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NEOLITHIC TRANSITION IN EUROPE: THE CHALLENGE FOR BIOARCHAEOLOGY

ABSTRACT: The adoption of farming practices is one of the major transformation processes in the human history. The knowledge of the transition from hunting and gathering to farming has increased considerably with contributions from a wide variety of natural sciences. As a result, the study of farming spread and its consequences in Europe has shifted from the domain of archaeology to the domain of bioarchaeology. This Special Issue of the journal Anthropologie *entitled* Bioarchaeology of European Neolithic Populations *documented the diversity of bioarchaeological approaches to the study of Neolithic transition. A total number of ten contributions is divided into two volumes (Issue 1 and 2). Articles concerned with a variety of topics and methods including mobility and diet reconstruction in Neolithic via stable isotope analyses and analyses of external auditory exostoses; an osteobiographic analysis of one individual using osteological, chemical, and genetic techniques; health transition based on the analysis of skeletal stress indicators; phenotypic and genetic variability on intracemetery and interregional level via biodistance analysis; analysis of funerary practices and social organisation based on osteological analysis of skeletal remains; and techno- and typological comparison of personal ornaments used in Late Mesolithic and Early Neolithic communities. We argue that the bioarchaeological approach presented in contributions of this Special Issue provide important insights into the transition from foraging to farming and provide independent evidence to the mechanism of transition on biological and social levels.*

KEY WORDS: Bioarchaeology – Neolithic transition – Europe – Farmers – Hunter-gatherers – Interdisciplinary research

INTRODUCTION

The adoption of farming practices is one of the major transformation processes in human history and it is not surprising that the beginning of Neolithic agriculture continues to be a major topic of current research into prehistory in Europe (Larsen 2011). Although the agriculture originated in at least seven independent centres around the world, its spread from Near East into Europe is best documented (Richerson *et al.* 2001). Since the introduction of the concept of Neolithic revolution by Vere Gordon Childe in 1920s, the knowledge of the

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transition from hunting and gathering to farming has increased considerably with contributions from a wide variety of natural and social science disciplines. The high popularity of Neolithic research is also documented by the fact that search for "Neolithic" performed in Google Scholar (January 2014) returns 199,000 results.

During the long history of Neolithic research, authors have repeatedly addressed the fundamental question of why and how agriculture emerged as the dominant economic system in most world regions (Larsen 2011: ix). Or, from the view of bioarchaeological studies: Why relatively tall and healthy Palaeolithic hunters-gatherers gradually changed into Neolithic farmers who suffered from infectious diseases which shortened their stature (Cohen, Armelagos 1984, Crubézy *et al.* 2002)?

After the decades of research, there is still matter of intense debate, whether Neolithic transition was largely based on either cultural or population change (Gronenborn 2007). Although the original concepts of colonisation (Childe 1925), demic diffusion (Ammerman, Cavalli-Sforza 1984), and cultural diffusion (Dennel 1983) represent a simplistic interpretation of a regionally variable process, it is still useful in defining the range of possible explanations.

