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Reviews

Human Bioarchaeology of the Transition to Agriculture. Ron Pinhasi, Jay T. Stock (Eds.). John Wiley & Sons, Ltd, Chichester, UK, 484 pp. ISBN 978-0-470-74730. £79.99 / €99.99 (hardcover).

Bioarchaeology as a study of human skeletal remains has become more clearly formed at the end of the seventies. It was coined at the 11th annual meeting of the Southern Anthropological Society with Jane Buikstra's contribution "Biocultural Dimensions of Archeological Study: A Regional Perspective" (Buikstra, Beck, 2006). This entailed a change in the understanding of the role of skeletal anthropology as a new tool for reconstruction of human behavior based on investigation of skeletal tissue. This paradigm shift, in the frame of processual archaeology, brought a new bio-culture approach to the anthropological sciences. Human remains from archaeological sites are analysed to reconstruct lifestyle, health, diet, activity and behavior patterns. Bioarchaeology, in this sense, can be well applied in the research field of Neolithic transition.

The volume *Human Bioarchaeology of the Transition to Agriculture* responds to this thirty-year development of the given discipline, focusing on the process of "neolithization". Scientists from all over the world have collected data from osteological assemblages in order to assess universal biological responses to agriculture. All of them discovered a certain biological response to this transition, often in the form of health impairment. This general deterioration in health has been documented in numerous skeletal collections, although there is a substantial divergence in the rate, type and degree of this process. The variability and specificity of the transition process in different regions precludes simple generalizations. This variability is treated by the authors of the volume under this review. Contributions in the book emphasize regional differences in agriculture transition in four thematically grouped sections. The first section deals with diet reconstruction using isotope analyses, the second section

focuses on changes in body morphology and growth patterns, the third concentrates on biomechanics and the fourth on palaeogenetics and palaeodemography. The authors have come to the following conclusions: a) social and dietary change occurred over an extensive range of time and this process must have been very energetically expensive; b) the process of the Neolithic transition was regionally specific; c) cultural change associated with this transition exerted its new selective pressures on human populations (e.g. lactose persistence); e) huge demographic changes in the population across the world took place.

A collective of 33 authors, primarily from USA and Canada, further from UK, Germany, Argentina, Israel, Sweden, Greece, Ireland and Serbia contributed to these proceedings. The scholars summarized the results of long term investigations into the transition to agriculture from different parts of the world. Specifically, sites from Central, South-east, and Northern Europe, as well as from the areas of the Middle East, the South-east of North America, South America, Japan, Siberia, South Africa or Egypt are mentioned here. Given the number of areas from Central Europe investigated, the absence of any Central European contributor is striking. Only the Czech anthropologist Vladimír Sládek, the Slovak archeologist Juraj Pavúk, and Marek Zvelebil are cited there, with the last of these being the person this entire volume of the journal IANSA is dedicated to and, moreover, he was actually a British archaeologist, despite being of Czech origin. A number of the contributions in the volume are based on his research in the Baltic area. The absence of Czech scientists among the authors has to be explained by their unwillingness or inability to gain recognition in prestigious journals and present their results in conferences abroad. If this handicap is not overcome, domestic archaeology will always be isolated from world archaeology.

The first section of the reviewed proceeding deals with the methods of direct and indirect diet reconstruction using stable

isotope analyses and stature assessment throughout Europe and South Africa. In the first article, R. Schulting introduces an investigation of past diets in Europe and draws attention to the fact that the Neolithic transition is basically a transition from a heterogeneous to homogeneous diet, despite the regional specifics. The differences are most evident in coastal areas. The author asks the question "why?" The reason may be that the isotopic sea-level diet is more distinguishable from an inland diet. A more plausible reason, however, is the fact that inland skeletal collections are extremely rare due to worse preservation or different funeral practices.

In the following section, M. Lillie and Ch. Budd focus on the Baltic and the Dnieper geographic area. They initially emphasize the limitations of stable isotope analyses, in particular differences in extraction from bone bioapatite and collagen. These limitations restrict isotope analyses to the distinction of a coastal and inland diet, C3 and C4 plants, the estimation of trophic level and the reconstruction of migrations. According to the authors, more detailed analyses are not possible. The authors focus on changes in diet between the Mesolithic and Neolithic population in the mentioned territories; noticeable differences are only manifested in the Middle Neolithic. They conclude that local populations in both areas "took their time" when adapting to agriculture. The reasons can be found in environmental conditions in both regions. Both the Baltic, as a coastal area with networks of rivers, and the Dnieper river basin, although without access to the coast with also a significant proportion of the river diet, persisted in their subsistence strategies for a significant period of time.

