areas in Scania, Stevns and Thy. Here, pioneering farmers quickly established flint mines and a systematic axe production. The increased production of pointed-butted axes, particularly in Scania and Stevns, have been

used to establish a large network of agrarian societies further north in the regions poor on flint on Bornholm and Gotland and in Västergötland, Östergötland and Närke (Fig. 11).

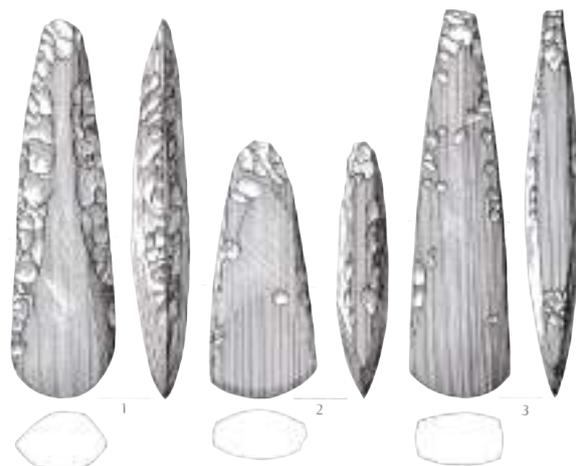


Fig. 10. Drawing of pointed-butted flint axes of type 1, 2 and 3. Type 1 has an oval cross section. Type 2 has a three-sided cross-section. Type 3 has a four-sided cross section. After Nielsen 1977



Fig. 11. Distribution of pointed-butted flint axes, flint mines and important flint resources in southern Scandinavia and northern Germany. After Sørensen 2014

The consolidation phase

The consolidation phase from 3800 to 3500 cal BC marks the beginning of a fully adapted agrarian society, with an increased social hierarchy, where technological innovations of an economic, logistic and symbolic character created the foundations for an intensified usage of the landscape. The intensified exploitation of the landscape created the need for making territorial markers in the landscape. The necessity for making such monumental markers in the landscape was not necessary for the pioneering farmers, as they were the first to clear the forest, which in itself would be a clear visible monument in the landscape. It is therefore not a coincidence that the first earthen long barrows were built on top of pioneering agrarian settlements, because they now acted as monumental and territorial marks for the descendants of the first farmers in specific

areas of the landscape (Sørensen 2014). The increasing territorial demands may have resulted in a greater number of conflicts and the construction of enclosures, which could be used for a variety of activities such as protection of goods and people, feasting grounds and symbolic actions (Andersen 1997; Christensen 2004; Klassen 2014). The presence of exotic copper objects within the consolidation phase suggests that the agrarian societies in South Scandinavia were interconnected with a larger European network, from where they received continuous cultural and social impulses during the following centuries (Klassen 2000).

In order to investigate what happened during the centuries leading up to the consolidation phase it is necessary to study the changes as well as evidences of continuity in these pioneering agrarian and transitional hunter-gatherer societies in South Scandinavia.

Chronology	Late EBK	Late EBK	Late EBK	EN Ia
Cal BC	4600-4400	4400-4200	4200-4000	4000-3900
EBK ceramics	X	X	X	
Core axes	X	X	X	
T-shaped antler axes	X	X	X	
Shoe-last axes	X	X	X	
EBK lamps	X	X	X	rare
Diet predominantly marine	X	X	X	rare
Kitchenmiddens	X	X	X	X
Lake shore sites	X	X	X	X
Hunting, gathering, fishing	X	X	X	X
Cooking of wild foods	X	X	X	X
Flake axes	X	X	X	X
Flat burials	X	X	X	X
Huts	X	X	X	X
Dominant blade production	X	X	X	rare
Dominant flake production		rare	rare	X
Jadeite axes		rare	rare	rare
Polished flint axes		rare	rare	X
Agrarian evidences on kitchenmiddens		rare	rare	rare
Domesticated animals		rare	rare	X
Domestic plants		rare	rare	X
Forest clearances			rare	X
Votive offerings			rare	X
Inland sites on easy arable soils				X
Cattle management for dairying				X
Movement of cattle by boat				X
TRB ceramics				X
Battle axes				X
Cooking of milk				X
Diet predominantly terrestrial				X
Flint mines				X
Two-aisled houses				X
Copper axes				rare
Causewayed enclosures				
Plough marks				
Cattle sacrifice				
Human bog burials/offerings				
Earthen longbarrows				
Megaliths				
Hunter-gatherer network (limited contact with agrarian societies)	X	X	X	
Scouting phases from agrarian societies visiting hunter-gatherer societies		X	X	X
Pioneering phase (population duality or/and one population commuting between coastal and inland zones)				X
Consolidation phase (fully developed agrarian society and integration between farmers and hunter-gatherers)				