Several general findings might be drawn about Neolithic transition in Europe based on the research of past two decades. (1) *Incoming farmers coexisted and admixed with local foragers.* The majority of scholars concerned with the Neolithic transition in Europe have shifted away from binary dichotomy "cultural vs. demic" and have inclined towards the view that adoption of farming practices in Europe involved both processes and have accepted that both incoming farmers from the Near East and local Mesolithic hunter-gatherers were actively involved in the transition in Europe (e.g. Gronenborn 2007, Robb, Miracle 2007, Zvelebil, Pettitt 2013). (2) *Neolithic transition in Europe was a regionally diverse process.* The spread of agriculture was not as homogenous a process as it was originally interpreted. By contrast, it involved a variety of mechanisms that were shaped by regional conditions. On the one hand, local Mesolithic groups played a significant role in the spread of agriculture throughout much of Northern Europe (Rowley-Conwy 2004, Zvelebil 2006), the Atlantic fringe of France (Mazurié de Keroualin 2003) and Central Iberia (Zilhão 2000). On the other hand, the Eastern Mediterranean (Biagi 2003) and South-Eastern Europe (Tringham 2000) are regions that probably experienced farmer migration (for summary, see Robb, Miracle 2007, Zvelebil 2000). (3) *The study of Neolithic transition has developed into a truly interdisciplinary research.* The interpretation of the spread of farming in Europe has shifted from the domain of archaeology to the domain of bioarchaeology, i.e. the interpretative framework that in the study of past societies integrates cultural and biological data (Buikstra, Beck 2006). In addition to archaeological publications, the results of the study of Neolithic transition were regularly published and discussed in journals such as Current Anthropology, Journal of Archaeological Science, Human Biology, PLoS One, PLoS Biology, American Journal of Physical Anthropology, Physical Review to name only few. The bioarchaeological nature of Neolithic studies was demonstrated in books and special issues of journals, which further documented the interdisciplinary approach between archaeology and biological anthropology, genetics, zooarchaeology, isotopic studies, demography, physics, etc. (e.g. Bickle, Whittle 2013, Bocquet-Appel, Bar-Yosef 2008, Pinhasi, Stock 2011, Steele, Shennan 2009, Whittle, Cummings 2007, Zvelebil, Pettitt 2008).

BIOARCHAEOLOGICAL APPROACH TO NEOLITHIC TRANSITION

The area which has probably recently garnered the most attention in bioarchaeological studies of Neolithic transition is palaeogenetics. The analyses of ancient DNA (aDNA) allowed the comparison of the genetic composition of populations directly involved in Neolithic transition, i.e. Mesolithic foragers and early Neolithic farmers. The first Neolithic aDNA study concerned with mtDNA of farming groups of Central Europe (Haak *et al.* 2005). Authors observed that the first farmers in Central Europe had limited success in leaving a genetic mark in modern Europeans (Haak *et al.* 2005: 1017) and proposed a Palaeolithic ancestry for modern Europeans. Later aDNA studies revealed substantial genetic discontinuities between indigenous hunter-gatherers and early farmers of Central Europe (Bramanti *et al.* 2009, Brandt *et al.* 2013, Haak *et al.* 2010). The authors interpreted these observations as evidence that the first Central European farmers were not descendants of local foragers and that Neolithic transition in Central Europe were accompanied by large genetic influx from the Near East, Anatolia, and the Caucasus (Brandt *et al.* 2013). Further, the aDNA studies (Bramanti *et al.* 2009) also documented significant differences in genetic composition between modern Europeans and both early farmers and hunter-gatherers. These pattern of discontinuity led authors to assume that varying admixture proportions between incoming farmers and

local hunter-gatherers had an important impact upon the modern European gene pool, i.e. the demographic processes that reshaped European genetic variation after the Neolithic transition (Pinhasi *et al.* 2012).

Cultural and genetic connections of the earliest farmers and Near Eastern populations were not observed only in Central Europe but also in other regions of Europe. Gamba *et al.* (2012) suggested that similarities between early Neolithic population from northeastern Iberia and Near East is compatible with a model of pioneer colonisation along the Mediterranean coast. Genomic DNA studies conducted on a small historical sample from Scandinavia suggested that the first Scandinavian farmers were genetically similar to extant southern Europeans and distinct from local hunter-gatherers (Skoglund *et al.* 2012). This view is consistent with ancient mtDNA data according to which the first farmers from Scandinavia were of Central European origin and interacted with local hunter-gatherers who finally adopted farming (Brandt *et al.* 2013).

In addition to recent palaeogenetic studies, a large body of genetic literature analysed the DNA of extant European populations with the aim of describing population changes during the transition to agriculture. Authors of these studies observed frequency clines from southeastern to northwestern Europe for classical genetic markers (Ammerman, Cavalli-Sforza 1984), autosomal DNA markers (Belle *et al.* 2006), or Y-chromosomal markers (Semino *et al.* 2000) that have been interpreted as a support for the demic diffusion model. Recent study by Balaresque *et al.* (2010) confirmed the existence of a southeastern-northwestern cline of Y-chromosomal haplogroups and asserted that most European Y chromosomes originate in the Neolithic expansion.

