New theoretical discourses in the discussion of the Neolithisation process in South Scandinavia during the late 5th and early 4th millennium BC – an identification of learning processes, communities of practise and migrations

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ABSTRACT – *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 practises to spread as ideas. Instead, based on a detailed survey of primary agrarian evidence (direct ^{14}C dates of cereals and domesticated animals) and secondary evidence of material culture (polished axes and pottery), it is claimed that the expansions of agrarian practises in South Scandinavia are associated with the migration of farmers who were related to the Michelsberg Culture. These incoming farmers had the appropriate skills and the ability to teach the indigenous hunter-gatherer populations about agriculture by establishing communities of practice, a fact which supports the theory of integrationism. The engagement in these communities of practise changed the identity and material culture of the immigrating farmers, as well as the indigenous hunter-gatherers, thus creating new agrarian societies in South Scandinavia which were interconnected in a regional as well as larger European network.*

IZVLEČEK – *V članku razpravljamo o tem, da je poljedelstvo zelo kompleksna tehnologija, za učenje katere potrebujemo veliko časa, kar pomeni, da se znanje o poljedelskih praksah težko širi le kot ideja. Nasprotno – na podlagi raziskav primarnih agrarnih podatkov (neposredno ^{14}C datiranje žit in domačih živali) in sekundarnih podatkov o materialni kulturi (polirane sekire in lončenina) trdimo, da je širitev poljedelskih praks v južni Skandinaviji povezana z migracijo poljedelcev, ki so bili v sorodu s kulturo Michelsberg. Ti prihajajoči poljedelci so imeli potrebne spretnosti in možnost poučevanja domorodnih lovcev in nabiralcev o poljedelstvu, tako da so ustanovili vadbene skupnosti, kar podpira teorijo integracije. Srečanja v takšnih skupnostih so spremenila identiteto in materialno kulturo imigrantskih poljedelcev kot tudi domorodnih lovcev in nabiralcev, kar je povzročilo nastanek nove poljedelske skupnosti v južni Skandinaviji, ki je bila vključena v povezane regionalne in širše evropske mreže.*

KEY WORDS – *Neolithisation; South Scandinavia; agrarian expansions; knowledge exchange and migration*

Introduction

The purpose of this article is to integrate some new discourses of learning and migration theories into the discussion of how, when and why agrarian societies spread from Central Europe to South Scandinavia during the late 5th and early 4th millennium BC, as no consensus has been reached (*e.g., Becker 1947; Troels-Smith 1954; Lichardus 1976; Jennbert 1984; Larsson 1984; 2013; Fischer 1982; 2002; Zvelebil, Rowley-Conwy 1984; Nielsen 1985; 1987; 1994; Rowley-Conwy 1985; 2004; 2011; Madsen 1987; Solberg 1989; Price 2000; 2016; Skak-Nielsen 2003; Hartz, Lübke 2004; Klassen 2004; Sørensen 2005; Hartz* et al. *2007; Andersen 2008; Hallgren 2008; Brinch Petersen, Egebjerg 2009; Terberger* et al.

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2009; Sjögren 2012; Sørensen, Karg 2014; Sørensen 2013; 2014; 2015) (Fig. 1). Currently, there seems to be agreement on a 1500-year period of standstill, which lasts from approx. 5500 cal BC to 4000 cal BC, in the agrarian expansion from Central Europe towards South Scandinavia (Fig. 2). What could explain the static border during the Ertebølle Culture (5400–4000 cal BC), and what caused the swift or gradual change towards the emergence of agrarian societies during the Early Funnel Beaker Culture (4000–3300 cal BC)? Was the introduction of agrarian practises the result of migration or gradual adaptation through a process of diffusion? New theoretical approaches together with novel discoveries from excavations and investigations of key artefacts will be presented in this article in order to discuss the questions raised above and to present a new hypothesis of the Neolithisation process in South Scandinavia.

Curtural 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 South Scandinavia.

Definitions of agrarian practices

The appearance of the first agrarian societies in South Scandinavia is often defined as an economic and ideological change from a hunter-gatherer society. But in prehistoric times, hunting, fishing and gathering were practised by both hunter-gatherers and agrarian societies. In my opinion, what separates farmers from hunter-gatherers in a transitional situation in South Scandinavia is crop cultivation and managing animal husbandry all year round. However, I do not see any problem with the fact that hunter-gatherers could have kept a few domesticated animals for meat reserves and prestige reasons. The managing of a few domesticated animals could be interpreted as initial and experimental herding activities by communities that still lived mainly as hunter-gatherers.

Why do agrarian societies expand?

Generally, the reasons for the adoption of agrarian practises and their expansion in South Scandinavia can be narrowed down to three lines of argumentation, concentrating on population growth, resource availability caused by climate changes and social changes within societies, or a combination of all three (see *Sørensen 2014.27–29*). However, researchers tend to prefer one explanation over another, emphasising either the advantages of the agrarian subsistence strategy, or the social, ideological and power-related benefits of the adoption of agriculture. Therefore, the perception of who the primary bearers and movers of agrarian knowledge and practises were varies with each of the proposed hypotheses (see *Sheridan 2010; Thomas 2013*). To attempt to establish the identity of the primary carriers of agrarian practises, it is necessary to investigate the processes behind agrarian expansions.

How do agrarian societies spread?

In general terms, the discussion regarding the transition from hunter-gatherer to farming communities has concentrated on three competing hypotheses: migrationism, indigenism and integrationism (*e.g., Rowley-Conwy 2011*). The three hypotheses characterise not only discussions of the Neolithisation process in southern Scandinavia, but throughout Europe. The migration hypothesis argues that agriculture was introduced by a swift process of a smaller or larger migration, where it is the migrating farmers who are the primary bearers of agrarian technologies. The hypothesis of indigenism and diffusion argues that the introduction of agrarian technologies is a gradual process, lasting several hundred years. Here, hunter-gatherers are the primary bearers of agrarian technologies, which spread as an idea between humans. The integration hypothesis is a combination of the first two hypotheses, but here there is still no consensus about who introduced agrarian practises, and how big a role the local hunter-gatherers played in this spread of agrarian technologies (*e.g., Sørensen, Karg 2014*). Previous studies of the Neolithisation process in South Scandinavia (*e.g., Klassen 2004; Rowley-Cowy 2011*) have suggested that migrating farmers expanded from Central Europe towards the North by leap-frog punctuated migration (*e.g., Moore 2001*). A similar model has also been presented for the rapid expansion of agrarian societies in the Mediterranean region (*e.g., Zilhão 2001; Horejs 2015*). These mobility models of agrarian expansions have been combined with Marek Zvelebil's and Peter Rowley-Conwy's (*1984*) availability and agricultural frontier model in order to explain the geographical setting of where the actual Neolithisation process occurred. However, these models fail to discuss how the actual 'fields' (*e.g.,*

Bourdieu 1977) of social meetings and structures between humans occurred during the process. Within the investigation of whether agrarian technologies spread as an idea or by migrating farmers, a central issue has often been overlooked, which concentrates on how easy or difficult it is to learn the agrarian technologies in question (see *Sørensen 2014.30–44*). This view focuses on how people, particularly indigenous hunter-gatherers, learn agrarian technologies, and which processes are included in this, which then can contribute to a more nuanced picture of the primary bearers of agrarian practises and technologies.

Learning about livestock and cultivation practices

Cultural evolutionist theories suggest that the learning of domestication practises is the result of the emergence of complex hunter-gatherers combined with either an optimal foraging strategy or niche-constructing behaviour (*Bird, Connell 2006; Zeder 2015*). 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 able to, adopt agrarian practices. However, in periods of low yields, within the experimental domestication phases, populations would have switched back and forth between strategies dominated by foraging activities, or combined foraging with more or less agrarian activities (*Codding, Bird 2015*). The learning processes behind the domestication of livestock and crops was thus a longer process of experimentation and optimising yields and reproductive success with agrarian practises, which was initiated in several areas of the Fertile Crescent around 10 000 to 8500 cal BC (*Fuller 2008; Larson* et al. *2014*). Fully developed agrarian practises thus constitute a very complex technology, which requires detailed knowledge exchanges between different actors.

The management of stockbreeding practises is probably the least difficult technology to be adopted by a hunter-gatherer society. Several ethnographic studies have documented that animal husbandry practices could be integrated in a relatively short time into a hunter-gatherer subsistence pattern (*e.g., Nicolaisen 1975; Gregg 1988.53; Xavier* et al. *2008.1ff; Sadr 2013*). So it is possible that animal husbandry practises 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, 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 permanent and 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 herds would be to systemise breeding patterns and thus regulate when a yield could be expected (*e.g., Mackinzie 1980; Perry 1984; Gregg 1988*).

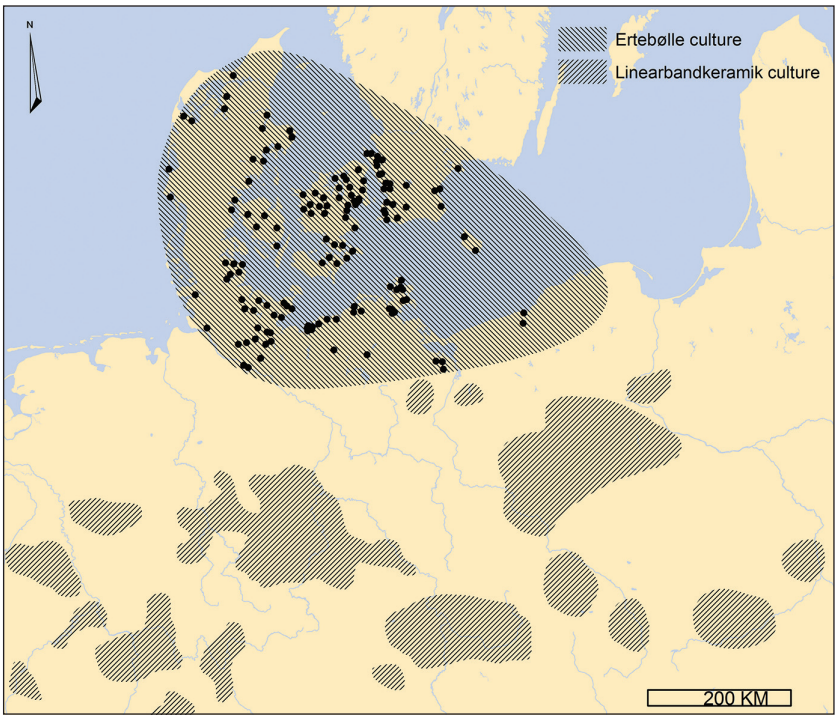

Fig. 2. The distribution of the Linearbandkeramik Culture and the Ertebølle Culture (after* Hartz *et al.* 2007*).