Fig. 12. Archaeological evidence from the late 5th to the early 4th millennium BC showing both changes towards an agrarian society and continuation of certain foraging practices and technologies

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EN Ia	EN Ib	EN Ib	EN Ib	EN II-MN	Reference
3900-3800	3800-3700	3700-3600	3600-3500	3500-3000	Sørensen 2014
					Sørensen 2015a
					Sørensen 2012
					Sørensen 2014
					Klassen 2004
					Czekaj-Zastawny et al. 2011
rare					Fischer et al. 2007
X	X	X	X	X	Andersen 2008
X	X	X	X	X	Fischer 2002
X	X	X	X	X	Sørensen 2014
X	X	X	X	X	Craig et al. 2011
X	X	X	X	X	Stafford 1999
X	X	X	X	X	Price et al. 2007
X	X	X	rare	rare	Sørensen 2014
rare					Stafford 1999
X	X	X	X	X	Stafford 1999
rare					Klassen 2004
X	X	X	X	X	Sørensen 2014
rare	rare	X	X	X	Sørensen 2014
X	X	X	X	X	Sørensen 2014
X	X	X	X	X	Sørensen 2014
X	X	X	X	X	Sørensen 2016
X	X	X	X	X	Sørensen 2014; Koch 1998
X	X	X	X	X	Sørensen & Karg 2014
X	X	X	X	X	Gron et al. 2015
X	X	X	X	X	Gron et al. 2016
X	X	X	X	X	Sørensen 2015
X	X	X	X	X	Zápotocký 1992
X	X	X	X	X	Issakson & Hallgren 2012
X	X	X	X	X	Fischer et al. 2007
X	X	X	X	X	Sørensen 2014
X	X	X	X	X	Sørensen 2014
rare	X	X	X	X	Klassen 2000
rare	rare	X	X	X	Klassen 2014
	X	X	X	X	Beck 2013
	X	X	X	X	Price & Noe-Nygaard 2009
	X	X	X	X	Fischer et al. 2007
	X	X	X	rare	Sørensen 2014
			X	X	Persson & Sjögren 2001
X	X				
	X	X	X	X	

Continuity and change

The sudden changes in the settlement pattern appear at the same time as the disappearance of the Ertebølle Culture. However, some of the kitchenmiddens contains layers from the Late Ertebølle and Early Funnel Beaker Culture. These coastal sites show on the one hand a clear break in the material culture and on the other hand continuity, because some sites continued to be settled during the Early Neolithic (Andersen 2008). Investigations of the continuity and changes within the material culture could therefore shed some light on how the farmers and hunter-gatherers influenced each other in a field of social interaction during the first centuries of the neolithisation process (Fig. 12). The first example involves a comparison of the lithic assemblages from the Late Ertebølle Culture and Early Neolithic showing both continuity and changes. Evidences of continuity have been documented in connection with the production of blades and flake axes, as these tools are produced and used in the Early Neolithic (Nielsen 1985; 1994; Andersen 1991). However, continuity from the Late Ertebølle to the Early Neolithic can also be associated with agrarian societies from Central Europe, because larger blades and flake axes also occurs in lithic assemblages from the agrarian Michelsberg Culture (Sørensen 2014, 236). Major changes in the lithic assemblages can be observed in the switch from a production dominated by blade tools towards a production dominated by flake tools (Skaarup 1973; Stafford 1999). Another change can be observed by the disappearance of core axes shafted as adzes and the emergence of polished pointed butted axes (Sørensen 2012). The disappearances of T-shaped antler axes and shoe-last axes are also associated with the end of the Ertebølle Culture (Klassen 2004; Sørensen 2014). 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 illustrates that the Michelsberg and Early Funnel Beaker assemblages are very similar, whilst the assemblages from the Late Ertebølle culture differ (Sørensen 2014). Generally, the evidences of changes within the lithic assemblages and technologies were swiftly integrated by the indigenous hunter-gatherers in South Scandinavia, thus showing a swift influence from the incoming farmers.