Earlier studies of mtDNA of recent European populations showed limited geographic patterning (Simoni *et al.* 2000, Torroni *et al.* 2001), which made the interpretation of the mtDNA results less obvious than in Y chromosome. Fu *et al.* (2012), however, recently documented changes in the frequency of mtDNA haplogroups which corresponds to a population expansion at the onset of the Neolithic. Based on their data, they suggested that the spread of farming in Europe involved the expansion of farming populations into Europe that might be followed by the admixture with local foragers (compare however with Brotherton *et al.* 2013 who argued that changes in mtDNA haplogroups studied by Fu *et al.* are more Middle Neolithic than Early Neolithic age).

Rasteiro and Chikhi (2013) analysed both mtDNA and Y-chromosome data and favoured a demic diffusion process with an origin in the Near East that was accompanied by the admixture with local foragers (see also Soares *et al.* 2010). The authors emphasised that mtDNA and Y-chromosome data provide evidence for different demographic histories of females and males during the adoption of agriculture in Europe. The difference in the results of mtDNA and Y-chromosome data seems to indicate that spreading farmers were mainly males while females might be rather of local ancestry (Pinhasi *et al.* 2012).

Before the advent of molecular genetics, population history during the Neolithic transition has been extensively studied using biodistance analyses of anthropometric data that serve a proxy for the genetic relationships (Pinhasi, von Cramon-Taubadel 2012). While earlier anthropometric studies largely relied on univariate comparisons of groups, recent attempts focused on multivariate statistical analyses that allow the highlighting of more complex affinities between populations. Brace *et al.* (2006) compared the craniofacial form of European Neolithic and recent populations. Based on significant differences between both populations, they supported the demic diffusion model, i.e. the interbreeding of the incoming Neolithic people with the local foragers derived from the Late Pleistocene inhabitants of Europe. The demic diffusion model was favoured also by other craniometric analyses (Pinhasi, Pluciennik 2004, Pinhasi, von Cramon-Taubadel 2009, von Cramon-Taubadel, Pinhasi 2011). Their results provide the evidence for the active dispersal of people from Near East to Europe during Neolithic accompanied with some gene flow. Pinhasi and von Cramon-Taubadel (2009) argued, however, that their data does not support strong admixture level between Neolithic and Mesolithic populations. Craniometric data also suggest that the demographic transition in Europe was probably not uniform and represents a mosaic of population replacement, admixture and adoption of farming practices by indigenous populations (von Cramon-Taubadel, Pinhasi 2011, von Cramon-Taubadel *et al.* 2013).

In recent years, human mobility during the Neolithic transition in Europe has been extensively approached from perspective of geochemical studies. Boric and Price (2013) analysed strontium isotope data from the key region in Southeastern Europe, the Danube Gorges. They documented several waves of non-local individuals into the region and argued for intense interaction and coexistence between indigenous groups and early farmers before the foragers were absorbed by farming communities in later centuries. Richards *et al.* (2008) brought evidence of foragers-farmers admixture based on isotopic results from the Vedrovice site in Central

Europe, another important region for the understanding of early Neolithic spread. Richards *et al.* (2008) compared sulphur and strontium isotopic values of individuals from the Vedrovice cemetery and found that most individuals (~90%) spent the majority of their life at or near the site but they were also able to identify a few individuals who lived elsewhere as children or adults (Richards *et al.* 2008) (see also Smrčka *et al.* 2008). Based on these results, Zvelebil and Pettitt (2008, 2013) proposed that Vedrovice was founded by a small community of incomers, who probably originated in western Hungary, and soon after the foundation, the new Neolithic community was supplemented by hunter-gatherers from adjacent and distant regions. A similar pattern was observed by Bentley *et al.* (Bentley 2007, Bentley *et al.* 2002, 2004) in early Neolithic skeletons from southern Germany. Authors revealed a substantial proportion of non-local individuals (mainly females) within those buried at LBK cemeteries in the region and argued that immigrants moved to Neolithic villages from surroundings uplands that were likely inhabited by Mesolithic hunter-gatherers. Analyses of strontium isotopes indicated a high degree of human mobility during the early Neolithic also in Hessen in Germany (Nehlich *et al.* 2009) where the vast majority of analysed individuals were labelled as non-locals or immigrants with possible origin in western Hungary, the Czech Republic, or Austria. In addition to the determination of individuals with local and non-local origin, Bentley *et al.* (2012) summarised the strontium isotope data for a large sample of more than 300 early Neolithic skeletons and showed that the variance of $^{87}Sr/^{86}Sr$ is significantly larger among females than males. They interpreted it as the signal of patrilocal kinship system in early Neolithic communities of Central Europe.

