Niels V. Skak-Nielsen

The neolithisation of Scandinavia

How did it happen?

Abstract

Since the early 1970s there has been a near-consensus among archaeologists that agriculture was introduced to southern Scandinavia around 4000 cal BC without any immigration, through a voluntary decision by the indigenous hunter-fisher population. It has been surmised that the necessary technology was adopted through contact with Neolithic cultures on the Continent.

In the present paper it is pointed out that these views, as well as later models of an economic shift without any immigration, are untenable. In the absence of any immigration, there would have been neither opportunity nor motive for the shift to a new economic culture. The European background to the shift is reviewed, taking into accout new results in this field of research. It is shown on the basis of published archaeological research that there has been immigration into southern Scandinavia.

The expansion of Neolithic cultures took c. two centuries from Holstein into the peninsula of Jutland and the Danish Isles, onward to Scania, and then to Bornholm, the Lake Mälaren area, Gotland and the Oslo Fiord. There is a strong likelihood that a climate change at the time, which caused the Danish straits and part of the Baltic Sea to freeze over during the winters, made this rapid spread of a new culture over such a large area possible. It is shown that this spread entailed immigration on a considerable scale compared to the size of the area's Mesolithic population.

Key words: Scandinavia, Neolithic, immigration, climate change

Siden begyndelsen af 1970'erne har der blandt arkæologer bestået næsten konsensus om, at landbrug omkring 4000 f.Kr. blev indført i den sydlige del af Skandinavien uden indvandring gennem en frivillig beslutning af den derværende jæger- og fiskerbefolkning. Man antog, at den nødvendige teknologi var blevet tilegnet gennem kontakter med neolitiske kulturer på kontinentet.

Det påpeges, at disse synspunkter – såvel som senere fremførte forklaringer på et erhvervsskifte uden indvandring – ikke kan være holdbare. Uden indvandring har der hverken været mulighed for eller tilskyndelse til overgang til den nye erhvervskultur. Den europæiske baggrund for erhvervsskiftet gennemgås under inddragelse af resultaterne af ny forskning på området. At indvandring i det sydlige Skandinavien faktisk må have fundet sted påvises på grundlag af eksisterende arkæologisk forskning.

Spredningen af de neolitiske kulturer skete indenfor et par hundrede år fra Holstein over den jyske halvø og de danske øer til Skåne og derfra til Bornholm, Mälardistriktet, Gotland og til Oslofjorden. Det er overvejende sandsynligt, at en samtidig ændring i klimaet og deraf følgende tilfrysning om vinteren af farvandene mellem de danske øer og Sverige og i Østersøen har muliggjort den hurtige spredning af den nye kultur over et meget stort om-

råde. Det påvises, at der må have været tale om en betydelig indvandring målt i forhold til størrelsen af den hidtidige mesolitiske befolkning.
Nøgleord: Skandinavien, neolitikum. immigration, klimaændring

Introduction:

The Danish-Swedish synthesis

Until about 1970 the dominant view among Danish and Swedish archaeologists was that the Neolithic came to Denmark and southern Sweden through an immigration of farmers from the south. In many other cases, migration had been used incorrectly as an explanation of changes in the archaeological record, and these explanations had been misused for political purposes (e.g. Nazi ideas of Aryan migration). Therefore a change occurred in most archaeologists' attitude to the question of neolithisation. This was partly due to the New Archaeology. Migration was generally discounted as an explanatory model and evolutionist or diffusionist ideas were preferred. According to these, the observed changes would either have been caused by evolution within a society, by ecological parameters or by foreign cultural influences. A belief in migration was largely seen as politically incorrect. There may also have been an element of nationalism in this changed viewpoint, and the insurrection of 1968 against "old professors" would also have played a part. Some scholars may have been motivated by a wish to paint an idyllic picture of the past.

The New Archaeology originated among Anglo-American archaeologists who shared this aversion toward explanations based on migration. Many British archaeologists tend to deny any prehistoric immigration into the UK after the original one that took place while the British Isles were land-locked for a time after the latest Ice Age. History documents at least four migrations to the Isles in later millennia. Against the background of the current movement toward European unity, it may have been important that the UK, like Scandinavia, is on the periphery of our subcontinent. The wish to distance oneself from the recent colonial past beyond Europe has clearly also contributed to the resistance against any explanatory model that interpreted the neolithisation of Europe as the colonisation by a farming population of an area inhabited by Mesolithic fishers and hunters.

Among Danish archaeologists, the reason for the new view of the neolithisation was that radiocarbon dates in the 1970s appeared to show that the final phase of the Mesolithic Ertebølle culture (EBK) had been replaced almost without any chronological overlap by a farming culture that was called the Funnel Beaker culture (TRB) due to its characteristic pottery. This led to the conclusion that there had been no immigration. In such a case, the new culture would have had to co-exist with EBK for a considerable time before the Mesolithic population had been assimilated or exterminated. There appeared to have been no period of such "culture dualism". Thus the TRB population was seen as immediate descendants of the Ertebølle people.

However, one may just as well argue the opposite. If the shift involves not only culture as seen e.g. in mortuary customs, but also basic technologies (agriculture, stock breeding, flintaxe grinding and new pottery), then it must take quite some time to develop locally, while it would be easier to imagine an abrupt shift if an immigrant farming population replaced the previous Mesolithic one. Swedish archaeologists, who agreed with their Danish colleagues in denying immigration, took the latter view. The shift appeared to have been more gradual in Scania than in Denmark, and this was taken also to indicate an absence of immigration.

The Continental background

It is commonly accepted that agriculture reached Europe in Greece from Anatolia c. 7000 cal BC. About 1500 years later it had reached present-day Hungary across the Balkans (Price 2000). Here the Linear Pot-

tery Culture (German Linearbandkeramik, LBK) appeared, and during two centuries spread westward, through Germany across the great plains of loess soil to parts of the Netherlands and Belgium, and eastward, to the Ukraine.