The second example of continuity and changes can be observed within the ceramic assemblages during the Late Ertebølle and Early Neolithic transition in South Scandinavia (Fig. 12). Around 4000 cal BC the characteristic pointed-based pottery from the Late Ertebølle Culture disappeared

and at the same time the short-necked funnel beakers together with flasks, bowls, discs and spoons emerged (Sørensen 2015a). The funnel beakers are characterized by a novel technology, thinner vessels, finer temper, thus documenting new cooking methods. However, 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). But, these lipid investigations lack information from vessels found at inland sites located on easily workable arable soils, where a different pattern of more agrarian cooked food products could emerge, which is confirmed by lipid analysis from the inland site of Skogsmossen in Västmanland, which confirmed that cooking of milk have taken place at this inland-oriented habitations (Isaksson & Hallgren 2012). The emergence of the funnel beakers around 4000 cal BC can also 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 2012). The changes in ceremonial practices have been associated with offerings, which might have been part of a cycle of social gatherings within agrarian societies (Fig. 12). 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 house structures located on easy arable soils (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. These depositional practices are not observed in the Late Ertebølle Culture. But there are also some evidences of continuity within the ceramic assemblages during the neolithisation process. Continued use of the Late Ertebølle 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 indicates continuity. 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. 2011) (Fig. 12). Furthermore, some narrow vessels with possible rounded bases have been 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 (Andersen 1993; 2011). However, the documentation of these transitional vessels and their technological production still remains to be studied in detail. 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 2008; 2011).

Generally, these comparisons of lithic and ceramic assemblages indicate that the changes in the material culture and symbolic practices emerged in connection with the introduction of an agrarian society to South Scandinavia through a migration of Central European farmers (Sørensen 2013). The migration of Central European farmers to South Scandinavia changed relatively swiftly the material culture on all types of sites, thus making it difficult to identify a possible population duality of indigenous hunter-gatherers and incoming farmers (Fig. 12). Nevertheless, empirical studies of the Early Neolithic kitchen middens have shown that most of the layers dated from 4000 to 3700 cal BC contain very limited evidence of charred grains, clay discs (interpreted as baking plates) and grinding stones (Sørensen 2014), things usually associated with farming. Only later Early Neolithic kitchen middens layers dated from 3600 to 3300 cal BC, show charred grains, clay discs and grinding stone (Skaarup 1973; Andersen 1991; Sørensen 2014). The later and rather limited appearance of agrarian practices on these kitchenmiddens could support the hypothesis of a population duality during the first centuries after the introduction of an agrarian society. The indigenous population stayed on the coastal sites, whereas the incoming farmers settled further inland on easy arable soils. The coastal hunter-gatherers swiftly changed their material culture during these first centuries of the 4th millennium BC and supplemented their economy with domesticated animals, thus being in the periphery of the newly established agrarian societies. The speed of the neolithisation process could therefore be varied in different regions depending on how engaged the hunter-gatherers was involved, or was allowed to be involved with the neighboring agrarian societies. The change of material culture clearly demonstrates that some knowledge exchange occurred between the two populations perhaps through social gatherings and marriage alliances. The limited evidence of cereal cultivation practices on the coastal sites clearly demonstrates that this technology could be associated with a knowledge barrier for the indigenous hunter-gatherers.