Crop cultivation is an even more difficult agrarian activity to master than animal husbandry, which is documented in several ethnographic and experimental studies (*e.g., 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. In order to have initiated cultivation practices, it would have been necessary to obtain domesticated crops and obtain skills and knowledge relating to the properties of the crops, thus minimising mistakes. Cereal cultivation 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 that of hunter-gatherers. Soil fertility is a crucial matter when cereals are grown repeatedly in the same place, thereby exhausting the soil. 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 (see *Lüning, Meurers-Balke 1980; Schier 2009*). One solution could be to supply the soils with nitrogen oxides by implementing a manuring strategy using domesticated animals. The manuring method is most efficient when combined with a fallow strategy, which allows the regeneration of the soil's organic content. Grass fallow is faster, taking a few years; bush fallow takes less than a decade, whereas forest fallow can take up to several decades. The use of manuring can be tested by investigating the nitrogen content of charred cereals from the Early Neolithic, while fallow strategies can be tested by studying pollen analyses in South Scandinavia, which can be used in the discussion of how advanced the first pioneering agrarian societies actually were in South Scandinavia.

The new categories of food resources from agrarian products would have led to new cooking practices and new material culture. This change can be seen in the emergence or introduction of new types of pottery suited to new food sources, and the more complex use 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 process to make cheese, curd, whey, and yoghurt. The handling of new ceramic vessels would have involved new cooking, storage, and consumption practises, which could have transformed the rhythms of social life (*e.g., Parker-Pearson 2003*). Generally, the use and implementation of these agrarian technologies requires the ability to plan several years ahead, which means that the learning processes could take decades.

Learning practices

Generally, agrarian technologies can be associated with many practises which are articulated and especially unarticulated, thus making it difficult to learn. When an individual has learned agrarian technologies, they tend to become routine practice, which are more or less repeated every year according to the preferred strategic choices in the breeding of animals, cultivation of crops, and securing of winter fodder, or foraging activities. The repeated patterns of agrarian strategies can be interpreted as routine practices (*e.g., Giddens 1984*). According to Anthony Giddens, routinisation is fundamental to daily social activities from which learning processes could emerge. The routines are repeated modes of activity by agents who do not need to consciously think or speak about them, so they are not articulated. The code of such actions makes it unnecessary for the agents to engage in constant negotiations. This might be knowledge about combining certain cereal types with an individual soil type, thus optimising 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 routine practises that make agrarian activities so difficult to learn, as there are over 30 processes associated with possible unarticulated, routine information relating to cultivation or animal husbandry practises (*e.g., Gregg 1988*). Furthermore, the time frame of when to initiate certain actions in agrarian practises is very long and could potentially last several years. Moreover, in critical situations, the unspoken conventional and social codes would change and new ones would emerge. These new codes of action could also be unspoken and based on previous experience. There could be several pieces of information that are not expressed in 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 unarticulated or forgotten details are vitally important in practise. The knowledge process would be challenging even if the actors spoke the same language, because the learning of agrarian practises requires a detailed understanding of many technical words.

And if knowledge exchange occurred when the different actors, in this case hunter-gatherers and farmers, spoke different languages, then the learning process would have been even more difficult. Colin Renfrew (*1987*) and Peter Bellwood (*2005*) have argued that the expansion of agrarian societies around 7500 cal BC also involved the spread of Indo-European languages into Europe during the Neolithic period. Words like wheel, cart and traction have been associated with Indo-European languages (*e.g., Mallory 1989*). However, these technologies did not exist before 4200–3700 cal BC, thus suggesting a later spread of Indo-European languages into Europe (*e.g., Rowley-Conwy 2011*). The expansion of agrarian societies into South Scandinavia began around 4000 cal BC (*e.g., Sørensen, Karg 2014*), thus making it possible that an exchange of knowledge could have taken place in two different languages spoken by the indigenous hunter-gatherers and farmers.

Learning about farming is a social process which requires years and possibly decades of active participation in order to implement agrarian technologies and have consecutive years of positive yields (Fig. 3). Prehistoric people who wanted to learn this had to engage in social relations with certain individuals or groups who had the right skills and knowledge to teach other individuals. Such dynamic and active participation in exchanges of knowledge could have flourished in what Jean Lave and Etienne Wenger (*1991*) defined as a community of practice.

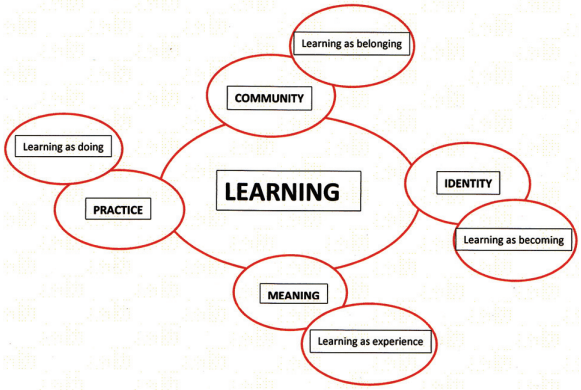

Fig. 3. Components of a social theory of learning (after* Lave, Wenger 1991*).

Communities of practise

According to Lave and Wenger (*1991*), the concept of communities of practise is a system of relationships between people, activities and the world, which develops over time and in relation to other overlapping communities of practise, in which exchange of knowledge and experience can be developed (Fig. 4). Within communities of practise, knowledge is negotiated through a process of participation and reification, and thus they are important places of learning, meaning, identity and power (*e.g., Wenger 1998*). Some characteristic features have been identified in connection with communities of practise. 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*) also distinguishes between three modes of belonging to a community of practise. 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 practise also involves the learner progressing from peripheral to more centrally-orientated learning practises, depending on the types of activities and the length of time spent in the community of practise (Fig. 4).

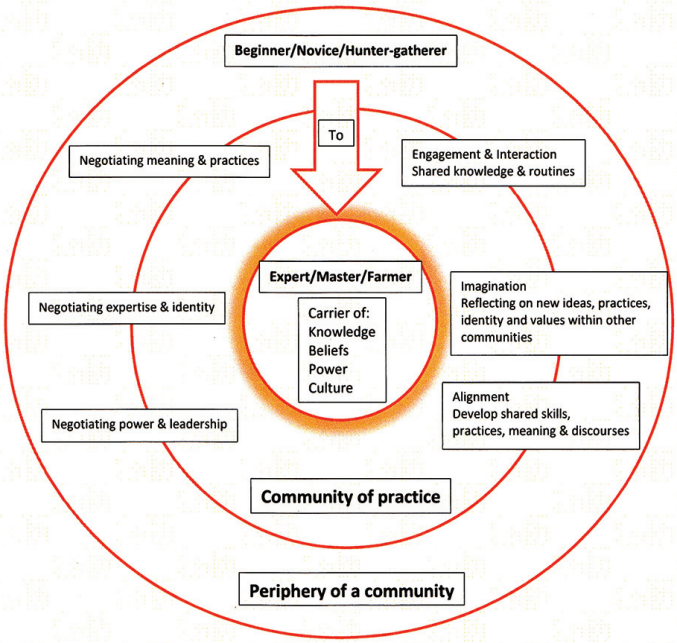

Fig. 4. Community of practise: a system of relationships between people, activities and the world (after* Lave, Wenger 1991; Wenger 1998; 2000*).

Studies of communities of practise have shown that learning does not occur through isolated processes, but by active participation and interaction (*e.g., Lave, Wenger 1991*). Hunter-gatherers could have engaged 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 practise could have emerged. However, this would have depended on the farmers' and the hunter-gatherers' desire to teach and learn the knowledge of agrarian practises. In addition, it also depended on how to produce the material culture – such as axes, pottery and houses – associated with agrarian practises. If a large part of an indigenous population decided to participate in such communities of practise 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 practise could be associated with a rapid change in material culture and subsistence practices. A different scenario could entail limited interaction between farmers and hunter-gatherers who chose to live in isolated groups. Here we should expect to identify a synchronic cultural duality of hunter-gatherer and farming societies living as neighbours, thus showing a slow change in the material culture. Such a scenario could be applied to hunter-gatherers who wanted to participate in these communities of practise and had to give up some of their power vis a vis the farmers, because the latter were the bearers of agrarian knowledge, beliefs, ideology, culture, long-range networks and taboos. At first, the hunter-gatherers had to submit themselves within the community of practise on the periphery of the community until they had accumulated enough knowledge to attain a higher status. In this process of knowledge exchange and learning agrarian practises, the hunter-gatherers would have changed their identity towards becoming farmers (Fig. 3). These newly emerged farmers could then set up new communities of practise, where they were the bearers of ideological and cultural power. For some hunter-gatherers, their surrender of power in communities of practise could have been seen as intimidating, especially for individuals of high rank in their societies. But if submission meant that you, your children or the juveniles in your society would have the chance to attain an even higher status within an agrarian society, this could have been a motivating factor. In addition, farmers could give the leading hunter-gatherers more influence within the communities of practise, so that the rest of the group would follow into the agrarian communities of practise. It would then have been easier to create alliances with other hunter-gatherer societies, thus creating a domino effect of hunter-gatherers joining agrarian societies and communities of practise.

