



Step by step – The neolithisation of Northern Central Europe in the light of stable isotope analyses

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ABSTRACT

There is a long lasting debate on the nature of the neolithisation process in the northern European lowlands and in southern Scandinavia. Early evidence of domesticates and crop cultivation indicate a transition to farming in this area during the late 5th millennium cal BC. However, there is limited information how this process took place and to what extent the new economy was adopted during the subsequent centuries. Here we present new results of more than 50 stable isotope samples of human remains (¹³C/¹⁵N) from northern Central Europe covering the period from the Mesolithic to the early Bronze Age. They show a high relevance of aquatic resources during the early Mesolithic. Food from marine and fresh water environments was also of considerable relevance during the late Mesolithic (6th/5th millennium cal BC). Aquatic resources were still important for parts of farming societies during the 4th millennium cal BC, especially around 3000 cal BC. Farming economy was introduced in all parts of the lowlands during the early 4th millennium cal BC, but it was not before the 3rd millennium cal BC that it became fully established on a general scale. Our results correspond well with archaeobotanic evidence. They also contribute important information to the discussion of palaeogenetic data, which provide evidence for autochthonous individuals with signals of hunter-gatherer ancestry in farming societies until c. 3000 cal BC.

1. Introduction

The transition from hunter-fisher-gatherer groups with a foraging lifestyle to farming communities during the early Holocene was a process of fundamental impact on prehistoric societies. In European archaeology, a discussion has been ongoing for decades whether this transition was just triggered by mobility and migration of early Neolithic farmers from their homelands in the Near East and South-East Europe (demic diffusion), or whether local Mesolithic hunter-gatherers also adopted the Neolithic innovations through cultural contacts and were thus themselves significantly involved in the introduction of the new economy (cultural diffusion), and perhaps even participated in autochthonous domestication processes.

In the 1990s, archaeologists were discussing a possible contribution of late foraging communities in the neolithisation process during the Atlantic and later periods (late Mesolithic, c. 7000-4000 cal BC). The cultural competence of complex hunter-gatherers was re-assessed, and possible continuities in the material culture between late Mesolithic

and the incipient Linear Band Pottery culture were pointed out (Tillmann, 1993; Kind, 1998). This was also discussed for the transformations from Mesolithic to Neolithic in North Central Europe (e.g. Hoika, 1993). Long-distance contact networks of the late Mesolithic groups were suggested to have played an important role in the adoption of the “Neolithic package” (Gronenborn, 1997). Subsequently, a neolithisation scenario with Linear Band Pottery culture “missionaries” interacting with late Mesolithic locals was suggested (Lüning, 2006). This scenario was seemingly supported by botanical evidence of (possible) crop cultivation centuries before the Linear Band Pottery culture started (see e.g. Haas, 1996; Tinner et al., 2007); an assumption that has been vehemently criticized (Behre, 2007) and today is still under discussion.

Further contributions to the interactive model came from the regions west of the early farmers: sites with La Hoguette pottery discovered since the 1980s were seen as the legacy of nomadic herders with western affiliations that had adopted pottery production independent of the Linear Band Pottery culture and were raising sheep as

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Fig. 1. Sites from which samples for AMS dating and isotopic analysis were taken for the research presented here (map: H. Piezonka). (For interpretation of the references to colour in this figure legend, the reader is referred to the online version of this article.)

first domesticates (e.g. Lüning, 2000: 5, 105; Crombé, 2010). However, the interpretation of La Hogue pottery as Mesolithic ceramics has also been criticised (Constantin et al., 2010) and the interactive model was rejected by scholars (e.g. Verhart, 2000).

The last years saw considerable progress in this discussion, and based on results of palaeogenetic (aDNA) studies there is now increasing consensus that the new economy was introduced in Central Europe by partly mobile farmers of Linear Band Pottery societies in the middle of the 6th millennium cal BC (Bramanti et al., 2009; Haak et al., 2010; Mathieson et al., 2015; Hofmanová et al., 2016). Signals of hunter-gatherer admixture into early farming societies appear already during the early Neolithic in southeastern Europe but tend to be low (Gamba et al., 2014; Hofmanová et al., 2016).

However, the situation is different in the northern lowlands: For more than a millennium, the advance of the Neolithic way of life halted at the northern margin of the fertile (loess) zone (Hoika, 1993). The southern margin of the Lowlands and the lower courses of the rivers Elbe, Oder and Vistula must have been not only an environmental and socio-cultural demarcation line in the late 6th and 5th millennia cal BC, but also a frontier between different communities and societies. From a structural point of view this historical situation is comparable to other boundaries within the European neolithisation process, where also very similarly the “neolithisation” was halted for many centuries (cf. Guilaine, 2007; Müller, 2015).

In contrast to the manifold interrelations between the “North” and the “South” in respect to domesticated animals, and different items of material culture (pigs: Krause-Kyora et al., 2013; material culture: Klassen, 2004; Klimscha, 2016), it was not before the late 5th millennium cal BC that the farming economy started to spread into northern Germany, Pomerania in Poland and southern Scandinavia (e.g. Terberger, 2006; Müller, 2011; Czekaj-Zastawny et al., 2013; Sørensen, 2014). But what was the nature of this transition?

2. Models of neolithisation of the Northern European lowlands

Concerning the nature of the transition, competitive models are up until now under debate. According to M. Zvebil (1998) the process of neolithisation of the lowlands, the Baltic region and southern Scandinavia can be subdivided into an availability phase, when late hunter-gatherers got into contact with Linear Band Pottery farmers (c. 5300 to

4200 cal BC), an adaptation phase, when first farming elements were integrated into the way of life (c. 4200 to 3500 cal BC), and a consolidation phase, when farming was intensified. It is a matter of debate whether or to what extent these new elements were introduced into the North by colonizing horticulturalists of early Funnel Beaker societies or Michelsberg communities from the south, or whether a process of local and regional adaptations within supra-regional network structures took place. More recently it was proposed that the Dragsholm man - buried in a kitchen midden in the early 4th millennium cal BC and equipped with a funnel beaker and weapons - might have been an early Funnel Beaker traveller bringing Neolithic innovations to Zealand (Price et al., 2007; Sørensen and Karg, 2014).

Altogether, the indigenous hunter-fisher population is expected to have been largely responsible for the transition towards a farming economy in this region. There are clear indications for a very limited role of domesticated animals and crop cultivation in the early phase of the Funnel Beaker societies, and this is seen in favour of a transitional, gradual adoption of farming by local native communities (cp. Hoika, 1993; Sørensen, 2014). At the same time early Neolithic coastal sites with their persisting importance of fishing and traditional elements of the material culture such as oval clay lamps indicate cultural continuity in the early 4th millennium cal BC (e.g. Hartz et al., 2007b; Grohmann, 2010; Czekaj-Zastawny et al., 2014). In principle the terminal Mesolithic and the early Neolithic can be seen as one phase lasting from 4300 to 3800 cal BC (Müller, 2013).

Nevertheless, stable isotope studies on human remains from southern Scandinavia have revealed a marked difference between the coastal Mesolithic/Neolithic and Neolithic populations, the latter mostly found in graves located in the inland (Fischer et al., 2007; Sjögren, 2017). Here we present the results of systematic $^{13}\text{C}/^{15}\text{N}$ isotope analyses of human remains from northern Germany and neighbouring regions, which shed new light on changes in subsistence economy against the background of social and cultural developments and absolute chronology in Northern Central Europe.

3. Materials and methods

3.1. The sampled sites

Within the project “Population genetics of late hunter-gatherer-

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