Advanced agrarian practices as crop cultivation could only spread successfully through direct and long term social knowledge exchanges, which did occur during the first centuries of the 4th millennium in South Scandinavia. Such a scenario is demonstrated by the Dragsholm man, who was buried as a farmer, hunter and warrior on a coastal site (Fig. 13). The Dragsholm man showed terrestrial $\delta^{13}C$ values and was dated to 4000-3800 cal BC (5102±37 BP, 3973-3798 cal BC, AAR-7416) (5090±65 BP, 4035-3712 cal BC, AAR-7418) (Brinch Petersen 1974; 2008; Price et al. 2007) (Fig. 16). The burial of the Dragsholm man contained some significant finds showing both change and continuity, 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, thus connecting the man with status and power living in a transitional world. 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 earliest phase of the Early Neolithic 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 to the indigenous hunter-gatherer population (Brinch Petersen 2008; Nielsen & Nielsen 2017).

Based on the rare evidence from the Dragsholm man it is clear that some social interaction between the incoming farmers and indigenous hunter-gatherers did occur. But how should we understand the settlement continuity on the coastal settlements in South Scandinavia? One theory argues for a population duality, where one population lived near the sea and lived mainly as hunter-gatherers, but changed their material culture and supplemented their economy with domesticated animals and cultivation of gardens, thus being in the periphery of agrarian societies. This hypothesis finds support in the limited evidence of crop cultivation practices found on these coastal sites during the first centuries of the 4th millennium BC.

The other population lived as farmers on the easy arable soils, which represents the migrating farmers. It is first around 3500 to 3300 cal BC, where the inhabitant abandons these coastal settlements and joins the full agrarian subsistence strategy, which is contemporaneous with the building of the megaliths (Andersen 2008; Ebbesen 2011). The theory has been questioned by some researchers,

and an alternative hypothesis has suggested that the coastal and inland sites were populated by the same agrarian population, who commuted between the coastal and inland areas during various seasons. An alternative scenario could involve both hypotheses consisting of a population duality in certain regions and one agrarian population commuting between coastal and inland zones in other regions, which could be the result of how fast the integration between the incoming farmers and indigenous hunter-gatherers occurred. Especially the interpretation of a sharp shift has been associated with 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 shift in diet from a marine to a terrestrial diet, as indicated by isotope values (Tauber 1981; Fischer et al. 2007). However, these analyses largely lack data from the remains of humans who lived at the Early Neolithic coastal sites, thus indicating that people did exploit marine food sources, which is supported by the continuity in what was being cooked in some of the funnel beaker vessels (Pedersen 1995; Craig et al. 2011).

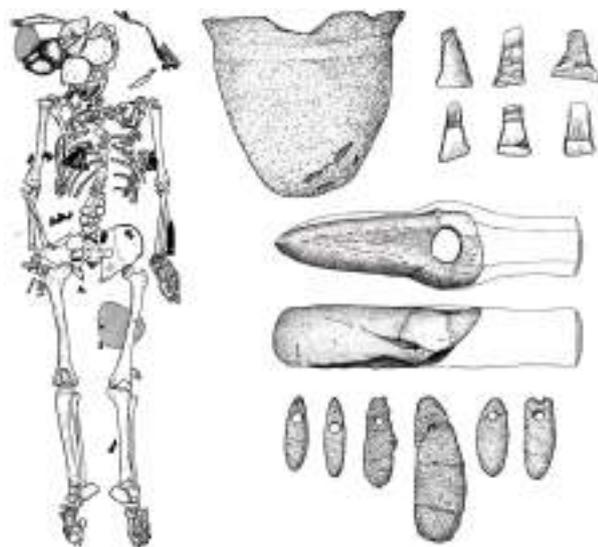


Fig. 13. The burial of the Dragsholm man containing a short necked funnel beaker, a polygonal battle axe, teardrop-shaped amber beads, transverse arrowheads, flint blades and a wrist guard.
After Brinch Petersen 1974; 2008