In the contribution of G. Grupe and J. Peterse, an isotope analysis of human and animal bones from the area of the Fertile Crescent is described. They focus on the time and ways of livestock domestication. They assume that the first farmers were "vegetarians". Meat constituted a minor diet component during the Early Neolithic when compared to the Late Neolithic. Based on the stable nitrogen isotope ^{15}N ,

local inhabitants consumed the same food as local fauna (e.g. gazelles); they were on the same trophic level. Differences were only detected through C4 and C3 plants analyses. Local fauna was feeding more C4 plants than humans, who avoided competition in this way.

In the following chapter, the Greek scientist A. Papathanasiou deals with the transition to agriculture in Greece from a palaeopathological point of view. In the Greek peninsulas, a relatively rapid adaptation to agriculture (to a diet more homogenous and less nourishing) is observed. In this area, health impairment and reduction of stature can be observed similarly to other sites. Deterioration of the health status is more evident in the Middle Neolithic. Papathanasiou emphasizes the fact that a biological response to the transition to the agriculture appeared long after the transition.

In the last paper of this section, J. K. Ginter is concerned with South Africa. Agriculture was introduced here around 2000 BC, with the peak around 1000 BC. Ginter observes the mechanism of emergence and the spread of the new technology, discussing traditional questions about migrations or diffusion. She examines the conditions which forced people to change their economy and investigates the impact of this change. On the basis of discrete and metric bone data, the author shows the continuous occupation of this area and advocates the diffusion theory. The skeletal signs which respond most readily to environment changes (e.g. stature) dramatically changed over the course of the “neolithization” process. According to the author, the reason for adaptation through agriculture is the unsustainable way of existing life and the appearance of sheep herds.

The second section is focused on changes in bone morphology and growth. Four cases from Europe, North America and Japan are described. In the first chapter, C. Meiklejohn and J. Babb follow up previous stature studies and revisit them. The authors systematically evaluate stature throughout the Upper Palaeolithic and the Neolithic throughout Europe. They demonstrate that stature was variable and refute the general conclusion that the most significant shifts in body size in Europe occurred between the Mesolithic and the Neolithic. A significant change in stature is recorded at the turn of the earliest period (Early Upper Palaeolithic) when compared with the following periods. Stature reduction over time can be explained by several reasons, among them nutritional stress, climatic changes or gene flow. Technological improvement, leading

to decreased size due to the lack of need of a large body and associated metabolic cost, must also be taken into account (page 170). All these factors show the variability in the relationship between the stature and the Neolithic transformation. Certain ethnographic parallels reveal that stature may change periodically independently of the transition to agriculture. Skeletal samples may also distort the results as they come from throughout Europe, when various climatic zones can significantly influence the growth and body proportion of individuals.

In the second chapter, Pinhasi *et al.* are concerned with the growth variability of long bones in Southeastern Europe. They investigate the changes in growth trajectories among age categories, sexes, in body proportions and in single bones. They focus on neonatal bone length between Mesolithic and Neolithic groups. These growth profiles are then compared with other skeletal collections. The results indicate differences in growth between single age categories and in the size of distal limbs segments between Mesolithic and Neolithic samples. The problems of these measurements are quite pronounced. Apart from the osteological paradox, state of preservation, and estimation of demographic parameters, the fact that growth does not only reflect health status, but also individual hormonal levels, type of diet and other factors has to be taken into account as well. Evaluation of growth patterns within the life of one individual is basically not possible either. We only evaluate the phase of the individual's death; the previous and following phases are unknown. Finally, the total number of 42 analysed individuals, it has to be said, is extremely low.

In a further contribution, B. M. Auerbach measures the BMI of the South-eastern population in North America. Agriculture appeared around 2000 BC in this area. According to the author, the BMI indicator is an extremely important health sign, similarly to stature. Inter-population and intra-population variability is investigated and recorded here. The fundamental difference observed here is between the two modes of subsistence as the farmers were significantly higher and larger than hunter-gatherers. This observation again contradicts the generally accepted assumption that agriculture brings about body reduction. The results, however, may also indicate migration, as is discussed by the author.