Integrating local hunter-gatherers could very well have been a necessary and deliberate strategy for the first pioneering farmers in South Scandinavia, because they needed manpower to clear the dense and thick forest in order to create arable land. Such a project would require the commitment of many more people, whereby the hunter-gatherers could have played an active role. Over time, the formation of several parallel and simultaneous communities of practise could have helped to create a larger network which would have been closely linked through social relationships and alliances. The prime movers of agrarian practices were thus people who, in a long-term learning process, acquired a detailed knowledge of, and skills in, agrarian practices. Agrarian expansion to different regions was most likely related to the migration of farmers and the willingness of indigenous hunter-gatherers to adopt agrarian practises, possibilties which support both migrationism and integrationism.

The structure of migration

Migrations and the processes behind them are subject to certain rules and structures that can be characterised as part of a larger process in which migration is a type of behavior carried out by a sub-group within a group (see *Anthony 1990*). 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 exchanges 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 these 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. 5).

The second phase would be the actual immigration of pioneering farmers of men, women and children,

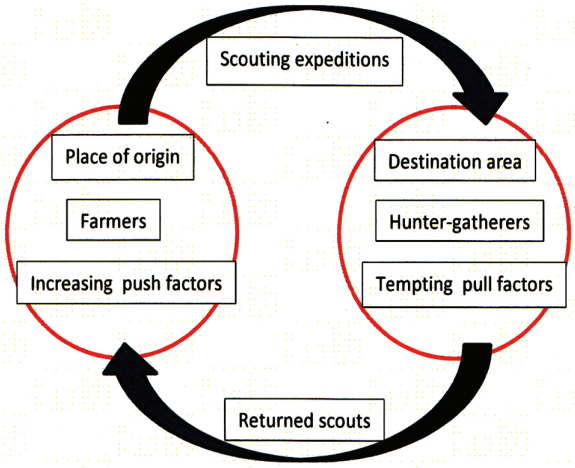

Fig. 5. The first phase of migrations would include several scouting expeditions to possible destination areas, which could be contemporary with the appearance of push factors at the place of origin.

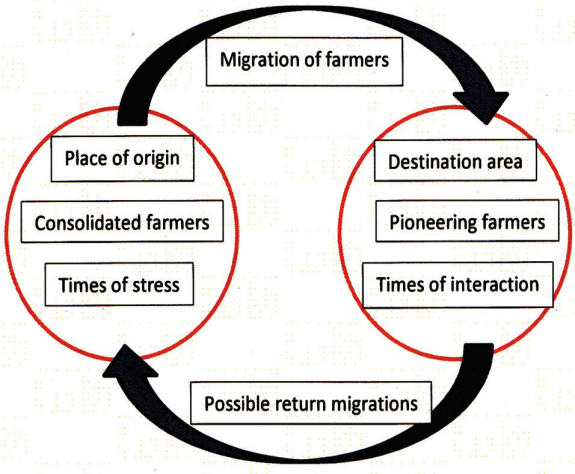

Fig. 6. The second phase of migrations would be an actual immigration of pioneering men farmers, which could be followed by return migrations to the place of origin.

carrying a complete knowledge of farming, 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 practise, 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 in 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, unless there were continuous push factors at the place of origin. Additionally, there would have been active engagement in larger networks by the pioneering farmers (Fig. 6).

The third phase can be characterised 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. The migrations could in fact have become an embedded tradition within these pioneering agrarian societies, where juvenile groups were expected as part of their rite of passage to actively take part in scouting expeditions and migrations to new regions (Fig. 7). The main contribution from these studies compared to earlier expansion and colonisation models of Zvelebil's and Rowley-Conwy's availability model and Zilhão's pioneer colonisation model (*e.g., Zvelebil, Rowley-Conwy 1984; Zilhão 2001*) is the identification of a scouting phase in the centuries before the actual agrarian expansions. The scouting phase does not result in any agrarian practices for the indigenous hunter-gatherers, but gift exchanges of objects from agrarian societies. However, the second pioneering and third consolidation phase overlaps with Zvelebil's and Rowley-Conwy's availability model and Zilhão's pioneer colonisation model (*e.g., Zvelebil, Rowley-Conwy 1984; Zilhão 2001*).

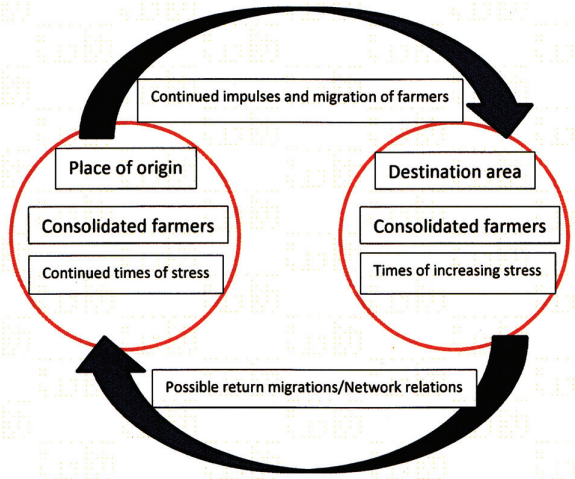

Fig. 7. The third phase of migrations can be characterised as a consolidation stage in which the pioneering farmers expanded their territory and continued to receive impulses and possible immigrants from the place of origin.

Turning to the archaeological data

In the following, the theoretical hypothesis will be tested in order to identify migrations and the establishment of communities of practise by studying material culture during the transition between the 5th and 4th millennium BC in South Scandinavia.

Evidence of scouts in the archaeological material

There are some important finds in southern Scandinavia which may be interpreted as material evidence from groups of scouts that originated from Central European agrarian societies. The first example is from the inland site of Flintbek in Schleswig-Holstein, where a pit was filled with short- necked funnel beakers, flake cores and scrapers (*e.g., Zich 1993*). Charcoal pieces from the pit were ^{14}C dated between 4300 and 3900 cal BC, making it one of the earliest discoveries of funnel beaker ceramic in northern Germany. Signs of contact between agrarian scouts and coastal hunter-gatherers could also be interpreted in connection with the few bones from domesticated animals found at contemporary Late Ertebølle coastal sites at Wangels and Neustadt, which were located approx. 30km 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 ^{14}C dated between 4200 and 4000 cal BC, which indicates that the material in the pit could be evidence of agrarian scouts (*e.g., Brusling 2003*). Scania also has signs of contact between these scouts and local hunter-gatherers, which is expressed in the famous finds of grain impressions on Ertebølle ceramics from the sites of Löddesborg and Vik (*e.g., Jennbert 1984*) (Fig. 8).

A third example of scouting is observed in the pollen analysis from South Scandinavia. Some pollen analysis, especially from the inland parts of Scania, claims that cerealia pollen has been found stratigraphically below the elm decline in South Scandinavia, thus indicating that crop cultivation was practiced during the Late Mesolithic (see *Sørensen 2014.84*). However, the few examples of cerealia pollen from these pollen diagrams are problematic, as they are probably from wild grasses, thus suggesting smaller openings in the forest. Hunter-gatherers could have cleared the forest and created open spaces in order to improve their hunting of grazing animals such as red and roe deer. But then we should expect a repeated pattern

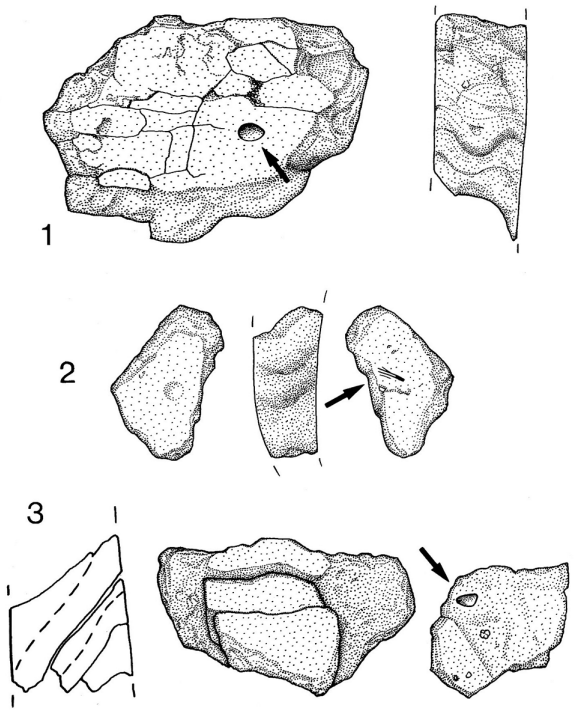

Fig. 8. Drawings of Ertebølle sherds with grain impressions from the settlements at Vik and Löddesborg in Scania.* 1 *Sherd with impressions of wheat (*Triticum compactum*);* 2 *Sherds with impressions of a barley grain (*Hordeum*);* 3 *Sherd with impression of einkorn wheat (*Triticum monococcum*) (after* Jennbert 1984; Koch 1998*).

going back to the Middle Mesolithic, which is not the case. Instead, most of the wild grasses are found just below the elm decline, which could be interpreted as evidence of scouts preparing the landscape for future farming. Perhaps the scouts were involved in preparing the landscape for farming by creating smaller clearings and making fields, so that the first pioneering farmers could begin cultivating just after they arrived.