Another branch of the Neolithic movement spread westward from Greece across the Mediterranean. About 5500 cal BC it had reached the east coast of Italy. Then it began to move fast. It reached Portugal in about two centuries, following the coasts of Italy and southern France and around the Iberian peninsula. A branch reached up from the coast through the Rhone river valley. From Portugal it apparently continued along the Atlantic coast and formed the Michelsberg culture in Northern France, Belgium and the Rhineland during the second half of the 5th millennium cal BC. Part of this culture was influenced by the LBK that had reached western Europe long before from the east, as described above. The resulting mixed culture rapidly spread back eastward through Central Europe (cf. Klassen 2004:273). These two main Neolithic groups appear to have pushed each other to and fro, probably through migration.

The majority opinion among scholars seems to be that both the rapid expansion of LBK across Europe c. 5500 cal BC and the Mediterranean expansion would only have been possible through migration. Some of the areas reached by these expansions appear never to have been populated before the arrival of Neolithic populations. Many, however, also believe that the spread of LBK and of Neolithic cultures in i.a. parts of France and Germany were a result of the Mesolithic populations' acceptance of the new culture, perhaps after a period of reciprocal acculturation.

After 5200 cal BC the geographic limit of neolithisation in northern Germany was largely stable for more than a millennium. Mesolithic population density was relatively high here in the coastal areas – as was the case in south Scandinavia. The Ertebølle culture was based on a solid fisher-hunter-gatherer economy. In the later part of this period the Funnel Beaker Culture (TRB) developed slash-and-burn agriculture, an adaptation of the LBK economy suited to the less fertile, mainly forested moraine areas of northern Germany. The eventual northward expansion of TRB from Holstein took place with a speed and across distances that can be compared to the expansion of LBK across Central Europe and of Neolithic cultures across the western reaches of the Mediterranean.

But there are also examples of a slower spread of Neolithic culture traits. Before the appearance of TRB, a slow diffusion of LBK technology can be seen in northern Germany and Holstein in the first half of the 5th millennium cal BC (Hartz et al. 2002). Bones of domesticated cattle dated to 4800–4600 cal BC have been found in Mesolithic culture layers at Rosenhof in Holstein. There are also indications of cereal agriculture north of LBK's limit at the time in northern Germany. Agriculture and stock breeding nevertheless appears to have been of little economic importance at this stage. The spread of these Neolithic technologies would probably not have been accompanied or caused by migration. Only with the spread of TRB across southern Scandinavia about 4000 cal BC did the entire Neolithic culture complex expand rapidly, which, as argued below, must have had to do with migration.

Where did the migrants come from during the rapid expansion of the LBK and later by the TRB? The most likely answer seems to be that the population expansion that followed upon neolithisation first claimed nearby marginal soils. More labour intensive agriculture could also put food on the table for a time as populations grew. Eventually, however, emigration would have begun to look more and more appealing.

Arguments against the immigration hypothesis

Dating problems

The original argument against the immigration hypothesis – the new datings – is, as discussed above, untenable. Furthermore, many of the datings from the transitional phase turned out to have large margins of error when tree-ring calibration became available in the 1980s. The rather flat calibration curve at the transition to the Neolithic in southern

Scandinavia gives particularly large margins of error (see below). Other sources of error have also been identified.

Where did TRB come from?

Another argument against the immigration hypothesis was that one could not point to any particular area south of Jutland from which the farmers would have come. In Jutland, as on Zealand and in Scania, there are two Neolithic groups with differences in their material and ideational culture. The Oxie group is most common on the Danish Isles and in Scania. The Volling group was initially dominant in Jutland. According to new research (Klassen 2004:323, 339), the Oxie group had links to areas in central Germany. The roots of the Volling group appear to have been in the Michelsberg culture of the westernmost parts of Europe that had not been influenced by LBK. The problem of where these cultural influencies came from remains, regardless of whether migration or diffusion is seen as the impetus for the economic shift.

Continuous flint technology

A third argument against the immigration hypothesis was that there were not any great changes in flint technology apart from the appearance of ground axes. The agricultural populations of Europe, however, lived for a very long time alongside Mesolithic cultures. They may have acquired their neighbours' superior flint technology, which was similar to that of the Scandinavian Mesolithic.

How do opponents of the immigration hypothesis explain the shift to TRB?

The arguments against immigration are thus untenable. How, then, do the opponents of this hypothesis explain the economic shift? A requisite for the shift must have been that the hunters and fishers of southern Scandinavia learned how to cultivate the soil and breed livestock, grind flintaxes and make the new pottery. It was supposed that there had been a far-reaching trade network across the Baltic connecting Late Mesolithic southern Scandinavia with farming populations on the Continent. Around 4000 cal BC these farmers had already lived there for more than 1000 years.

This idea was based on finds from Denmark (primarily Lolland and Zealand) and Scania of "shaft-hole axes or adzes", tools made of amphibolite, a hard but not brittle mineral. Their function is a matter of debate. They were used in LBK for about 1200 years and thousands have been found in the area of this culture. The shape and use wear of these tools, as well as details of their design, indicate that they were not in fact used as axes but as hoes. They would have worked well to make furrows in the hard loess soil for the seed corn and to remove weeds. A few grisly finds show that they were also used as weapons.

The idea was that the trade contacts indicated by the shoe-last axes could have built up local knowledge that enabled the neolithisation. The technology and culture was available to neighbouring Mesolithic populations during an often very long "availability phase" (Zvelebil & Rowley Conwy 1986). They would thus have been able to make the shift whenever they wanted to. As early as 1982, Fischer suggested such an explanation. Along with many other scholars, he supposes that the possession of shoe-last axes conferred prestige in south Scandinavian Mesolithic societies, and that this was the reason that they were imported. The question, however, is if even intensive trade contacts allow the transferral of technology and changed cultural traits. If the axes came to Denmark and Scania in the Late Mesolithic, they may have been traded from settlement to settlement across small distances.