To move forward in this ongoing discussion it is necessary to make future surveys and excavations behind the middens and to carry out DNA, 14C and 13C analysis of the human bones found at these Late Mesolithic and Early Neolithic kitchenmiddens and inland sites. Currently, no DNA analysis has been undertaken on human

bones dated to the transition between the Late Ertebølle Culture and Funnel Beaker Culture in southern Scandinavia. Such investigations are presently underway (Sørensen, 2015b). An example of a recent analysis of a human bone dated from 3945 to 3647 BC originating from a woman found in Saxtorp, Scania belonged to the mtDNA haplogroup of T2b (Mittnik et al. 2018). The result suggests that the woman from Saxtorp was part of a migration of agrarian societies from Central Europe to South Scandinavia, because the T haplogroup is a characteristic type, which has ancestral connections to the Linearbandkeramik Culture and thus connected to the agrarian farmers in Central Europe (Sørensen 2014). Previous mtDNA analysis of Mesolithic hunter-gatherers dated from 5700 to 5500 BC from Motala in central Sweden was connected to the U5 haplogroup, thus being genetically different from the central European Linearbandkeramik Culture, which is dominated by the T, X, K, J and N haplogroups (Sørensen 2014, 107). However, more DNA analysis is needed from humans living in the phase between the Mesolithic and Neolithic transition in South Scandinavia in order to investigate which genetic impact the migrating farmers had on the indigenous hunter-gatherers in this region. Despite the lack of understanding of what happened with the local ertebølle hunter-gatherers it is very clear, that their main part of their material culture disappeared, but the foraging subsistence strategies continued alongside with the new agrarian practices into the Neolithic together with the appearance of the first pioneering farmers.

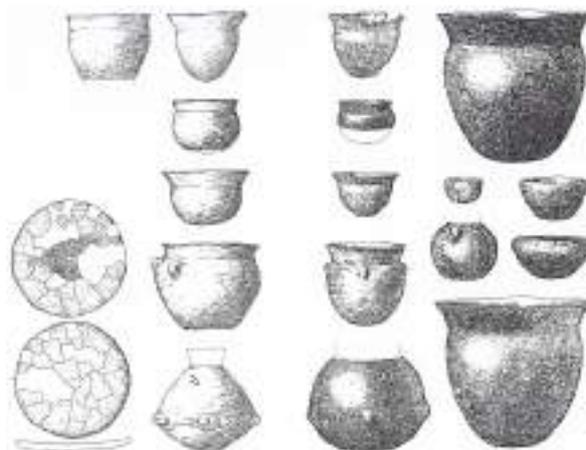


Fig. 14. Comparisons between ceramic assemblages from the Michelsberg site of Rübeld-Baumannshöhle in Harzen (left) and the Early Funnel Beaker site of Muldbjerg I on Zealand (right).
After Troels-Smith 1957; 1982; Richter 2002

The origin of the pioneering farmers?

The cultural impulses creating the Early Funnel Beaker Culture was influenced by pioneering farmers, which was either directly or indirectly connected to the large scale network of the Michelsberg Culture on the transition between the 5th and 4th millennium BC. Typical Michelsberg sites demonstrate many similarities with Early Funnel Beaker sites (Fig. 14). They are both located on easily worked arable soils and characterized by a small number of pits containing objects including short-necked funnel beakers, clay discs, clay spoons, pointed-butted axes, flake axes, ordinary blades, disc-shaped flake scrapers, transverse arrowheads and flake perforators (Lüning 1968; Nielsen 1985; Vermeersch 1988; Koch 1998; Vanmontfort et al. 2008; Sørensen 2013; 2015a). Generally, the new material culture also followed new practices of disposing ceramics in pits, which also points towards a contact, associated with pioneering farmers who were interconnected with people from the Michelsberg Culture (Becker 1954; Biel et al. 1998; Jeunesse 2011) (Fig. 15). Especially, the appearance of the pointed-butted flint axes also demonstrates an impulse from the Michelsberg Culture (Fig. 16). 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). 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; Collet et al. 2004; Grooth et al. 2011; Giligny et al. 2012; Baczkowski 2014). 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 (Olausson et al. 1980; Rudebeck 1986; Becker 1993; Barber et al. 1999; Stevens & Fuller 2012; Sørensen 2012; Sørensen & Karg 2014) (Fig. 16).