Another approach to the study of population movement during the Neolithic transition in Europe have stemmed from demographic modelling. The majority of models have been based on the reaction-diffusion equation (Ammerman, Cavalli-Sforza 1973), which is believed to be a mathematic expression of the demic diffusion model. The authors applied various generalisations of the basic model to the prediction of the speed of the Neolithic front in Europe and checked the validity of models by comparisons with the speed estimated from archeological and radiocarbon data (Ackland *et al.* 2007, Davison *et al.* 2006, Fort *et al.* 2004, Isern, Fort 2010, Isern *et al.* 2008, 2012, Pinhasi *et al.* 2005). These models, however, describe the spread of Neolithic populations at continental level, although it is well accepted that Neolithic transition was highly diverse among the regions of Europe (Bentley *et al.* 2009). In contrast with large-scale approximations mentioned above, several authors (Galeta, Bruzek 2009, Galeta *et al.* 2011, Petrasch 2001) dealt with the demographic modelling on a regional scale. For example, Galeta *et al.* (2011) modelled the spread of the Neolithic in Central Europe. Specifically, they tested whether the fertility rates of Neolithic farmers were high enough to allow them to colonise Central Europe without admixture with local foragers. On the basis of their model, they concluded, that colonisation is highly unlikely and that Mesolithic foragers significantly contributed to the establishment of earliest farming communities in the region.

There is a number of other disciplines that work within a bioarchaeological framework and bring independent lines of evidence of Neolithic transition in Europe, e.g. palaeopathology (Eshed *et al.* 2010, Lillie 2008, Nicklisch *et al.* 2012, Wittwer-Backofen, Tomo 2008), palaeodiet studies based on isotopic analyses (Dürrwächter *et al.* 2006, Nehlich *et al.* 2009, Oelze *et al.* 2011, Richards *et al.* 2008) or on dental microwear (Horwath *et al.* 2014, Jarošová 2008, Nystrom 2008), zooarchaeology (Kovačiková *et al.* 2012, Salque *et al.* 2012), archaeobotany (Bogaard 2004, Bogaard *et al.* 2013, Bogaard, Jones 2007, Saqalli *et al.* 2014, Vaiglova *et al.* 2014), or palaeoecology (Banks *et al.* 2013, Innes *et al.* 2013).

BIOARCHAEOLOGY OF EUROPEAN NEOLITHIC POPULATIONS ISSUE THEMES

Although the past decades are characteristic by an intense effort to explain the mechanism of the spread of farming practises in Europe, many unanswered questions still remain. Moreover, as the Neolithic transition is now viewed as a regionally diverse process, we need further data from particular regions for better understanding of this process. The aim of this Special Issue of the journal *Anthropologie* is to share current findings concerned with the Neolithic life at the level of various European regions. We would like to bring together bioarchaeological studies that will broaden the regional record and strengthen our knowledge about the life of Neolithic populations (cf. Lukes *et al.* 2008; Special Issue of the journal *Anthropologie* that summarises the results of the *Vedrovice Bioarchaeological Project*, co-edited by Marek Zvelebil and Alena Lukes).