Some Swedish archaeologists have had difficulties in applying this model to the spread of neolithisation northward from Scania. It is hard to imagine intensive contacts between Mesolithic groups on the shores of Lake Mälaren and the Oslo Fiord and farmers south of the Baltic (cf. Kihlstedt et al. 1997:123). These scholars did not, however, contest the applicability of the availability model to Denmark and Scania. To explain the expansion to the Lake Mälaren area it was supposed that there had been a long-distance social network between this area

and Scania through which the new culture propagated.
Hallgren (1996) suggested that these two areas formed a Late Mesolithic social unit whose component groups exchanged spouses across distances of 400–500 km, thus allowing the new technology to spread rapidly to Lake Mälaren. Hallgren's model was adopted by e.g. Jensen (2001) and Fischer (2002) as a possible subsidiary explanation for the spread of TRB to Denmark. There is no evidence of such spouse exchange networks in northern Europe. Price et al. (2001), however, argued for such exchange between farmers in the Rhineland and Mesolithic groups in adjoining mountainous areas. If there had been close contacts between Scania and Lake Mälaren in the Late Mesolithic, it is inexplicable that such a useful technology as the pointed-base pots and pottery lamps of EBK never spread north of Scania (cf. Persson 1999:134). Nor did other elements of EBK spread north of Scania.
The availability model, as said before, requires intensive contacts between Mesolithic southern Scandinavia and north German farmers. There was, however, most likely a language barrier. The farmers south of the Baltic would probably have spoken another language than the Ertebølle people (cf. Renfrew 1987; Bellwood 2004). Be that as it may, transportation would have posed even worse problems. Land transportation was difficult. All travel was by foot and entailed considerable risks. Times were anything but peaceful. Seaborne transportation was the best way to move people and goods over long distances.
Many Mesolithic log dugouts have been found. The longest one, measuring more than 10 metres, dates from the late 5th millennium BC and was found at Tybrind Vig in Denmark (Andersen 1988). There are also many Early Neolithic dugouts from the 4th millennium, but not from the later stages of the Neolithic in the 3rd and early 2nd millennium.
The Neolithic dugouts have new technological traits. Details indicate that planks were sometimes added to raise the gunwale, which would make the vessel more seaworthy (Rieck & Crumlin-Pedersen 1988). This fact argues against the existence of seaworthy vessels already in the Mesolithic that could have been used for long seaborne journeys. If such journeys had been possible with other types of vessels then there would have been no reason to improve the construction of the dugouts. If there were other, more seaworthy boat types in Mesolithic southern Scandinavia, then one would also expect finds of such boats from the following millennia – but there are none. Nor are such seaworthy craft known from other countries in northern Europe at the time.

Scandinavian archaeologists (cf. Hesjedal et al. 1996) have suggested that there may have been boats made of animal skins stretched across a light-weight wooden frame, in southern Scandinavia. Such craft are depicted in rock carvings prior to 4000 cal BC in the circumpolar area. Some of them are similar to the umiak of the Inuit. They could carry several people but were only useful in coastal archipelagos. No remains of such boats are known from southern Scandinavia, and Neolithic rock carvings south of the line Nämforsen-Trondheim do not feature any boats (Lindkvist 1994:18). Boats are, however, very common in Bronze Age rock art. They may represent a development of boat types after 3000 cal BC leading towards the plank-built boats of the Iron Age. The earliest find of such a boat is the Early Iron Age boat from Hjortspring in Denmark (c. 300 cal BC).
Our knowledge of Ertebølle material culture in various parts of southern Scandinavia tells us quite a deal about transportation and communication at that time. There is hardly any difference between Zealand and Scania, which means that the strait of Öresund was no barrier. The strait of Storebælt, however, was apparently a barrier against frequent contact as shown by the differences between material culture on Zealand and in Jutland. There is no sign of contact between Bornholm and the Continent, where the distance is 90–100 km. Any seaborne contact in the Late Mesolithic across the 40 km between Bornholm and Scania was very limited (see below).
There is thus no indication that the Mesolithic population of southern Scandinavia could

have switched economies by themselves. They would not, in the absence of close contact with farmers, have been able to acquire their technology or cultural traits.

Another question is why these fishers and hunters would have chosen to switch economies. Many archaeologists believe that the Mesolithic economy was not very labour intensive. This view is based on, among other things, anthropological studies of modern societies with a similar way of life. Thus, the economic shift was not inescapable but must be explained. Some have suggested ecological and population-based factors behind the shift: overpopulation, elm decline and climate deterioration, including a local extinction of the oyster.

These ideas have largely been abandoned. Others (e.g. Jennbert 1984; Fischer 2002:343–385) have proposed social mechanisms behind the economic shift. Imported grain and livestock may – like the shoe- last axes – have conferred status. If the leaders of farming communities could host feasts with pork and beer, then they had a competitive edge on the hunters and fishers. But such a scenario is hard to imagine where great distances separated the different populations and precluded frequent contact.

The question of motives for autonomous cultural change has not been answered by the opponents of the immigration hypothesis. This hypothesis can, however, offer an explanation. Immigrant Neolithic populations placed the Mesolithic locals under stress. Certain important coastal Ertebølle settlements and the Jutish inland settlement of Ringkloster were abandoned about the time of neolithisation. This did most likely not occur by the inhabitants' free will. Late Mesolithic culture could not survive the close competitive encounter with Neolithic groups. This does not preclude the possibility of a voluntary shift in some localities. There are indications that traditional food sources, e.g. the fishing that had supplied the staple food of EBK, played a continued important role into the Neolithic.

In the following we shall review further main arguments that an immigration did in fact take place.

Further main arguments for the immigration hypothesis

Problems with diffusion

An important argument for the immigration hypothesis is that a diffusion of technology from one area to another would have been an extremely slow process. This has been the case also in historic times. In the early 16th century AD, King Christian II of Denmark wanted his people to grow greens like the Dutch did, for the provision of Copenhagen. For this purpose he invited Dutch peasants to settle on the nearby island of Amager. Potatoes took a long time coming to Denmark, and the people who finally began to grow potatoes and teach this art to the Danes were Germans who had been invited in the late 18th century to cultivate the Jutish moors.
Returning to prehistory, it has been mentioned above that elements of LBK's agricultural technology spread very slowly northward or westward to Holstein during the 5th millennium cal BC. When EBK groups in northern Europe acquired pottery technology through contacts with farmers, it took about 700 years for it to spread from Holstein to modern Denmark (Klassen 2004:111). Only two vessel types were concerned: pointed-base pots and pottery lamps. Neolithisation, however, entailed the transferral of an entire technological package: 1) agriculture, 2) stock breeding, 3) new pottery with thin-walled and more durable funnel beakers in many specialised shapes, and 4) flintaxe grinding. There was also a cultural shift regarding 5) burial customs, and 6) widespread wetland sacrifice of axes and pots containing food and/or drink. Almost all of these elements were present where TRB replaced EBK, although there are differences in how fast they appeared or have been documented. This new knowledge or attitude could not have been acquired no matter how long there had been trade and cultural contact. Whatever may have been learned during trips to the Continent about 4100 cal BC would have been forgotten. The appearance of various