A fourth 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 (see *Lomborg 1962*) (Fig. 9). Such axe deposits are usually observed in Central European agrarian societies and could have been a symbolic offering made by scouts searching for new lands in the North. A similar example is the appearance of jadeite axes, which could also stand for several deposits made by Central European agrarian scouts (*e.g., Klassen 2004*) (Fig. 10). Perhaps the depositions of these exotic axes could have been associated with embedded symbolic practices relating to the establishment of new farming community in southern Scandinavia. The importation of the shoe-last axes has been inter-

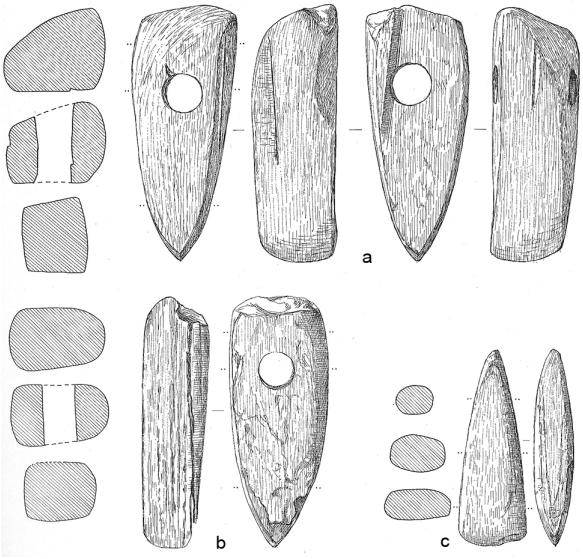

Fig. 9. Deposition of two shoe-last axes and one pointed-butted amphibolite axe from Udstolpe, Lolland (after* Lomborg 1962*).

preted as evidence of direct contact between Central European agrarian cultures and Ertebølle hunter-gatherers, where ideas of agrarian practises could also have been exchanged. But often the shoe-last-axes show signs of heavy usage on the neck and most were found in ordinary waste layers (see *Sørensen 2012*). So it is likely that the original ideas behind these exotic axes as status and prestige symbols were lost in a hunter-gatherer contact network. In such a more-or-less indirect network of agrarian societies and hunter-gatherers, it would have been difficult to initiate detailed knowledge exchanges about agrarian practices, which could explain why the border between Central European agrarian societies and Mesolithic hunter-gatherers in South Scandinavia was almost static for 1500 years from 5500 to 4000 cal BC.

How complex were agrarian practises during the Early Neolithic?

Clear evidence of agrarian practises is first documented on a broader scale from 4000 cal BC onwards, which was documented by investigating all the known ^{14}C dates of charred cereals and domesticated animals in South Scandinavia (Fig. 11). But how complex and advanced were the first agrarian practises? New research indicates that they were already very advanced from the beginning of the 4th millennium BC, which indicates that highly skilled people were involved in the process.

Pollen analysis has yielded some of the empirical data, especially from the Ystad project in Scania. Here, high concentrations of charcoal dust appear in the pollen diagrams around 4000 cal BC, thus indicating the use of slash-and-burn agriculture (*e.g., Digerfeldt, Welinder 1989*). Other pollen diagrams from South Scandinavia show higher pollen concentrations of ribwort plantain (*Plantago lanceolate*) and birch (*Betula*) around 4000 cal BC, which indicates the use of a short- and long term fallowing strategy. However, most of the pollen analysis show an absence of cerealia pollen from the beginning of the Early Neolithic. Unfortunately, most pollen samples in Scandinavia have been taken from larger bogs or lakes, thus showing that environmental changes to the landscape covered a radius of 5–10km (*e.g., Sørensen 2014*), so pollen from cereals is rarely detected, because wheat and barley are self-pollinating species, which means that the pollen does not spread over long distances. The phenomenon has been confirmed: an experiment has shown a very low dispersal of wheat pollen just 10m away from the crop field (1.4%) and a greater amount (26.6%) at the ac-

Fig. 10. Alpine jade axes from South Scandinavia.* 1 *type Chelles, jadeitite, Zealand, unknown find location;* 2 *type Puy, jadeitite, Zealand, unknown find location;* 3 *type Durrington, eclogite, Højgård, Tulstrup parish, Eastern Jutland;* 4 *type Durrington, amphibolite, Danmark, unknown find location;* 5 *type Durrington, jadeitite, Lolland-Falster, unknown find location;* 6 *type Puy, eclogite, South Funen, unknown find location;* 7 *type Durrington, jadeitite, possibly South-western Scania, unknown find location. Photo: Louise Hilmar, Moesgćrd Museum, Aarhus University (after* Klassen 2013*).

tual threshing site (see *Diot 1992*). Fortunately, some other pollen samples in connection with the Ystad project in Scania have been taken from much smaller bogs which had higher concentrations of cerealia pollen around 4000 cal BC (*e.g., Berglund 1991*). Furthermore, new research of ^{15}N values of charred 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 emmer cultivation (*e.g., Kanstrup* et al. *2013*). The result indicates that cultivation and animal husbandry practises were interacting factors in the same system already from the beginning of the Neolithic in South Scandinavia. Additionally, another argument can be proposed when measuring the sizes of cereal grains from the Early Neolithic and Middle Neolithic in Denmark. The results document that the average size of emmer kernels increased by 59% over a period of only 400 years, between 3500 and 3100 cal BC, thus indicating that emmer was cultivated in the Early Neolithic (*e.g., Westphal 2005*).

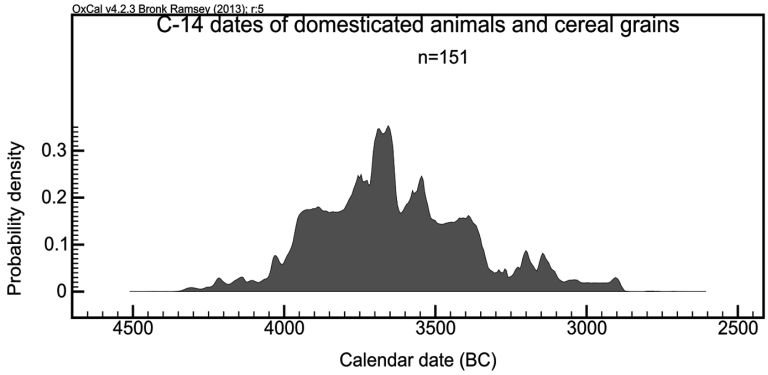

Fig. 11. Graph showing distribution of all ^{14}C dates of charred cereals and domesticated animals from the Early Neolithic in South Scandinavia (after* Sørensen 2014*).

The fact that cultivation was efficient and covered larger fields can also be documented by new and old finds of plough marks. Plough marks have been found below the long barrow at Højensvej 7, near Egense on Funen, where the furrows covered an area of 85m^2 (see *Beck 2013*). Some 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.

Recent research has also argued for complex cattle husbandry methods during the Early Neolithic. The most recent study was based on a strontium isotope-analysis of Early Neolithic cattle teeth from the sites at Almhov in Scania and Havnelev on Zealand. The results indicated some variation in the local origin of the animals. But both sites also yielded at least one individual showing strontium isotope ratios indicating movement over water by boat between Zealand and Scania, thus documenting that exchanges of cattle occurred already during the Early Neolithic (*e.g., Gron* et al. *2016*). Another study based on the analysis of δ^{18} on cow teeth also from Almhov, demonstrated that cattle calved in more than one season. The implication of this study means that breeding was artificial manipulated to produce calving and milk throughout the year. Calving throughout the year, especially in winter, must have demanded for extra fodder and long-term planning for these Early Neolithic farmers. It would also have produced a higher milk yield and thus stimulated the need to produce longer-lasting products such as cheese and yogurt, which changed the material culture (*e.g., Gron* et al. *2015*).

Changes in diet were also confirmed when Henrik Tauber measured the ^{13}C values of human bones from the Ertebølle and Funnel Beaker cultures (see *Tauber 1981*). His results revealed a very clear change from a marine diet during the Mesolithic period to a terrestrially dominated diet in the Early Neolithic in South Scandinavia. 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 an absence 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 farmers, the indigenous hunter-gatherers changed their view of marine food resources, which came to be regarded as less prestigious than agrarian products (*e.g., Milner* et al. *2004*). Such an interpretation could explain the sharp shift from a marine to a terrestrial diet, as indicated by isotope values (*e.g., Tauber 1981; Fischer* et al. *2007*). Nevertheless, these analyses lack data from the Early Neolithic remains of humans who lived in the coastal sites, thus indicating that people did exploit marine food sources (see *Pedersen 1995*).

Contemporary with the introduction of advanced agrarian techniques, some clear changes occur around 4000 cal BC. Firstly, the Late Ertebølle pottery, adzes, T-shaped antler axes disappear, and the emergence of new material culture can be observed in the form

of short-necked funnel beakers, clay discs, clay spoons, pointed-butted flint axes and battle axes from the Funnel Beaker Culture (Fig. 12). New constructions such as two-aisled houses and flint mines also emerged around 4000 cal BC, a feature unknown in Ertebølle Culture (*e.g., Sørensen 2014; 2015a*). The symbolic behaviour behind the material culture also changed, because many pointed-butted axes and short-necked funnel beakers were deliberately deposited, which is a characteristic feature observed in Central European agrarian societies. Such symbolic depositions of material culture are almost non-existent within Ertebølle Culture, thus documenting a physical as well as symbolic change in the material culture beginning around 4000 cal BC. All these data suggest that early agrarian societies in South Scandinavia were so advanced that migrating farmers from Central Europe must have been involved in the Neolithisation process.