The *Bioarchaeology of European Neolithic Populations* Issue was open to any contribution on the subject, we

appreciated, however, that a high number of authors are post-doctoral researchers. We believe that research conducted by post-docs is a source of innovative ideas and approaches with high potential for the future. The Special Issue finally consists of 10 contributions; seven articles are in English and three articles are in French (with English abstracts). Given the total extent of contributions, the Special Issue is divided to two parts (Issue 1 and 2 of Volume 52). In the following text, we briefly summarise the individual contributions to the Special Issue.

Diet and mobility

Olaf Nehlich and his team present results of sulphur, carbon, and nitrogen stable isotopes study of 120 humans and 33 animals from eight sites dated from Neolithic to Iron Age from Central Germany. Their paper called *Sulphur isotope ratios of multi-period archaeological skeletal remains from central Germany: a dietary and mobility study* shows the high potential of sulphur isotope ratio analyses in bioarchaeological studies, which is still less common compared to carbon and nitrogen ratios analyses. They emphasise that their study provides the largest regional multi-site dataset of archaeological sulphur isotope ratios that has been published to date. In the methodological background, Nehlich *et al.* explained that the only amino acid of human collagen containing sulphur is methionine, which, although it is an essential amino acid, cannot be synthesised by human or animal body and must be taken in food. Because only plants are able to incorporate inorganic sulphur from the soil and groundwater into their tissues, the human and animal bone collagen sulphur isotope ratios reflect the average bioavailable sulphur isotope composition of the biome from which the humans or animals obtained their food. It means that the analysis of sulphur isotope ratios is useful in detecting the source location of the food consumed, i.e. in detecting the "local" and "non-local" individuals at the site. An important part of the Nehlich *et al.* study is also providing a regional baseline for sulphur isotope ratios, which can be used in the future mobility reconstruction studies. In their dataset, Nehlich *et al.* detected only three non-local individuals and argued that human groups they studied likely represent a stable sedentary population with few incomers from other regions.

Penny Bickle and her team present another bioarchaeological study that is based mainly on the evidence of isotopic data. In their paper called *Early Neolithic lifeways in Moravia and Western Slovakia: comparing archaeological, osteological and isotopic data from cemetery and settlement burials of the Linearbandkeramik (LBK)* they analyse carbon, nitrogen, and strontium isotopes in a large sample of individuals from several Moravian and western Slovakian Early Neolithic sites. Their study is a part of large project called *The First Farmers of Central Europe: Diversity in LBK Lifeways*, which follows up an earlier *Vedrovice Bioarchaeology Project* led by Marek Zvelebil, which was presented in this Journal in 2008 (Zvelebil, Pettitt 2008). Bickle *et al.* combine in their study isotope data from the earlier project with newly acquired data from individuals buried at Vedrovice, Nitra, Těšetice-Kyjovice and Brno (Starý and Nový Lískovec). Probably the most important results of the Bickle *et al.* study is the evidence of reduced mobility over the duration of LBK (higher mobility in older site at Vedrovice and lower mobility in later LBK site at Nitra) and the detection of differences in diet and mobility between LBK males and females. Bickle *et al.* interpret the higher mobility of females as a evidence of patrilocality in the Early Neolithic of Central Europe, which might be viewed as one of the mechanism of LBK spread during the Neolithic transition.

The paper by Sébastien Villotte, Sofija Stefanović, and Christopher J. Knüsel entitled *External auditory exostoses and aquatic activities during the Mesolithic and the Neolithic in Europe: results from a large prehistoric sample* presents external auditory exostosis as a bioarchaeological marker of water related activities. Whereas the majority of studies used stable nitrogen and carbon isotope data to detect the dietary shift during the Neolithic transition, Villote *et al.* bring independent evidence to this debate. They analyse a huge sample of 449 adults from Portugal, France, Switzerland, Germany, and Serbia chronologically covering the period of Neolithic transition (from Late Mesolithic to Middle Neolithic). Villotte *et al.* observed that external auditory exostoses are significantly more frequent in the Mesolithic (9.1–19.4% of individuals) than in the Neolithic (0.0–5.0% of individuals). They interpret these results as an evidence of abandonment of marine/freshwater resources (fishing) towards the terrestrial sources of food (farming and pastoralism).