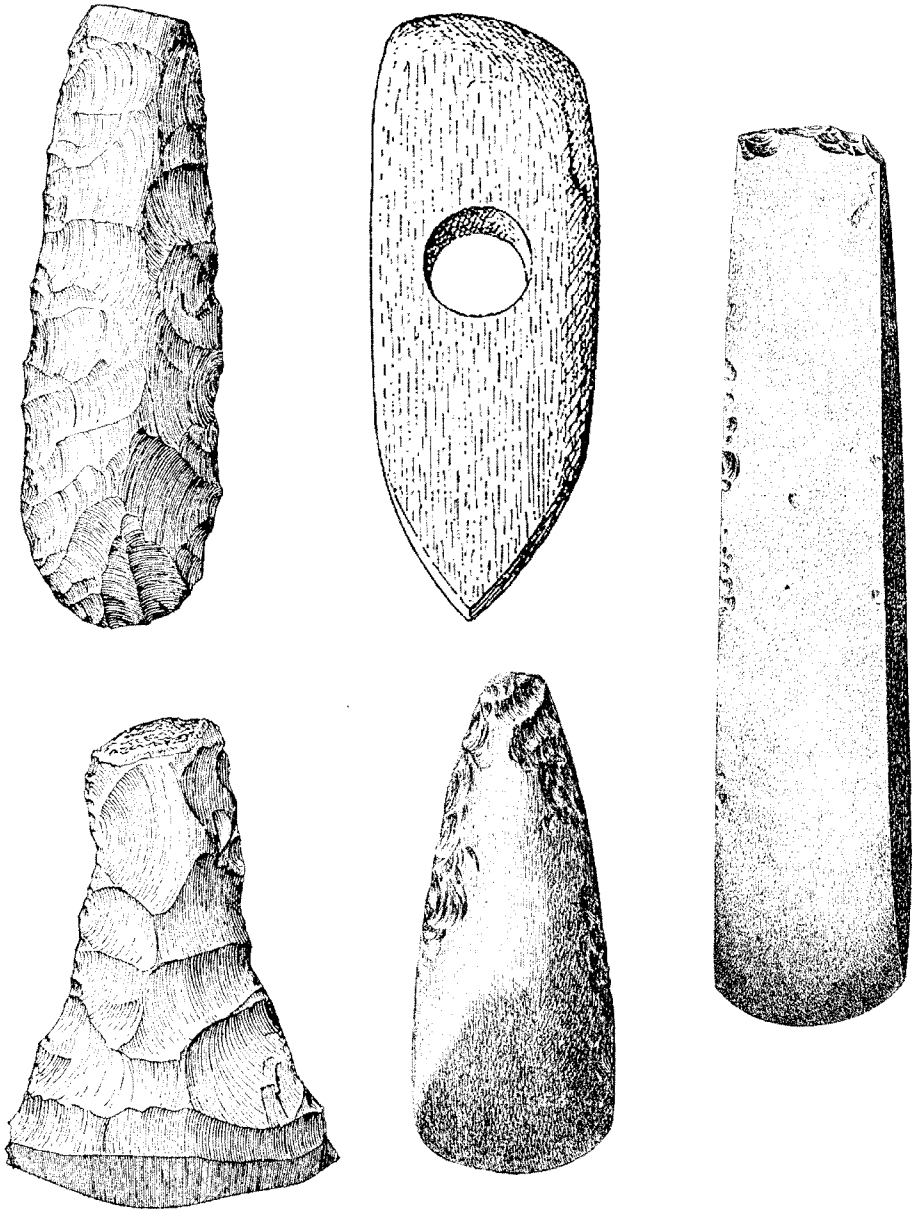


Figure 1. Left, two common axe types from the late Ertebølle Culture (EBK): a core axe and a flake axe (c. 15 and 10 cm long, respectively). Top centre, a shoe-last axe, c. 15 cm. Below and to the right, two axe types characteristic of the early Funnel Beaker Culture (TRB): a pointed-butted and a thin-butted axe from the Oxie and Volling sub-cultures respectively. Their length vary from c. 15 to 40 cm. Reproduced after Jeg ser på oldsager, Politikens Forlag 1979.

Figur 1. Til venstre ses to hyppigt forekommende økseformer under sen ertebøllekultur: en kerneøkse og en skiveøkse (hhv. ca. 15 og 10 cm høje). I midten øverst den i teksten omtalte skolæstøkse, ca. 15 cm. Derunder samt til højre to typiske økseformer fra tidlig TRB: en spidsnakket og en tyndnakket økse fra hhv. Oxie- og Vollingkulturen. Deres længde varierer mellem c. 15 og 40 cm. (Gengivet efter Jeg ser på oldsager, Politikens Forlag 1979).

new technologies together with new cultural elements in southern Scandinavia can only be explained through the immigration of farmers.

Two subcultures in the Early Neolithic

As mentioned above, there were two Early Neolithic culture groups in Denmark and Scania, Oxie and Volling, that display differences both regarding material and ideational culture. Oxie's flint assemblage and pottery design is closest to those of EBK, and its origins must according to Klassen (2004:323) be sought in Central Europe, more precisely southern Lower Saxony or the Mittelelbe/Saale area. Volling, on the other hand, is according to Klassen similar to cultures in the westernmost parts of Europe which had not been influenced by the LBK. This goes for the round-based and highly decorated pottery as well as the non-megalithic long-barrows that are both found in the Paris Basin and England. The Volling group also introduced flint mining. These two contemporaneous groups with different culture co-existed on Zealand among other places (Koch 1998:181–185).