The Michelsberg Culture is also characterized by large hall buildings and enclosures, which have not been found in first centuries of the Early Neolithic from 4000 to 3800 cal BC in South Scandinavia (Marolle 1989; Andersen 1997; Raetzl-Fabian 2009; Rzepecki 2011; Klassen 2014; Sørensen 2014). The lack of these monumental structures could be caused by the fact, that it was more important for the first pioneering farmers to invest most

of their time in clearing the forest, in order to make large areas suitable for arable farming. However, the first monumental long barrows and enclosures do appear in the consolidation phase during the following centuries from 3800 to 3300 cal BC in South Scandinavia, thus showing a continuous network exchange of people, ideas and knowledge either directly or indirectly with the Michelsberg Culture. These newly established pioneering agrarian societies in South Scandinavia also expanded their network, not only towards the Michelsberg Culture, but also towards Eastern Europe, which can be documented by the appearance of copper axes, battle axes and thin-butted axes (Todorova 1981; Zápotocký 1992; Klassen 2000; Klimscha 2007).

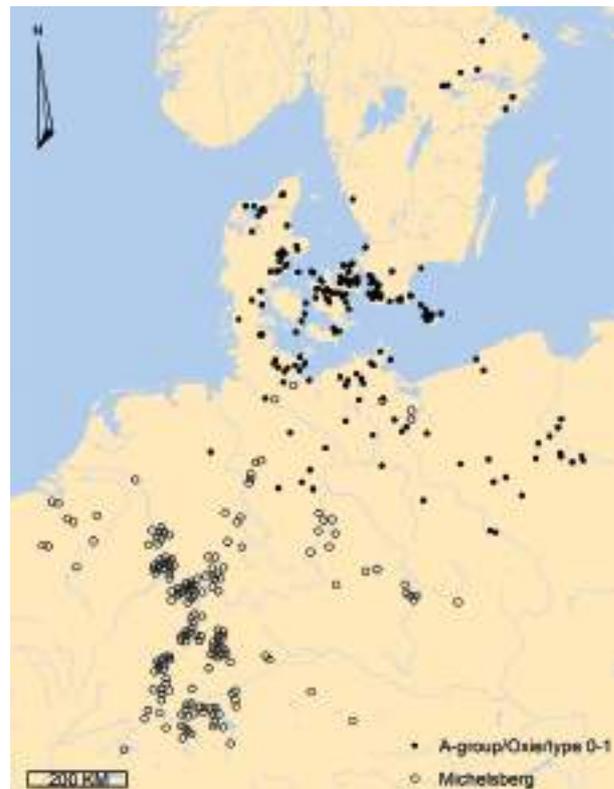


Fig. 15. Map of Michelsberg sites in Central Europe and localities containing short necked funnel beakers in southern Scandinavia, northern Germany and northern Poland. After Lüning 1968; Sørensen 2014