Osteobiography

Tomasz Kozłowski in the article entitled *Osteological, chemical and genetic analyses of the human skeleton from a Neolithic site representing the Globular Amphora Culture (Kowal, Kuyavia region, Poland)* put together a team of researchers from various disciplines to explore the life history of late Neolithic individual buried in a tomb found within a ceremonial complex at the Kowal

site in Central Poland. Their osteobiographical study suggests that skeleton belonged to a young adult man (27–35 years) with stature shorter than 160 cm. The man might have had a speech disorder but in general, his health and living conditions were relatively good. Stable carbon and nitrogen isotope analysis suggests that the man consumed terrestrial-based diet with probably a high proportion of millet. Finally, according to aDNA analysis (the first one isolated from human remains belonged to Global Amphora Culture), the person was unable to digest of lactose (lactose intolerant) and his ancestor belonged to first farmers arrived in Central Europe during the Early Neolithic.

Health and diseases

Marta Krenz-Niedbała in the contribution entitled *A biocultural perspective on the transition to agriculture in Central Europe* studies the health consequences of the transition to agriculture. She compares the frequency of skeletal stress indicators between two Neolithic populations from Poland with different subsistence strategies. The Lengyel Culture sample (Osłonki site, 68 individuals) represents in her study agricultural subsistence strategy while the Corded Ware Culture sample (Żerniki Górne and Złota sites, 62 individuals) represents agricultural-pastoral economy supplemented with hunting and gathering. According to her results, Lengyel and Corded Ware sample do not significantly differ either in the frequency of *cribra orbitalia* (20.0 vs. 20.4%) or in the frequency of Harris lines (54.2 vs. 65.8%). Statistically significant differences were detected, however, in the case of enamel hypoplasia where the Lengyel sample showed higher frequency of hypoplasia (64.7%) than the Corded Ware sample (43.5%). Krenz-Niedbała suggests that the Lengyel individuals that were dependent on agriculture suffered more frequent and severe stress episodes than Corded Ware individuals that relied on mixed economy. She argued that it can be explained by higher population size and density, sedentism, low hygiene, and less diversified diet in Lengyel compared to Corded Ware group.

Biodistance studies

Aude Civetta, in her article entitled *Morphological variability of several populations of the middle Neolithic between northern Italy, western Switzerland, central and southern France* (article in French), provides biodistance analysis based on cranial and post-cranial measurements of Middle Neolithic European populations. Civetta studies a large sample of 329 skeletons from three European countries, namely from northern Italy, western Switzerland, and central and southern France. Based on series of univariate and multivariate analyses, she detects a morphological gradient between populations of western Switzerland and two groups from central and southern France. She also observed differences in cranial shape between samples from northern Italy and southern France. Civetta suggests that ecological and environmental factors could play a relevant role in morphological differentiation among populations.

Aurore Schmitt and Bérengère Saliba-Serre present in their article entitled *Biological parameters and spatial organisation of the Middle Neolithic funerary assemblage of Poncharaud 2 (Auvergne, France)* (article in French) an bioarchaeological analysis of 68 Middle Neolithic individuals from Poncharaud 2 site in southern France. The burials are concentrated in five clusters and it has been suggested that these clusters might correspond to families or clans. Authors compare spatial distribution of the cemetery with biological characteristics of buried individuals. In addition to sex and age-at-death composition, they provide a biodistance study using non-metric cranial and dental traits to analyse genetic relationship within the sample. Their results show that the cemetery was not organised according to sex or age-at-death of buried individuals. There is, however, some evidence that at least several individuals were placed in clusters on the basis of biological relationship with other individuals of the same cluster.

Funerary practices and social organisation

Aline Thomas provides in the paper entitled *Social discriminations through the grave: identity and status of the dead in the Cerny culture (Middle Neolithic, Paris Basin, France)* an anthropological analysis of human remains found in monumental Neolithic cemeteries in Paris Basin. She analyses 137 individuals from five monumental cemeteries with long barrows and two flat cemeteries without monumental structures in order to study their social organisation. Thomas argued that her analysis of sex and age-at-death composition and grave-good distribution does not support a scenario according to which the elite were buried in the monumental and the rest of the population in ordinary cemeteries. By contrast, she finds out that a composition of both monumental and flat cemeteries is similar; men and several children occupy a central position in the cemetery while women seemed to be marginalised. Given the similarity between monumental and flat cemeteries, the existence of monumental cemeteries of Cerny Culture has to be explained by factors other than vertical social organisation of Cerny communities.