Regardless of whether Klassen's views of these two groups' areas of origin are correct, the existence of two Early Neolithic subcultures in Southern Scandinavia cannot be explained without reference to immigration.

Otherwise one part of late Mesolithic populations of Jutland, Zealand and Scania must have had long-standing contacts with one Continental Neolithic group, while another part of the population in the three areas had contacts with another Neolithic group. This is inconceivable. Immigration, however, offers a simple explanation: two farming groups have immigrated into the Jutish peninsula: first Oxie, then a century or two later, Volling, which was probably the larger group. Volling expanded across Jutland and onward to the isles and Scania. It put pressure on Oxie, a main part of which had moved via Fehmarn to Lolland and onward to Zealand and Scania. Apart from the areas mentioned, both groups are also present on Bornholm and around Lake Mälaren.

Klassen's view of the two groups' areas of origin fit well with this conclusion. He believes that limited immigration took place when the Oxie group spread to southern Scandinavia, but does not say anything about how the Volling group appeared. Considering Volling's likely area of origin toward the English Channel, no pre- or Early Neolithic contacts with EBK would have been possible. The only possible explanation for Volling's appearance is that the culture's bearers immigrated. They must have passed parts of the Continent that had already been neolithised, apparently without leaving archaeological traces. The Neolithic groups that migrated into Scandinavia would thus have come from both branches of the original wave that brought the Neolithic to Europe 9000 years ago.

The Oxie group probably brought shoe-last axes, many of which ended up as sacrifices in the bogs of the Danish Isles and Scania. 33 shoe-last axes of early types have been found in the EBK area, only 4 of them (12%) in modern Denmark and Scania. 59 late shoe-last axes, produced up until c. 4000 cal BC, are known from the EBK area. 26 of them (44%) have been found in modern Denmark and Scania. This marked change in the type's distribution could be due to most of the 26 axes having been brought by migrating farmers. The axes often show signs of wear and repair. They were thus probably not, as assumed by Klassen among others, imported before 4000 cal BC as prestige objects into EBK. They were most likely brought by migrating farmers as agricultural implements, regardless of the fact that they were neither necessary nor practical for this purpose on the stony light moraine soils of southern Scandinavia. The shoe-last axes are thus not evidence of intensive contacts with Continental farmers during the Late Mesolithic.

Bornholm and Gotland

The island of Bornholm, located in the Baltic Sea c. 40 km south-east of Scania, was landlocked southward in the Early Maglemosian and became populated from the Continent. Bornholm has many settlement sites from the interval 8300–6800 cal BC, but the finds dwindle swiftly over time, and Bornholm

Figure 2. Two pottery types of the EBK. Left, a pointed-base pot, c. 30 cm high, above, a lamp c. 25 cm long.

Figur 2. To fra ertebøllekulturen kendte keramikformer, til venstre en spidsbundet lerkrukke, ca. 25 cm høj, øverst en lampe ca. 25 cm lang.

Two Early Neolithic TRB pots. Left, an almost undecorated flat-based funnel beaker, characteristic of the Oxie sub-culture. Right, a small decorated round-based funnel beaker, from the Volling sub-culture. Volling has many pottery types for different purposes. Reproduced after Jeg ser på oldsager, Politikens Forlag 1979.

To lerkrukker fra tidlig TRB, til venstre et næsten udekoreret tragtbæger med flad bund, karakteristisk for Oxiekulturen, til højre et lille rundbundet, dekoreret tragtbæger fra Vollingkulturen. Fra denne eksisterer der mange typer af krukker, tilpasset forskelligt brug. (Gengivet efter Jeg ser på oldsager, Politikens Forlag 1979).

became isolated by the rising sea level during this period (F.O. Nielsen 1996). Then follow 2500 years without any finds. Big game populations declined during this period (Aaris-Sørensen 1998:127–128; Vang Petersen 2001). Apparently the island became depopulated. Animal species often become extinct when isolated in small areas, and the same may happen to people. Game was dwindling and the population may have been too small to change its subsistence strategy towards fishing and seal and porpoise hunting. They were

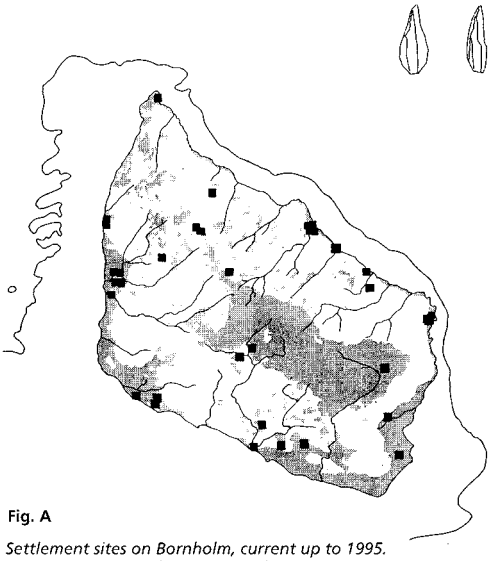


Fig. A

Settlement sites on Bornholm, current up to 1995.
Early Maglemosian (c. 8000 cal BC)

Bopladser fra ældre Maglemosekultur,
ca. 8.000 f.Kr. (1:500.000).
sandområder
Mikroliter (1:2), tilhørende fase 1 og 2.

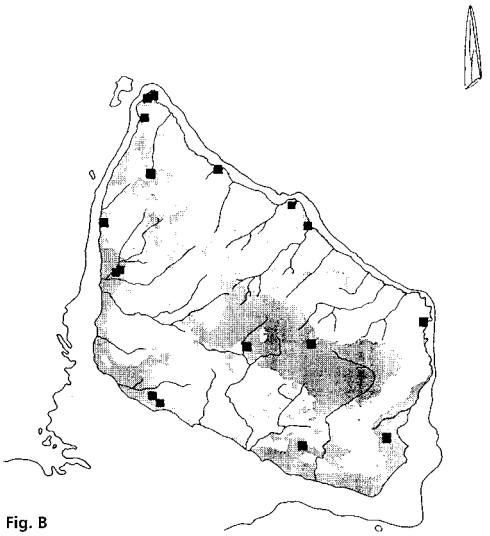


Fig. B

Settlement sites on Bornholm, current up to 1995.
Middle Maglemosian (c. 7500 cal BC)

Bopladser fra mellemste Maglemosekultur,
ca. 7.500 f.Kr. (1:500.000).
sandområder
Mikrolit (1:2), tilhørende fase 3.