Push factors within 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

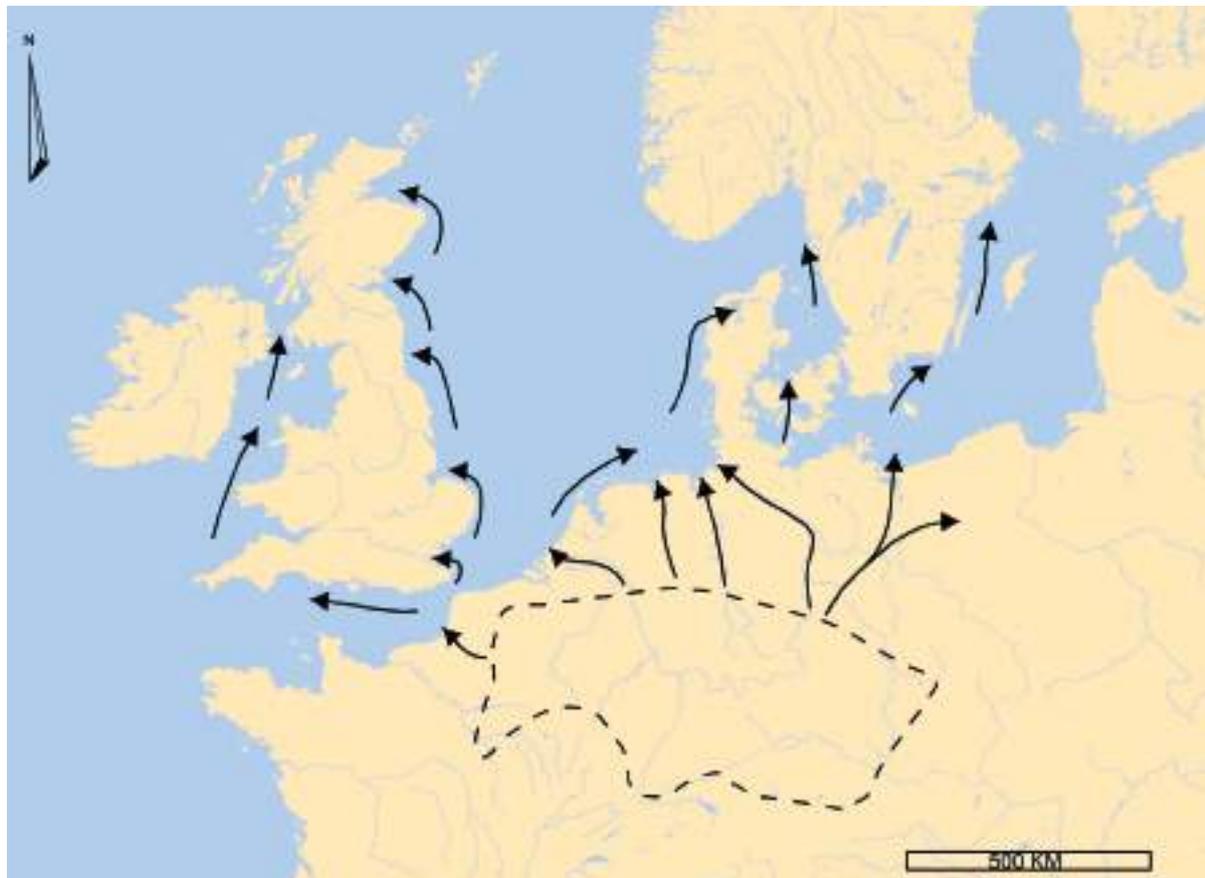


Fig. 17. The expansion of the Michelsberg Culture towards the British Isles and South Scandinavia around the transition between the late 5th and early 4th millennium BC. After Sheridan 2010; Sørensen 2014

Scandinavia (Leuschner et al. 2002; Gronenborn 2007; 2010; Shennan 2009; Müller 2011). Continuous conflicts in Michelsberg and the neighbouring Chasséen societies over territorial rights and the struggle for arable land, combined with new cultivation methods, could have served as a push effect, which may have led to a contemporary migration of pioneering farmers to the British Isles, Netherlands, northern Germany, northern Poland and South Scandinavia around 4000 cal BC (Louwe Kooijmans 2007; Hartz et al. 2007; Sheridan 2010; Rowley-Conwy 2011; Papiernik 2012; Sørensen & Karg 2014; Sørensen 2014) (Fig. 17). The centuries that followed marked the beginning of the pioneering phase of farmers settling in smaller colonies in selected areas on easy arable soils.