Rui Bonaventura and his colleagues provide in their article entitled *Funerary practices and anthropology during Middle-Late Neolithic (4th and 3rd millennia BCE) in Portugal: old bones, new insights* an updated review of Neolithic multiple human burials from the region of Estremadura and Algarve in Portugal. The authors emphasised that although in the past 150 years, more than 3000 Middle-Late Neolithic tombs have been found in Portugal previous research has been mainly focused on typological description of tombs and artefacts. In their study, Bonaventura *et al.* turn their attention to human remains discovered inside these funerary structures and present results of their long-lasting analysis. The authors summarise that anthropological material from the tombs is represented by poorly preserved commingled remains with minimum number of individuals ranged from less than 10 to more than 400. Age-at-death distribution shows that non-adults comprised from 18 to 50% of total sample and individuals younger than five years of age are underrepresented in the sample. Data suggest that more females than males were buried in tombs but it might be an effect of methodological bias of sex estimation methods. Based on the analysis of subtrochanteric femur shape, authors find evidence for a greater mobility than could be expected in fully sedentary Neolithic population. The systematic study of Bonaventura *et al.* highlights that funerary practices of Middle and Late Neolithic communities in Portugal were more diverse than has been suggested earlier. In addition to natural caves and dolmens, authors described recent discoveries of human remains in rock cut tombs, *tholoi*, pit graves, enclosed ditches and also findings of cremated human bones.

Personal ornaments

Solange Rigaud, in her article entitled *Personal ornaments of the first agro-pastoral societies in Bavaria (Germany): Integration? Acculturation? Convergence? New insights from Essenbach-Ammerbreite cemetery* (article in French) provides an interesting insight to Neolithic transition in Europe, which is based on the economic and technological analysis of personal ornaments. She conducts morphometric, technological, and use-wear analysis of 183 beads from Essenbach-Ammerbreite cemetery in Bavaria, Germany. Her results show that personal ornaments manufactured by Bavarian Early Neolithic communities are a result of mixed strategies. On the one hand, Early Neolithic farmers produced ornaments that were already used in Danubian Neolithic communities from the east and on the other hand, they adopted raw material of local origin. Moreover, Rigaud argues that local raw material was already used in production of personal ornaments by autochthonous Final Mesolithic foragers. She discussed cultural mechanism that could be responsible for such a mixed strategy in ornament production.

SUMMARY

Bioarchaeology of European Neolithic Populations Special Issue of the journal *Anthropologie* highlights the diversity of bioarchaeological approaches used to study of human life during the Neolithic in Europe. Three articles of the Special Issue are concerned with changes in diet and mobility during the Neolithic transition using analyses of carbon and nitrogen stable isotopes, using relatively new and promising analysis of sulphur isotope ratios from human bone collagen, and using the frequency of external auditory exostoses. Another two articles apply biodistance analysis of cranial and post-cranial measurements to study phenotypic and genetic similarities on intra- and between cemetery level. Two articles use skeletal evidence to address the issues related to funerary practices and social organisation of Neolithic communities. One contribution links the frequency of skeletal stress indicators to evaluate the impact of the farming way of life on the health of Neolithic populations. Another article represents an excellent osteobiographic study that takes advantage of multiple approaches, including osteological, chemical, and genetic analysis, that were used to assess the life history of an individual buried in the late Neolithic ceremonial complex. Finally, one article regards economic and technological analysis of personal ornaments as an evidence of mechanism of Mesolithic-Neolithic transition. Contributions published in this Special Issue represent almost all regions of Europe; skeletal samples studied by authors originate from Serbia on the east to Portugal on the west.

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