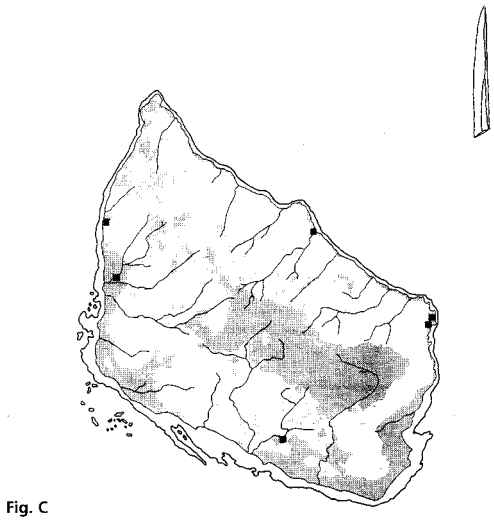


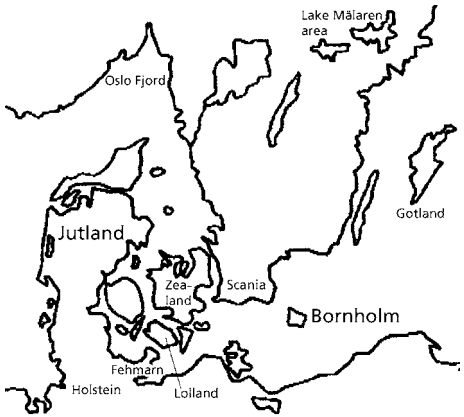
Fig. C

Settlement sites on Bornholm, current up to 1995.
Late Maglemosian (c.7000 cal BC)

Bopladser fra yngste Maglemosekultur,
ca. 7.000 f.Kr. (1:500.000).
sandområder
Mikrolit (1:2), tilhørende fase 4.

Three maps of settlement sites on Bornholm. There are no known settlement sites on Bornholm from 6800–4300 cal BC. Then the Ertebølle Culture reached the island. Reproduced after Forhistoriske interesser, Bornholms Amt 1996.

Tre kort over bopladser på Bornholm. Der er i de 2500 år fra 6800 f. Kr. indtil ertebøllekulturen nåede øen ca. 4300 f. Kr. ikke fundet bopladser på Bornholm. (Gengivet efter Forhistoriske interesser, Bornholms Amt 1996)



Southern Scandinavia

too few to develop their Maglemosian culture into something similar to the Kongemosian or EBK. EBK appears on Bornholm about 4300 cal BC. A number of coastal sites are known, and they show no sign of earlier occupation. This re-population seems to have taken place through migration from Scania. TRB reached the island c. 500 years later, without doubt from Scania as well, as shown by similar finds in the two areas.

If TRB developed locally on Bornholm through the impact of external influences, these contacts must have touched eastern Scania and not the southern shore of the Baltic. However, archaeology shows that Bornholm did not have close contacts with Scania during the Late Mesolithic. Bornholm's geology only offered small round flint nodules that only allowed the production of small objects such as arrowheads. Larger flint objects are extremely rare in Bornholm's EBK. If contact had been intensive, flint for e.g. axes would have been imported from Scania. Such an importation was not established until the Neolithic, when it delivered a considerable volume of flint, as seen by numerous finds of larger implements from this period.

During EBK's final phase on Bornholm, Neolithic cultures were newly established in Scania. Considering the clearly limited contacts, it appears that it would have been impossible for the fishers of Bornholm to acquire the knowledge necessary to switch economies on their own. Diffusion without migration is inconceivable, so Bornholm must have become neolithised through migration from Scania.

A corresponding argument can be made for Gotland, an island located c. 80 km from the Swedish mainland. It became populated c. 7500 cal BC, probably by people passing across the ice in wintertime. Northern Scandinavia was still partly covered by the inland ice at this time. People subsisted on fishing and seal and porpoise hunting, as the only larger land mammals on Gotland at the time were foxes and hares. A period of about 1000 years until c. 4300 cal BC shows no sign of habitation. Then fishers and gatherers reappeared, probably from mainland Sweden, apparently at about the same time as Bornholm was re-populated.

Bornholm and Gotland were neolithised by migration from mainland Sweden. It may be discussed if this tells us with certainty that migration played the same role in Denmark, Scania, the Lake Mälaren area and the Oslo Fiord. A model where Neolithic cultures spread by different mechanisms to different parts of the area should however in my opinion require support in the archaeological record, which is lacking.

How did Neolithic culture spread through Scandinavia?

As discussed above, datings from the time of the economic shift c. 4000 cal BC in southern Scandinavia suffer from various uncertainties. It appears fairly certain, however, that Neolithic culture took only c. 200 years to spread from Holstein through Denmark to Scania and Bornholm, and on to Lake Mälaren, Gotland and the Oslo Fiord. Large numbers of people passed straits and open sea with their livestock, seed corn and implements, and it appears unlikely that this could have been done with log dugouts, the only boats available at the time.

The rapid spread was apparently made possible by climate change that has been demonstrated for the period in question. Post-glacial warming since c. 13000 cal BC had not proceeded linearly. Temperature fluctuated until c. 9000 cal BC. Then mean July temperatures rose from c. 14°C to c. 19°C in the late 5th millennium cal BC (the final centuries of the EBK). This was 2–3° warmer than the mean temperature in Denmark during the past 40 years. Then, however, climate changed again. July temperatures fell slightly, and at the same time climate became more continental with colder winters (cf. Berglund 1991:69).