Evidence of pioneering farmers and colonies in the archaeological material

The settlement pattern also changed during the transition from the Late Ertebølle Culture and the Early Funnel Beaker Culture, because a new type of inland site located on arable soils emerges. However, investigations of the settlement pattern from the Early Neolithic are often biased, because they are unevenly distributed on the basis of various rescue excavations, thus making it difficult to document any possible clusters or colonies of pioneering agrarian societies. However, a recent survey of pointed-butted axes dated from 4000 to 3700 cal BC reflects the early expansion of pioneering agrarian sites in South Scandinavia (*e.g., Sørensen 2014*) (Fig. 13). Their distribution clearly illustrates that agrarian scouts did manage to find suitable areas for founding smaller colonies of pioneering agrarian societies in areas characterised by arable soils (Fig. 14). These areas are also characterised by a small number of sites associated with Late Ertebølle Culture. Such a pattern can be interpreted as if the pioneering agrarian societies had 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 systematic axe production. The increased production of pointed-butted axes, particularly in Scania and Stevns, was used to establish a large network of agrarian societies further north in regions poor in flint on Bornholm and Gotland and in Västergötland, Östergötland and Närke (Fig. 14).

The visible patterns emerging from the distribution of pointed-butted axes was tested by integrating the results from a 10 x 6km survey near Risø and Hedehusene on Zealand (Fig. 15). The survey was conducted over a 38-year period, from 1978 to 2016, by amateur archaeologists Hans Sørensen and his son Klaus Sørensen. They collected and plotted over 14 000 flint artefacts from the Mesolithic, Neolithic and Bronze Age in that particular area. The distribution of the artefacts presents a totally unique picture of the changes between the Late Ertebølle and Early Funnel Beaker Culture, thus indicating the huge research potential of such long-term surveys. The distribution clearly illustrates the location of Late Ertebølle kitchen middens near the coast and the location of Early Funnel Beaker sites located further inland on sandy and easily cultivated areas. Furthermore, it is possible to observe a few core axes with specialised edges at agrarian inland sites, which are characteristic archetypes of Late Ertebølle Culture (*e.g., Sørensen 2014*). These finds could indicate the possible integration of migrating farmers and indigenous hunter-gatherers engaging in new agrarian communities of practice.

Population duality or commuting farmers?

The sudden changes in the settlement pattern appear at the same time as the disappearance of Ertebølle Culture. However, some of the kitchen middens contain layers from the Late Ertebølle and Early Funnel Beaker cultures. On the one hand, these sites indicate a clear break in the material culture, and on the other hand continuity, because some sites continued to be settled during the Early Neolithic (see *Johansen 2006; Andersen 2008*). There is continuity in the economic exploitation of the sea and forest, as fishing, gathering and hunting activities continued into the Neolithic in South Scandinavia (*e.g., Andersen 2008*). Such behaviour is only natural, because Central European agrarian societies also continued to fish and hunt, as such activities are compatible with agrarian activities (*e.g., Hachem 2011; Höltkemeier 2011*). Often the busiest time of the year for agrarian endeavours is in early spring during and late summer, which leaves time for hunting, fishing and gathering during the period between sowing and harvesting activities. But how should we understand the settlement continuity of coastal settlements, as these sites have been used to argue for cultural duality?

The theory argues that one population lived near the sea and lived mainly as hunter-gatherers, but

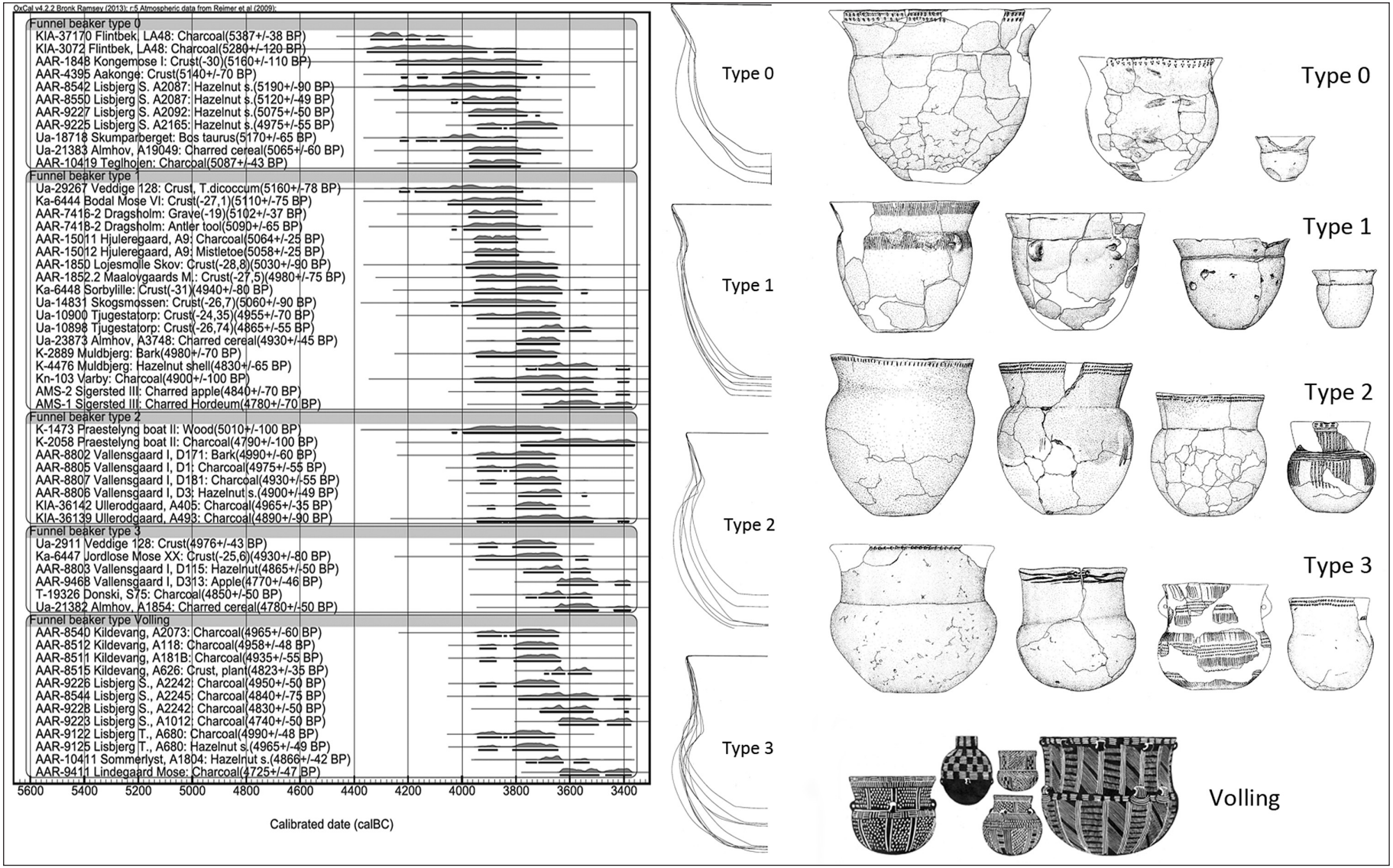

Fig. 12. ^{14}C dates of various types of funnel beakers (type 0, I, II, III and Volling vessels) in South Scandinavia (after **Koch 1998***).*

changed their material culture and supplemented their economy with domesticated animals and the cultivation of gardens. The other population lived as farmers on the easily cultivated land. It was around 3500 to 3300 cal BC that these coastal settlements were first abandoned, and the real agrarian process begins contemporaneously with the building of megaliths (*e.g., Andersen 2008; Ebbesen 2011*). The theory has been questioned by some researchers, and an alternative hypothesis suggested (*e.g., Skaarup 1973*) which argues that the coastal and inland sites were populated by the same agrarian population, who commuted between the coastal and inland areas during various seasons. This hypothesis is supported by the fact that the faunal evidence lacks the winter indicators of Early Neolithic kitchen middens, thus arguing for the seasonal exploitation of these coastal sites. However, detailed studies of the Early Neolithic kitchen middens show the same accumulation of layers as during the Late Ertebølle, indicating that these sites were not short-term seasonal settlements (see *Andersen 2008*). But the Late Ertebølle kitchen middens also lack faunal winter indicators, suggesting that they too were exploited in specific seasons and for special reasons, which continued during the Early Neolithic. Nevertheless, empirical studies of Early Neolithic kitchen middens have shown that most of the layers dated to 4000 to 3700 cal BC contain very limited evidence of charred grains, clay discs (interpreted as baking plates) or grindstones (*e.g., Sørensen 2014*). These studies can support the commuting hypothesis, because people could have specific tasks at seasonal sites not associated with agrarian practices. But the studies could also support the theory of population duality, where groups of people were more conservative and continued to hunt and fish, supplemented with some herding activities, and thus representing a slower transition and integration into the legitimate periphery of an agrarian community of practise. Generally, the lack of evidence of cultivation practises in these kitchen middens could also be due to current archaeological visibility. Perhaps the actual fields and other agrarian activities were located behind some of the kitchen middens. Unfortunately, few excavations behind Early Neolithic kitchen middens have been conducted. However, at the Bjørnsholm kitchen midden, located in northern Jutland, a large long barrow was discovered behind a midden where cultivation practices were identified (see *Andersen, Johansen 1992*). To move forward in this ongoing discussion, it is necessary to conduct surveys and excavations behind the middens and to carry out DNA, ^{14}C and ^{13}C analyses of the human bones found at these Late Mesolithic and Early Neolithic kitchen middens and inland sites.