D. H. Temple arrived at a similar conclusion as B. M. Auerbach, but in Japan.

On Japanese islands agriculture appeared around 500 BC and is characterized by the Yayoi culture. This culture in all probability came from SE Asia and mixed biologically and culturally with the local hunter-gatherer Jomon group. The newcomers show a higher health status than local hunters (greater leg lengths, fewer stress indicators and infectious diseases). These results again contradict the widespread idea of health impairment in the process of transition to agriculture. Another reason for this phenomenon may be the nutritional value of rice and also the fact that people there did not stop eating seafood.

The third section is devoted to biomechanics. This part consists of four contributions and discusses the areas of Lake Baikal in Siberia, North America, North Italy and Egypt. In the first contribution, Lieveise *et al.* investigate the mobility in the Mesolithic and Neolithic populations along the Baikal (6000 BC). In this region, the Neolithic is defined largely only by the presence of pottery, and metallurgy at a later point. In the archaeological record, continuous human occupation is evidenced here for at least the last 20,000 years with the transition dating to between 7000–5800 BP. The authors analyse, through multivariate approaches, the behavioural ecology in order to detect patterns of change between hunter-gatherers and farmers before and after the transition. In the farmers' skeletons changes in upper limb morphology were detected, interpreted as a result of a technological improvement (e.g. the development of kayaking). Additional evidence of probable technological improvement could be dietary changes detected by isotope analyses. Whereas in the Early Neolithic period aquatic dietary resources seem to have been dominated by littoral fish species, in the Late Neolithic aquatic resource consumption likely included more open water species. This difference could have been caused by technological advances, such as improvements in water transport.

In the following contribution, C. Larsen and Ch. Ruff investigate cross-section geometry and osteoarthritis in three regions of North America. These three regions are located in different geographic areas (two inland and one coastal). The authors assume that the transition to agriculture cannot have been uniform among these sites and back up this assumption in the text. In all the skeletal samples, only two markers identical for all the areas were recorded: increased population density and increased sexual diversity. It is suggested, in conclusion, that maize agriculture cultigen was not the only

cause of health and growth impairment in Neolithic populations. The transition to agriculture is more complex and primarily depends on the regional environment and living conditions.

D. Marchi *et al.* focus on robusticity and health status during the transition to agriculture in northern Italy. Again, they reject the general conclusion of health impairment and reduction of robusticity in this process. A comparison between male hunter-gatherers and farmers did not demonstrate any differences, with gracilization only being recorded in female skeletons. This can be explained by changing gender roles. Interestingly, these gender differences are not reflected in mortuary treatment. This evidence of identical burial patterns in both sexes suggests that gender ideology was not well developed among farmers. On the basis of this research, the fact that the funeral rite in itself cannot reflect gender roles must be accepted. A combination of various approaches is needed to interpret these roles.

In Egypt, J. T. Stock *et al.* confirmed the biological continuity from the Late Palaeolithic to the dynastic period along the Nile valley (13000–1500 BC). The authors reveal the reduction and subsequent increase in body size through this period. Differences between sexes, however, are observed over time. Male gracilization takes place during the transition from the Palaeolithic to the Neolithic whereas in females this can be recorded from later periods. Changing gender roles are, once again, probably responsible for this difference.

In the last section, four palaeodemographic and palaeogenetic contributions from Central Europe, Sweden, the Middle East, and Argentina are discussed. In the first paper, J. Burger and M. G. Thomas deal with the formation and spreading of LBK culture throughout Europe. They compile current palaeogenetic studies to reconstruct human and animal movements, their amount, ways of domestication, and the appearance of the lactase gene. According to the authors, the transformation of animals and plants must have taken about 2,000 years. Zooarchaeological evidence of livestock from this period morphologically and genetically differs from current forms. It is assumed that cattle must have been introduced from the core of “neolithization”, as indicated by its greatest genetic variability there, and consequently was not interbred with local species. This is in contrast to pigs which most likely came from several centres of origin. It is evident that these animals did not arrive by themselves. Their spreading in the new ecosystem could not

have happened without a strong human economy and culture. According to the authors, a significant amount of new arrivals must have taken place. This contradicts the theories regarding few incoming pioneers. The relationship between modern and prehistoric genetic signature is of interest, in the contemporary population, the Neolithic DNA is either missing or is very rare. This fact can support the theory about the few first Neolithic pioneers with the second possibility being that the DNA of the first farmers could have been subsequently replaced by other waves of new arrivals. It is apparent that the first LBK farmers were not direct ancestors of contemporary Europeans.