The melting of the inland ice and the subsequent rise of the land led to dramatic changes in the contact of the Baltic Sea with the Atlantic. This affected salinity. The Baltic was a fresh water lake (the Ancylus Lake) from c. 8400–6500 cal BC. Its drainage point into Kattegat varied. Then the modern straits of the Belts and Øresund formed, permit-

ting the entry of salt water into the Baltic basin. About 4000 cal BC, salinity was once again reduced in Kattegat and the Baltic due to rising land and lessening tidal effects. Together with the colder winters, this must have meant that straits and sea often froze over. Such was the case, for instance, in AD 1657–1658, which permitted King Carolus X of Sweden to invade Denmark on horseback. This happened during the "little ice age" from c. AD 1550–1700, a period with a mean temperature only 0.5° lower than current temperatures (Aaris-Sørensen 1998:202).
In this way, the migrating Neolithic farmers would have been able to pass the Belts and Øresund in the wintertime to reach the Isles and Scania, and then continue to Bornholm and along the icebound eastern coast of Sweden north to Lake Mälaren and Gotland, as well as along the western coast to the Oslo Fiord.
This also explains the varying communications between mainland Sweden and Bornholm and Gotland respectively. Only after the climate change did the islands have stable connections with the mainland. The re-population of the two islands c. 4300 cal BC may be connected with a short phase of lowered temperatures that allowed travel across the ice. Such a short cold spell occurred for instance during World War II.

How long did the spread of Neolithic culture take from Holstein to Lake Mälaren?

Many radiocarbon dates for Early Neolithic finds and contexts calibrate to 3950 or 3960 cal BC. This applies to Jutland, Zealand, Scania, the Lake Mälaren area and Norway (cf. e.g. Price 2000:271, 284, 287; Fischer 2002:346, 358). The explanation should probably be sought in the widespread use of the CALIB computer program from Seattle. CALIB often points out a single year as the calibrated date even when the probability distribution behind it is skewed. This also happens in cases where wiggles in the calibration curve produce (typically) three equally valid calibrated dates for one date bp. This is the case for datings from c. 3120–3020 bc where the range of possible calibrated dates for one uncalibrated date is typically 150 years. Many scholars have thus received the erroneous impression that neolithisation hit the southern part of Scandinavia explosively (cf. Hallgren 1996; Pettersson 1999; Price 2000:293). On the basis of calibrated radiocarbon dates, Fischer (2002:355–356) concluded that the year 3950 cal BC marks both the abrupt end of the EBK and the instant onslaught of the TRB. This view appears weakly founded.

The idea that the Neolithic appeared all over southern Scandinavia at the same time has led many scholars astray. Hallgren (1996:18) inferred that there could not have been any immigration. Immigration would according to his view have taken longer as the area involved is so large. Other Swedish archaeologists have also apparently been influenced by the seemingly rapid spread of neolithisation across Scandinavia.
One example is Kihlstedt (1997:122) who did not however entirely rule out migration as an explanation of the spread from Scania to lake Mälaren. It is not apparent, however, that other suggested explanations for a spread that is erroneously seen as instant are any better: e.g. frequent trade contacts in the 5th millennium (the availability model) or cultural community and exchange of spouses. These mechanisms would also have required time.

Malmer (2002:176) has pointed out that, if there were a consensus that the spread of a certain culture or economy took place from a certain direction – in this case, from the south – then we might choose among the probability maxima along a wiggle in an OxCal graph, taking the geographic location of the site under study into consideration. If Malmer's idea is accepted, one would choose the earliest intersection with the calibration curve of an uncalibrated date for the neolithisation of Denmark (and possibly Scania). Later intersection points would be more likely for datings of TRB's arrival around Lake Mälaren or the Oslo Fiord. This would allow TRB c. 200 years to travel from Holstein to Lake Mälaren and the Oslo Fiord.

What was the scale of the immigration?

In recent years a number of archaeologists have conceded that a certain amount of immigration into Scandinavia may have taken place in the Early Neolithic. They have, however, insisted that this happened only on a small scale (Price 2000:293; Fischer 2002:381; Malmer 2002:178; Klassen 2004:338), although no arguments for the small scale of immigration have been put forward.

This discussion is difficult without a shared definition of how large a small scale is. The fact that TRB spread across a very large area in a rather short time indicates that the immigrants were fairly numerous. It should also be taken into account that there seems to have been an abrupt shift from EBK to TRB at most coastal Danish sites. Occupation of some Danish EBK sites even ends entirely around the time of the appearance of TRB's Oxie sub-culture. Immigration thus seems to have been so considerable already at this early date that it did not confine itself to the inland, where farmers could have established themselves without any great friction with the original Mesolithic population. It apparently put the coast dwellers under considerable pressure.

Therefore it seems likely that immigrants to Denmark – even disregarding the later immigration connected to the spread of the Volling sub-culture – outnumbered the local Mesolithic population. Immigration to Sweden, where neolithisation appears to have been more gradual, may have been less massive than in Denmark, seen in relation to the local Mesolithic population numbers.

Translated from Danish by
Martin Rundkvist, PhD.

Niels V. Skak-Nielsen,
Gentoftegade 2.tv.,
DK-2820 Gentofte
ns-n@wanadoo.dk

Bibliography

Andersen, S. H. 1988: Mesolithic dug-outs and paddles from Tybrind Vig, Denmark. *Acta Archaeologica* 57, 1986, København.

– 1991: Norsminde. A Køkkenmødding with Late Mesolithic and Early Neolithic Occupation. *Journal of Danish Archaeology* 8, 1989.

– 1993a: Bjørnsholm. A Stratified Køkkenmødding on the Central Limfjord, North Jutland. *Journal of Danish Archaeology* 10, 1991. pp. 59-96.

– 1993b: Kystens Bopladser. I: S. Hvass og B. Storgaard (red.): *Da klinger i muld… 25 års arkæologi i Danmark*, 1993. pp. 65-68.

– 1998: Ringkloster. Ertebølle trappers and wild boar hunters in early eastern Jutland. *Journal of Danish Archaeology* 12, 1994–95. pp. 13-59.

– 2000: Fisker og bonde ved Visborg. I S. Hvass og det arkæologiske Nævn (red.) *Vor skjulte kulturarv*. pp. 42-43.

Andersen S.H. & Storgård, B. (red.) 1987: Ertebølle revisited. *Journal of Danish Archaeology* 5, 1986. pp. 31-61.

Bellwood, P. S. 2004: *First Farmers. The origin of agricultural societies*. Blackwell publishing.