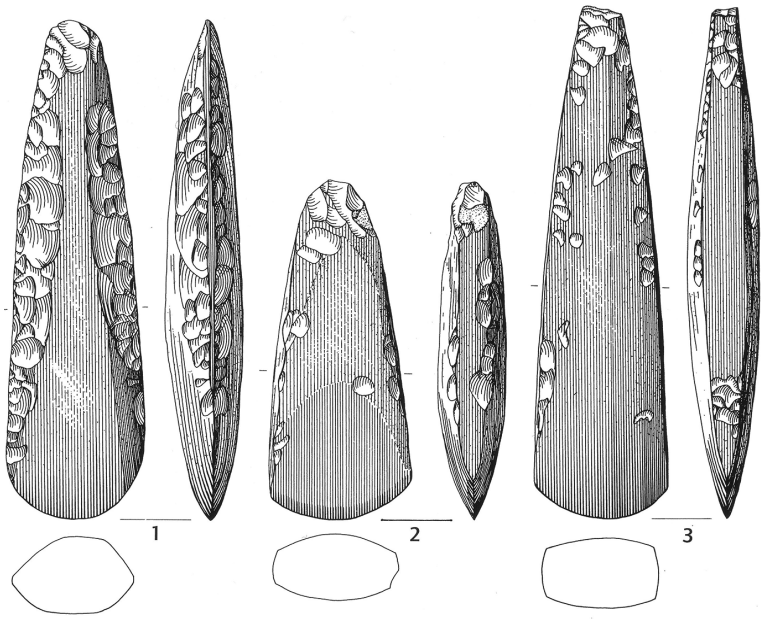

Fig. 13. Drawing of pointed-butted flint axes of type* 1, 2 *and* 3. *Type* 1 *has an oval cross section. Type* 2 *has a three-sided cross-section. Type* 3 *has a four-sided cross section (after* Nielsen 1977*).

One DNA study of humans from the Funnel Beaker Culture is not from the actual transition, but several hundred years later. The problem has been exemplified by Pontus Skoglund *et alii* (*2012*), who were able to extract mtDNA from a female skeleton found in 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 haplogroup H, which is associated with Middle Neolithic agrarian groups in Central Europe dated from 4600 to 3500 cal BC (*e.g., Sørensen 2014.105–109*). The result suggested that agriculture was introduced to South Scandinavia through a process of migration in which the Falbygden 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 of 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 (*e.g., Skoglund* et al. *2012; 2014*). No DNA analysis has been undertaken on human bones dated to the transition

between the Late Ertebølle Culture and Funnel Beaker Culture in South Scandinavia. Such investigations are underway, and preliminary results can be expected in the next couple of years (*e.g., Sørensen 2015b*). Nevertheless, mtDNA analysis has been conducted in Central Europe 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 agrarian expansion to South Scandinavia (*e.g., Bramanti* et al. *2009; Deguilloux* et al. *2010; Adler 2012; Bollongino* et al. *2013; Brandt* et al. *2013; Lizaridis* et al. *2014; Lee* et al. *2014*). These investigations showed a few individuals carrying the U5 haplogroup, which is normally associated with Palaeolithic or Mesolithic populations of Europe. The data indicate that there was some genetic mixture between hunter-gatherers and farmers, perhaps through marriage alliances. A similar result could perhaps be anticipated in connection with the agrarian expansion to South Scandinavia.

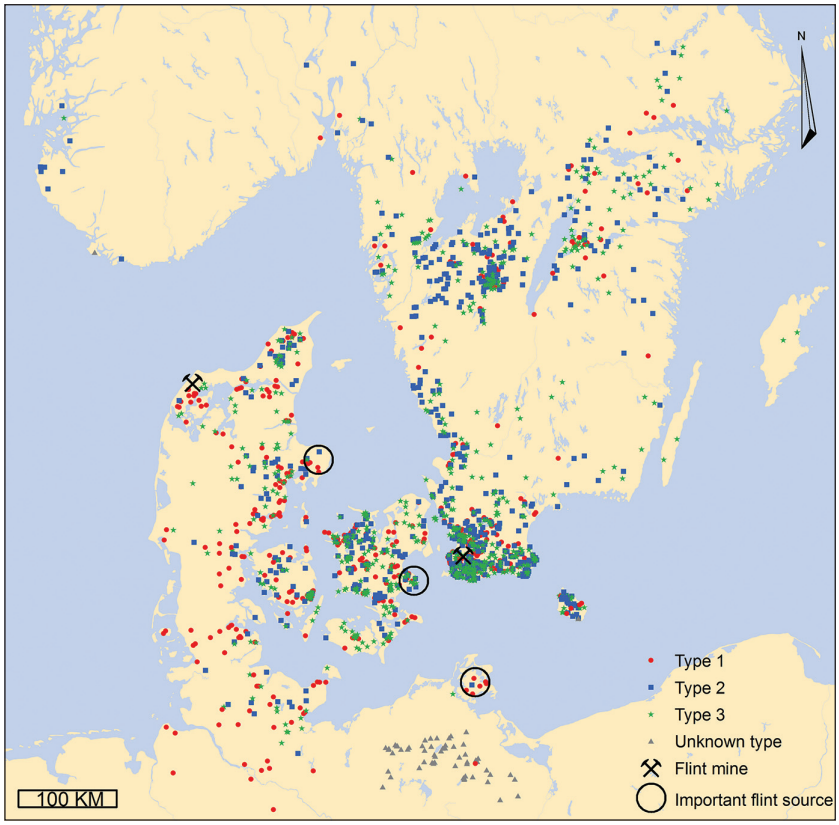

Fig. 14. Distribution of pointed-butted flint axes, flint mines and important flint resources in South Scandinavia and northern Germany (after* Sørensen 2014*).

One of the earliest farmers in South Scandinavia is the Dragsholm man, found in a burial on Zealand, who showed terrestrial ^{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) (*e.g., Brinch Petersen 1974; 2008; Price* et al. *2007*) (Fig. 16). The burial of the Dragsholm man contained some significant finds, including a short-necked funnel beaker (Oxie/ type 1) (see *Koch 1998*), a polygonal battle axe of type F III (*e.g., Zápotocký 1992*), teardrop-shaped amber beads, flint blades and a wrist guard, thus connecting the man with status and power. 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 be an example of a 'big man' who had the skills and the ability to disseminate information about agrarian practices (*e.g., Brinch Petersen 2008; Nielsen, Nielsen 2017*). 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 practise together with the indigenous population in this region. The Dragsholm man was probably from the first or second generation of pioneering farmers, but where did he and his ancestors come from?

Origin of scouts and pioneer farmers in South Scandinavia

The cultural impulses creating the Early Funnel Beaker Culture were influenced by pioneering farmers who were either directly or indirectly connected to the large-scale network of the Michelsberg Culture in the transition between the 5th and 4th millennium BC. It was these groups of migrating pioneering farmers who, together with the indigenous hunter-gatherers, established new agrarian communities of practices in connection with the expansion towards South Scandinavia. The integration of practises in these communities created the foundation and emer-

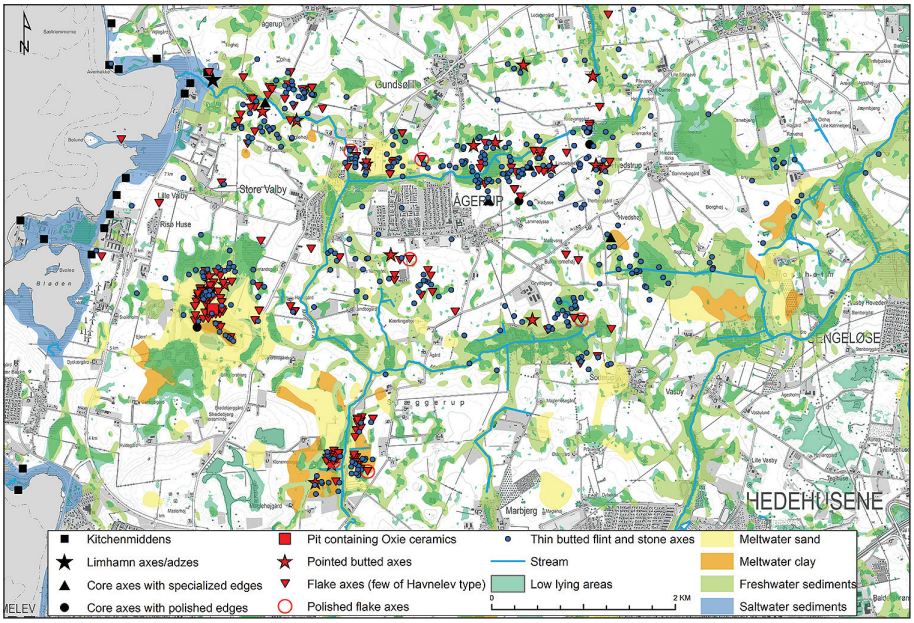

Fig. 15. Distribution of flint artefacts, showing the transition from Late Ertebølle to Early Funnel Beaker cultures in the area near Risø Zealand. The survey was conducted from 1978 to 2016 by amateur archaeologist Hans Sørensen and his son Klaus Sørensen.

gence of Funnel Beaker Culture. Investigations into the material culture, structures and types of sites of Early Funnel Beaker Culture clearly demonstrate the Michelsberg network influences on the first farmers who came to South Scandinavia. 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 (*e.g., Todorova 1981; Zápotocký 1992; Klassen 2000; Klimscha 2007*). The widely dispersed material culture associated with impulses from the Michelsberg Culture or Michelsberg-affiliated cultures can also be associated with agrarian expansions during the centuries around 4000 cal BC into the British Isles (*e.g., Sheridan 2010; Rowley-Conwy 2011*), the Netherlands (*e.g., Willms 1982; Louwe Kooijmans 2007; Raemaekers* et al. *2012*), central and northern Germany (*e.g., Brandt 1967; Lüning 1968; Hartz* et al. *2007; Vogt 2009*) and northern Poland (*e.g., Lichardus 1976; Czekaj-Zastawny* et al. *2011; Papiernik 2012*), thus making this spread of material culture and people a northern European phenomenon.