Concluding remarks

In this paper it is argued that agriculture is a very complex technology, which takes a long time to learn, thus making it very difficult for agrarian practices to spread as an idea. Instead it is suggested that the expansions of agrarian practices in Scandinavia are associated with the migration

of people. These people had the right competences and the ability to teach the indigenous population about agriculture by establishing some new pioneering agrarian societies, thus supporting the theory of integrationism. The engagement in these pioneering agrarian societies would have changed the identity and material culture of the immigrating farmers, as well as the indigenous hunter-gatherers, thus creating new agrarian societies.

The results presented in this paper suggest that the immigration of pioneering farmers from Central Europe to South Scandinavia was initiated by a scouting phase during the centuries before 4000 cal BC. The scouts searched for suitable agrarian areas. The information retrieved from these scouting expeditions would have laid the foundations for where the pioneering societies should settle. The pioneering migrations began 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.

These immigrating individuals brought with them know-how relating to agrarian technology, and a new material culture and ideology. The question of what happened to the local hunter-gatherers is still open for discussion: perhaps they

became farmers within one or two generations. This could explain the synchronism of inland and coastal sites, where both agrarian and natural food resources were exploited. Involvement in these pioneering agrarian societies 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 would evolve. A consolidation phase from 3800 to 3300 cal BC followed the pioneering phase, with the building of territorial markers such as long barrows and causewayed enclosures, which indicates continuous network exchange with Central European agrarian societies.

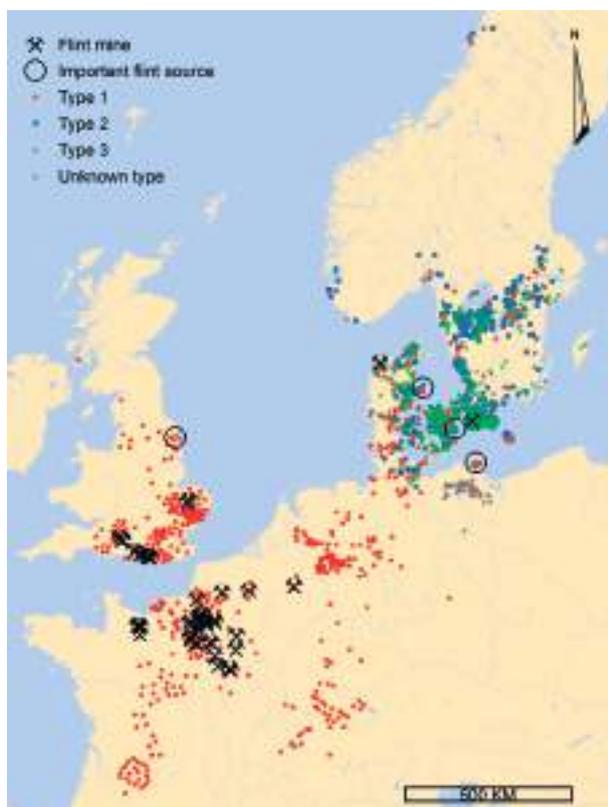


Fig. 16. Distribution of pointed-butted flint axes, flint mines and important flint resources in western Europe. After Sørensen 2014

The immigrating farmers coming to South Scandinavia probably came from or were interconnected with the Michelsberg Culture, which is confirmed by similarities within the material culture, symbolic practices, types of sites and monumental structures. The reasons for the expansion are still uncertain, but a combination of growing population pressure in the Middle Neolithic cultures of Central Europe, the emergence of new cultivation methods, unfavourable climatic conditions and easily accessible flint resources may have

motivated some farmers to move north. These groups of pioneering farmers did not only migrate to South Scandinavia but also to the British Isles, the Netherlands, northern Germany and northern Poland during the centuries around 4000 cal BC.

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