Berglund, B.E. (ed.). 1991. The cultural landscape during 6000 years in Southern Sweden. The Ystad project. *Ecological Bulletin* 41. Copenhagen.

Fischer, A. 1982: Trade in Danubian Shaft-Hole Axes and the Introduction of Neolithic Economy in Denmark. *Journal of Danish Archaeology* 1, 1982, pp. 7-12.

– 2002 "Food for feasting" in Fischer and Kristiansen, (ed.) 2002. *The neolithisation of Denmark, 150 years of debate*. Sheffield.

Fischer, A. & Kristiansen, K. (ed.) 2002. *The neolithisation of Denmark, 150 years of debate.* Sheffield.

Hallgren, F. 1996, Sociale territorier och exogamirelationer i senmesolitisk tid, etc. *Tor* 28: 3-27

Hartz, S. et al. 2002. Coastal Farmers - the neolithisation of northernmost Germany. In Fischer and Kristiansen (ed) 2002. *The neolithisation of Denmark, 150 years of debate*. Sheffield.

Hesjedal, A. et al. 1996. Arkæologi på Slettnes. Dokumentasjon av 11.000 års bosetning. *Tromsø museums skrifter* 26. Tromsø.

Hvass, S. & Storgård, B (red.) 1993. *Da klinger i muld ... 25 års arkæologi i Danmark*. Det kgl.

nordiske oldskriftsselskab & Jysk arkæologisk selskab. København.
Hvass, S. & det arkæologiske Nævn (red.) 2000. *Vor skjulte kulturarv*. København.
Jennbert, K. 1984: Den produktiva gåvan. Tradition och innovation i Sydskandinavien för omkring 5 300 år sedan. *Acta Archaeologica*. Lundensia, no. 16, Lund.
Jensen, J. 2001: *Danmarks stenalder*, Gyldendal. Copenhagen.
Karsten, P. 1994: Att kasta yxan i sjön. *Acta Archaeologica*. Lundensia, no. 23, Lund.
Kihlstedt, B. et al. 1997: Östra Mellansverige + Neolitiseringen som et socialt fenomen. I Larsson, M. & Olsson, E. (ed.) *Regionalt och Interregionalt*. Stockholm.
Klassen, L. 1999: The debate on the Mesolithic-Neolithic transition in the western Baltic: a central European perspective. *Journal of Danish Archaeology* 13, 1996-97.
– 2002. The Ertebølle Culture and Neolithic continental Europe. In: Fischer & Kristiansen (eds). The neolithisation of Denmark, 150 years of debate. Sheffield.
– 2004. Jade und Kupfer. *Jutland Archaeological Society*, vol 47, Århus.
Kristiansen, K. 1988: Det danske landbrugs historie. Oldtid til 500 f.Kr. I C. Bjørn (red.). *Det danske landbrugs historie. Bind 1*, Odense.
Koch, E. 1998: *Neolithic Bog Pots from Zealand, Møn, Lolland-Falster*. København.
Larsson, M. 1987: Neolithization in Scania – A Funnel Beaker Perspective. J*ournal of Danish Archaeology* 5, 1986. pp. 244-247
Larsson, M. & Olsson, E. (red.) 1997 *Regionalt och Interregionalt. Stenaldersundersökningar i Syd- och Mellansverige*. Riksantikvarieämbetet: Skrifter nr. 23. Stockholm
Lindqvist, Ch. 1994. Fångstfolkets bilder. En studie av de nordfennoskandiska kustanknutna jägarhällristningarna. Theses and papers in archaeology. *New series A5*. University of Stockholm.
Lindqvist, Ch. & Possnert, G. 1999. The First Seal Hunter Families on Gotland. *Current Swedish Archaeology* 7. Stockholm.
Madsen, T. 1987: Where did all the hunters go? - an Assessment of an Epoch-Making Episode in Danish Prehistory. *Journal of Danish Archaeology* 5, 1986. pp. 229-239.
– 1993: Høje med træbyggede grave. I: S. Hvass & B. Storgaard (red.): *Da klinger i muld… 25 års arkæologi i Danmark* pp. 96-99.
Malmer, M. P. 2002. *The Neolithic of South Sweden*. KVHAA. Stockholm.
Midgley, M.S. 1992: *TRB Culture. The First Farmers of the North European Plain*. Edinburgh.
Nielsen, F. O. 1988: Bornholms bebyggelse i yngre stenalder. *Fra Bornholms Museum* 1987-88. Rønne.
– 1996: *Forhistoriske interesser*. Bornholms Amt. Rønne.
Nielsen, P. O. 1987: The Beginning of the Neolithic - Assimilation or Complex Change? *Journal of Danish Archaeology* 5, 1986. pp. 240-243.
Persson, P. 1999: *Neolitikums början*. Göteborg.
Petersson, H. 1999: Where did all the farmers come from? *Journal of Danish Archaeology* 13.
Price, T. D. (ed.). 2000. *Europe's First Farmers*. Cambridge.
Price, T. D. et al. 2001. Prehistoric human migration in the Linearbandkeramik of Central Europe. *Antiquity* vol. 75, nr. 289.
Renfrew, Colin 1987: *Archaeology and Language. The problem of Indo-European Origins*. London.
Rowley Conwy, P. & Zvelebil, M. 1986. Foragers and farmers in Atlantic Europe. In: M. Zvelebil (ed.), *Hunters in transition*, pp. 67-93. Cambridge University Press.
Skak-Nielsen, N.V. 2003. Hvordan kom bondebruget til Sydskandinavien? + Addendum hertil. *Fornvännen* 98 (2003:1 & 2).
– 2004. Hvordan kom bondestenalderen til Danmark? *Fortid og Nutid* 2004:1. København.
Stafford, M. 1999. *From forager to Farmers in Flint*. Aarhus.
Tilley, C. 1996 *An ethnography of the Neolithic*. Cambridge.
Vang Petersen, P. 2001. Grisby – en fangstboplads fra ertebølletid på Bornholm. I Lass Jensen, O. (ed.). *Danmarks Jægerstenalder. Status og Perspektiver*. Hørsholm Egns Museum.
Aaris-Sørensen, K. 1998. *Danmarks forhistoriske dyreverden*. Gyldendal. Copenhagen.