Typical Michelsberg sites demonstrate many similarities with Early Funnel Beaker sites. They are both located on easily worked arable soils and characterised 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 (*e.g., Nielsen 1985; Vermeersch 1988; Vanmontfort* et al. *2008*). It has previously been suggested that the type 0 funnel beaker may be a transitional shape of vessel between the Ertebølle and Funnel Beaker cultures, thus indicating an inde-

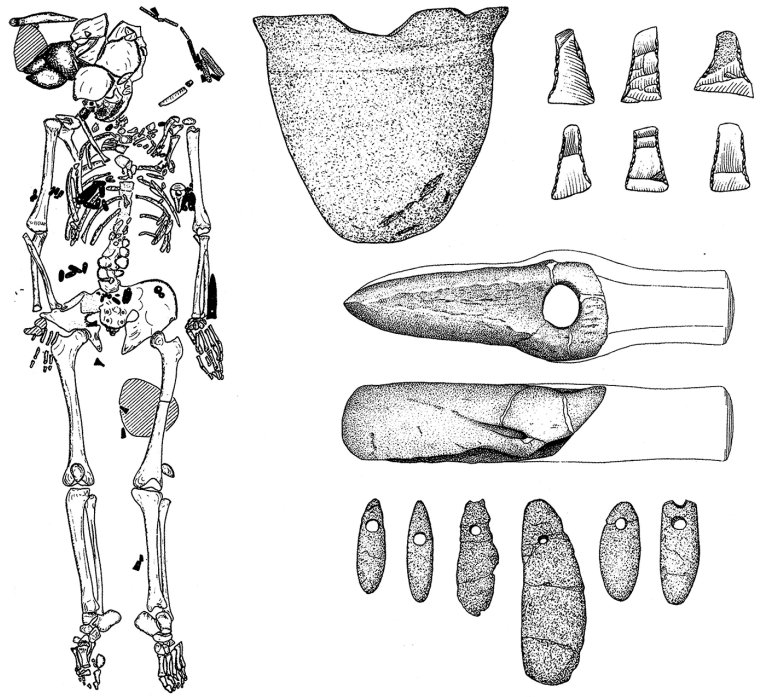

Fig. 16. The burial of the Dragsholm man, containing a short-necked funnel beaker, a polygonal battle axe, teardrop-shaped amber beads, transverse arrowheads, flint blades and a wrist guard (after* Brinch Petersen 1974; 2008*).

pendent evolution of funnel beakers (*e.g., Koch 1998; Andersen 2008*). However, type 0 has parallels with short-necked funnel beakers from the early stages of Michelsberg Culture, dated to 4400 to 4000 cal BC (Fig. 17). It is therefore probable that funnel beakers came to southern Scandinavia through direct or indirect contacts with agrarian groups around 4000 cal BC (see *Lüning 1968*). The new practice of disposing of ceramics in pits also points to a contact associated with pioneering farmers who were interconnected with people from the Michelsberg Culture (*e.g., Becker 1954; Biel* et al. *1998; Jeunesse 2011*).

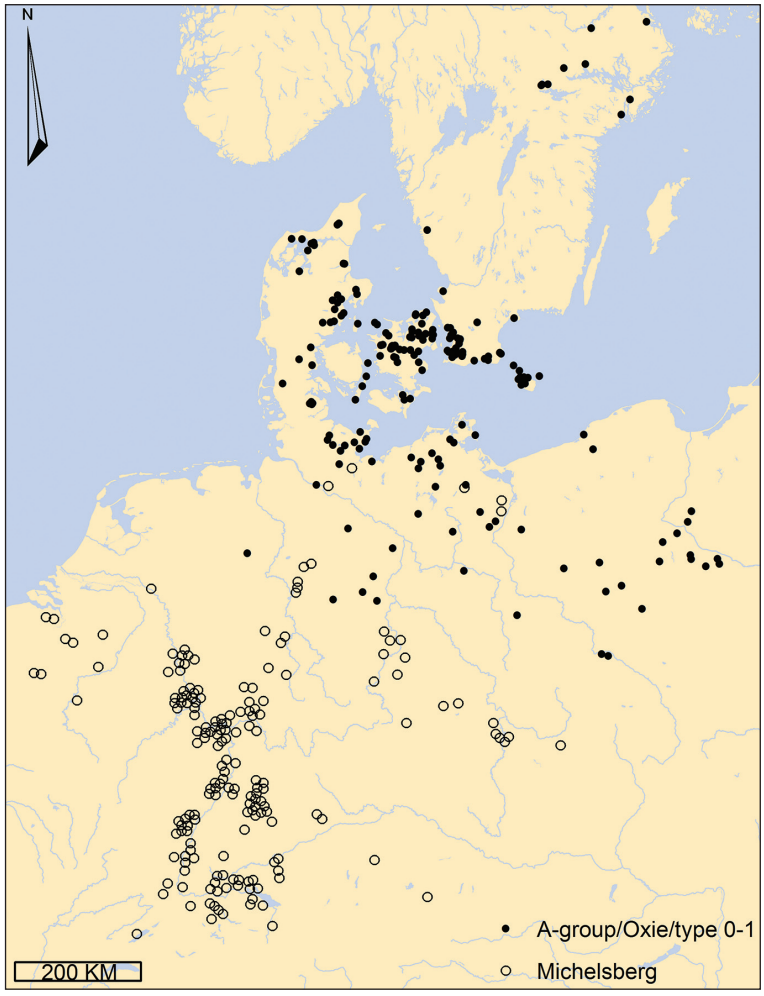

Fig. 17. Map of Michelsberg sites in Central Europe and localities containing short-necked funnel beakers in South Scandinavia, northern Germany and northern Poland (after* Lüning 1968; Sørensen 2014*).

The flint assemblages from the Early Neolithic in South Scandinavia have also been used to argue for a continuity from Late Ertebølle Culture (*e.g., 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 Michelsberg Culture, because polished flake axes similar to the Havnelev type have been found at Michelsberg sites at Schorisse-Bosstraat and Thieusies in Belgium in contexts ^{14}C dated to between the late 5th and early 4th millennium BC (*e.g., Mathiassen 1940; Nielsen 1985; 1994; Breunig 1987; Vermeersch 1988; Vermeersch* et al. *1991*). Furthermore, polished flake axes of the Havnelev type have also been identified from South Scandinavia in pits at the Almhov site, which have been ^{14}C dated to between 4000 and 3800 cal BC (see *Rudebeck 2010*). It is therefore clear that the tradition of polishing flake axes may have come from pioneering agrarian societies that were influenced by Michelsberg Culture.

Jade axes also reached South Scandinavia from scouting visits or pioneering farmers during the Early Neolithic (4000–3500 cal BC), an assertion supported by local imitations found in ^{14}C-dated contexts, thus making their introduction synchronic with the introduction of agriculture (Fig. 18). A pointed-butted flint axe imitating a Durrington type jade axe was found at Lisbjerg Skole in pit A2247, together with Oxie ceramics and threshing waste from cereals, which was dated to the earliest part of the Early Neolithic (see *Skousen 2008*). Other local imitations of jade axes from South Scandinavia include Durrington, Chelles, Bègude, Bernon, Saint Michel, Rarogne, Altenstadt, and Chenoise types, which were made from local raw materials such as flint, diabase, basalt, porphyry and slate (Fig. 18). The typological classification can be debated, of course, but some of the imitations of jade axes with splayed edges (Saint-Michel and Rarogne) clearly suggest imitations of specific jade axes found in Central Europe. Another characteristic type of axe is the pointed-butted axes with a perforation in the butt, which also show similarities with the contemporary Zug type, which is concentrated in Switzerland (see *Klassen 2014a*).

Jadeite may have been difficult to acquire, 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 (*e.g.,*

Pétrequin et al. *2012*). The result would have been an increased focus on exploiting more abundant raw materials, such as flint. 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 (*e.g., Gallay 1977; Pétrequin* et al. *2006; 2010*) (Fig. 19). 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 (*e.g., Bostyn, Lanchon 1992; Becker 1993; 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, in association with other cultural or social factors, could have generated migration 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 (*e.g., Olausson* et al. *1980; Rudebeck 1986; Becker 1993; Barber* et al. *1999; Stevens, Fuller 2012; Sørensen 2012; Sørensen, Karg 2014*) (Fig. 19).

The Michelsberg Culture is also characterised by large hall buildings, enclosures and long barrows, which have not been found in the first centuries of the Early Neolithic from 4000 to 3800 cal BC in South Scandinavia (*e.g., Marolle 1989; Andersen 1997; Raetzel-Fabian 2009; Rzepecki 2011; Klassen 2014b; Sørensen 2014*). The lack of these monumental structures could be because it was more important for the first pioneering farmers to invest most of their time in clearing the forest for large areas suitable for arable farming. However, the first monumental long barrows and enclosures do appear in South Scandinavia in the consolidation phase during the following centuries, from 3800 to 3500 cal BC, thus showing that there was a continuous network exchange of people, ideas and knowledge either directly or indirectly with the Michelsberg Culture.

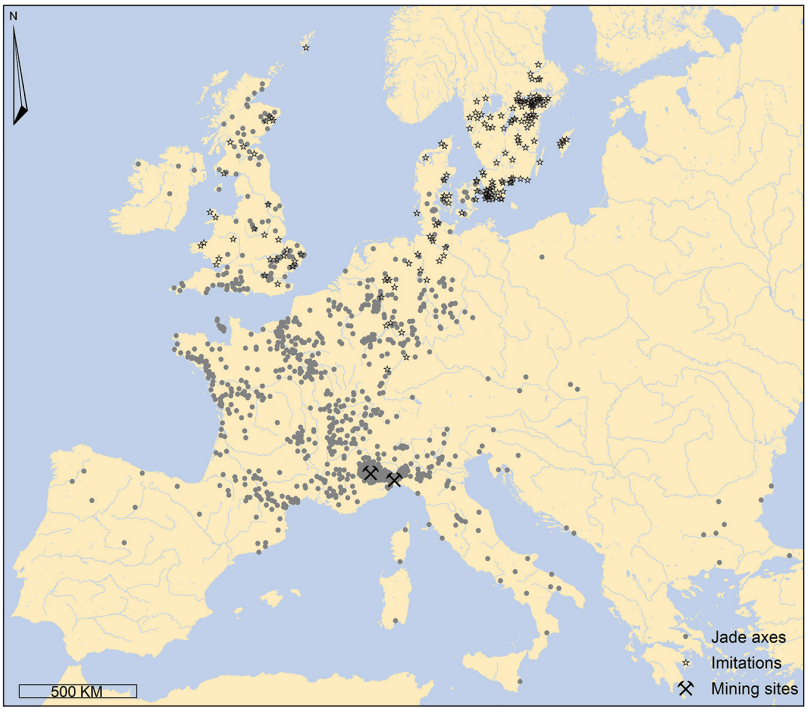

Fig. 18. Distribution of jade axes and imitations in Northern Europe (after* Sørensen 2014*).