Similar palaeogenetic research was carried out in the next contribution by Anna Lindeholm from Sweden. The transition occurred here approximately two millennia later than in south-east Europe. Agriculture was brought to Scandinavia by the Funnel Beaker Culture (TRB). At the same time, the hunter-gatherer Pitted Ware the PWC culture had already settled there. Both populations were coexisting side by side for 1,000 years, the TRB inland and PWC in coastal area. The mtDNA of TRB differs from present-day and also from local PWC populations. The author explains this by supposed massive migration of farmers or by genetic flow or by certain special demographic changes. Only the populations of the Bronze Age show close genetic resemblance to the modern Swedish population.

In another study, V. Eshed and E. Galili present palaeodemographic research from the middle Levant area. They observed mortality and fertility in a ten-year interval in the pre-pottery Neolithic sites of Atlit-Yam, Kfar HaHoresh and Ain Ghazal. At Kfar HaHoresh, a high mortality was recorded in younger adults (20–29 years) as well as a complete absence of individuals over 50 years which can be explained, according to the authors, by taphonomic factors. At the Atlit-Yam, a higher distribution of individuals over 50 years of age is recorded with all males. This can be explained by a superior marine diet in the coastal area, and greater safety. This study shows high variability in demographic distributions among populations of the same economy. There are many limitations, however, to demographic studies such as this. Problems regarding age estimation are well known, and the absence of individuals over 50 years of age in Kfar HaHoresh can be explained by the failure of age estimation methods.

In the penultimate paper, M. Sardi and M. Béguelin examine the variability in the morphology of the face and humeral and

femoral bones between hunter gatherers and farmers in the Diamond River in Argentina, where the domestication and cultivation occurred around 3000 BC. The results show a systematic reduction of the face and extremities in the farmers. This reduction of the limbs was only observed in women however.

The last chapter by R. Pinhasi and C. Miekielejohn is devoted to diachronic changes in teeth size in Central Europe among the populations of the Upper Palaeolithic, Mesolithic and Neolithic (35000–4500 BC). The results show a significant reduction in teeth size and confirm previous theories regarding general teeth reduction trend.

It is finally necessary to point out the quality of the primary data of Palaeolithic/Mesolithic research. Although certain authors critically comment on their skeletal collections, they only limit these comments to the discussion. There is no relevant evaluation of the preservation of the given skeletons. The question is whether the osteological material is able to provide a representative picture of health over the Mesolithic/Neolithic transition. From this perspective, a conceptual contribution regarding this problem of skeletal preservation and the relationship between preservation and stress markers is missing in the entire volume.

Although agriculture brought significant impairment to health, new infectious diseases and lower diet quality, it seems to be a convenient economic strategy from the evolutionary point of view. Agriculture could not have had a crucial negative impact on the human population as is shown by the huge demographic boom, the main assumption of species’ success strategy. According to the editors of the given volume, this fact represents a great palaeopathological paradox (page 3). Agriculture carried new technology, overproduction, and change in social organization both in cultural and religious expressions. In each region, however, different responses to this process can be found. These are influenced by climate, culture, social structures and local variability, such as plant and animal species. This book reveals a holistic view of the thirty-year development of bioarchaeology of the Neolithic transformation, it critically responds to the generalizations and emphasizes the variability. Finally, the editors J. T. Stock and R. Pinhasi summarize this conclusion: “On a surface level we could dismiss these disparities as inevitable conflict between the resolutions of data found in specific archaeological contexts and sort of generalizations that are broad-scale and global trends relevant to regional

expressions of Holocene subsistence transitions? To what extent is regional variation important in understanding the “big picture” of the causes and consequences of agriculture? If regional and temporal variation is so significant, can we even make such generalizations?”

In summary, this volume is a brilliant work of scholarship which focuses on bioarchaeological research of both hunter-gatherers and farmers living strategies

from all around the world. It shows a holistic bioarchaeological approach to archaeological science (dating methods, isotope analysis, mortuary analysis, environmental conditions, diet and health reconstruction, migration, ancient DNA, activity patterns *etc.*). I recommend these proceeding for superior courses in biological anthropology, bioarchaeology, archaeology, and for science professionals.

References

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