Why did agrarian groups connected to the Michelsberg Culture migrate?

The reasons for the expansion of Michelsberg Culture have been interpreted as a combination of population pressure and climatic change to drier conditions, meaning that better environments for growing crops 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 (*e.g., Leuschner* et al. *2002; Gronenborn 2007; Shennan 2009; Müller 2011*). The distribution of Michelsberg and Linearbandkeramik sites in Belgium shows interesting patterns (see *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 more widespread exploitation of the landscape from around 4400 cal BC (Fig. 20). 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 more marginal areas. This resulted in 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 conflict (*e.g., 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 the contemporary migration of pioneering farmers to the British Isles, Netherlands, northern Germany, northern Poland and South Scandinavia around 4000 cal BC (*e.g., Louwe Kooijmans 2007; Hartz* et al. *2007; Sheridan 2010; Rowley-Conwy 2011; Papiernik 2012; Sørensen, Karg 2014; Sørensen 2014*) (Fig. 21).

Concluding remarks

In this paper, it is argued that agriculture is a very complex technology which takes a long time to learn, making it very difficult for agrarian practices to spread as an idea. Instead, it is suggested that expansions of agrarian practices in Scandinavia were associated with migration. These migrants had the appropriate skills and the ability to teach the indigenous population about agriculture by establishing communities of practise, a fact which supports the theory of integrationism. Engagement in these communities of practise 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 began with 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 on the appearance of a complete agrarian technology and a quick expansion of farming activities all the way up to Central Sweden. The pioneering agrarian societies established their colonies in areas where the density of the indigenous population was low, with an abundance of easily worked arable soil and access to flint sources, which is evidenced by the distribution of pointed-butted axes. The rapidity of the process changed the material culture, thus supporting the argument that both the immigrating farmers and the indigenous population were involved in creating agrarian societies in South Scandinavia. The engagement of the indigenous population in agrarian communities of practise could explain the swift change in the material culture, as well as the emergence of new depositional practices at habitation sites and in wetland areas during the early stages of the Funnel Beaker Culture.

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

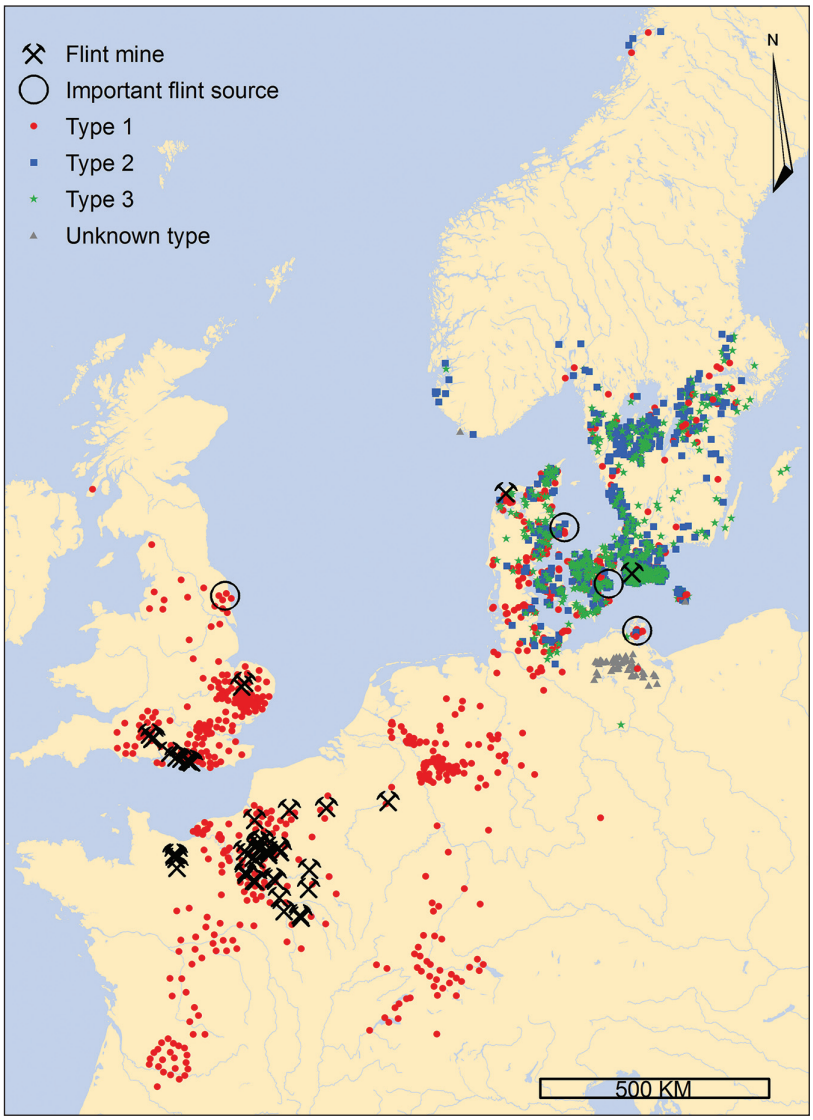

Fig. 19. Distribution of pointed-butted flint axes, flint mines and important flint resources in western Europe (after* Sørensen 2014*).

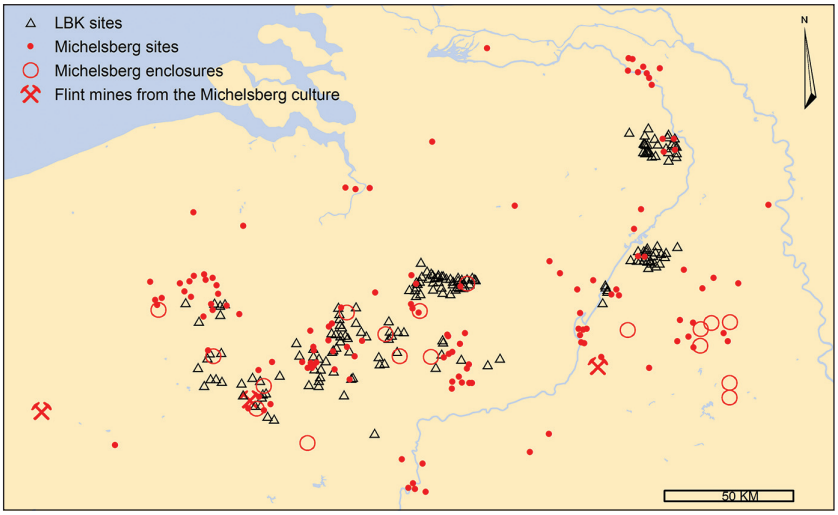

Fig. 20. Distribution of Linearbandkeramik Culture sites, and Michelsberg Culture sites, causewayed enclosures and flint mines (after* Vanmontfort *et al.* 2008*).

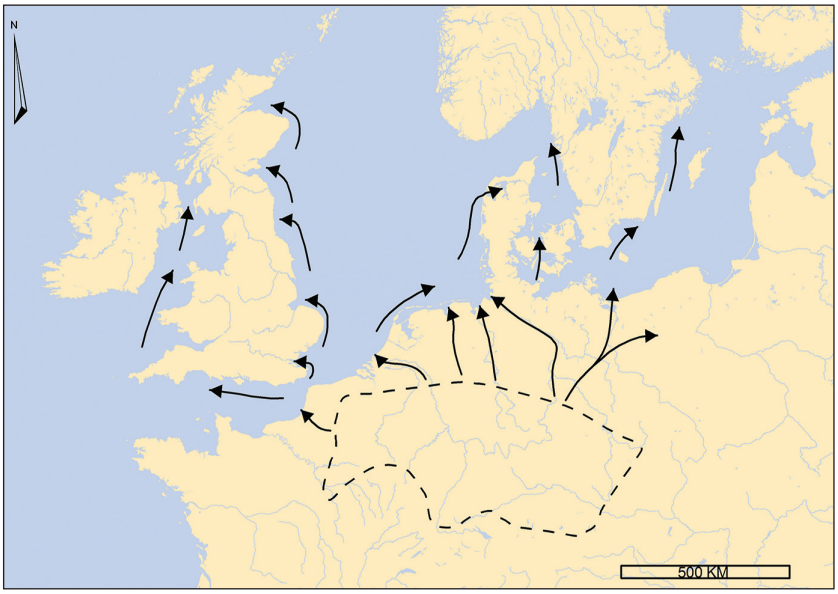

Fig. 21. The expansion of Michelsberg Culture to the British Isles and South Scandinavia around the transition between the late 5th and early 4th millennium BC (after* Sheridan 2010*).

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 communities of practise 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.

The immigrating farmers coming to South Scandinavia probably came from the Michelsberg Culture, or were connected with it, which is confirmed by similarities in the material culture, symbolic practices, types of site 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, unfavourable climatic conditions and easily accessible flint resources may have motivated some farmers to move north. These groups of pioneering farmers migrated not only 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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