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GERMAN-HUNGARIAN BIOARCHAEOLOGICAL RESEARCH PROJECT IN THE ARCHAEOLOGICAL INSTITUTE OF THE RESEARCH CENTRE FOR THE HUMANITIES, HUNGARIAN ACADEMY OF SCIENCES

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The link between archaeology and genetics is relatively new; one recent advance in archaeological research is the sampling of archaeological skeletal remains for DNA. Similarly to other fields of interdisciplinary research involving the application of archaeometric methods to aid archaeological interpretation, archaeogenetics too has occasionally come under heavy fire. Some scholars have perhaps been too quick in enthusiastically identifying the genetic evidence with archaeological cultures or peoples, while others have simply dismissed the entire method, contending that it is practically worthless owing to the often controversial results. This situation recalls the enormous scepticism, enthusiasm and heated debates generated by radiocarbon dating, which challenged and revolutionised traditional archaeological dating in the mid-20th century. Absolute dating has since then overcome its initial uncertainties and by providing increasingly accurate data, it has become indispensable for the assessment of the most diverse types of sites and finds assemblages. The ongoing debates, studies and books, as well as the new research paradigms and analytical procedures have contributed much to the advances made in radiocarbon dating since then. The same appears to hold true for archaeogenetics: while it is quite obvious that we are still at the beginning of the road, it is also clear that we should not abandon this field of research because DNA analyses is expected to play a crucial role in the study of ancient populations. As in the case of every new research method, we must raise the question what archaeogenetics can tell us and what it can not, what it can be used for and what it should not be used for. In Hungary, there is another danger in the interpretation of genetic analyses: a single genetic sequence or data set is sometimes removed from its proper academic context and begins a life of its own, becoming "proof" in a pseudo-historical and often ideologically charged narrative propounded by well-intentioned or less well-intentioned people. Professionals can only combat misrepresentations of this kind by a single means: by striving for excellence in their research projects, by well-grounded scientific interpretations and by clarifying the interpretative contexts for the interested public. This was one of the main goals of the perhaps most comprehensive Hungarian archaeogenetic research project focusing on Neolithic populations, conducted in collaboration with international organisations. The research project was begun in 2009 as a collaborative research between the Anthropology Department and Bioarchaeological laboratory of Mainz University and the Archaeological Institute of the Hungarian Academy of Sciences. The project itself was funded by a German research grant.[1] The research project is now nearing its end and yielding its first results, and thus a brief preliminary report on the major findings seems in order.

The main goal of the research project "Population history of the Carpathian Basin during the Neolithic and its impact on the peopling of Central Europe" was the examination of as many human skeletal remains as possible from the Neolithic cultures of the Carpathian Basin dating from the 6th–5th millennia BC. The analyses principally focused on samples from Hungary, but we were also able to examine human remains from Neolithic grave groups excavated in the Nitra Basin (Slovakia), eastern Slavonia (Croatia) and the Voivodina (Serbia). The keepers of the local museums and of various archaeological and anthropological

[1] The directors of the project are Kurt W. Alt, who applied for the DFG grant, and the author of this article. Although the Archaeological Institute has been part of the Research Centre for the Humanities of the Hungarian Academy of Sciences since 2012, the research project was continued.

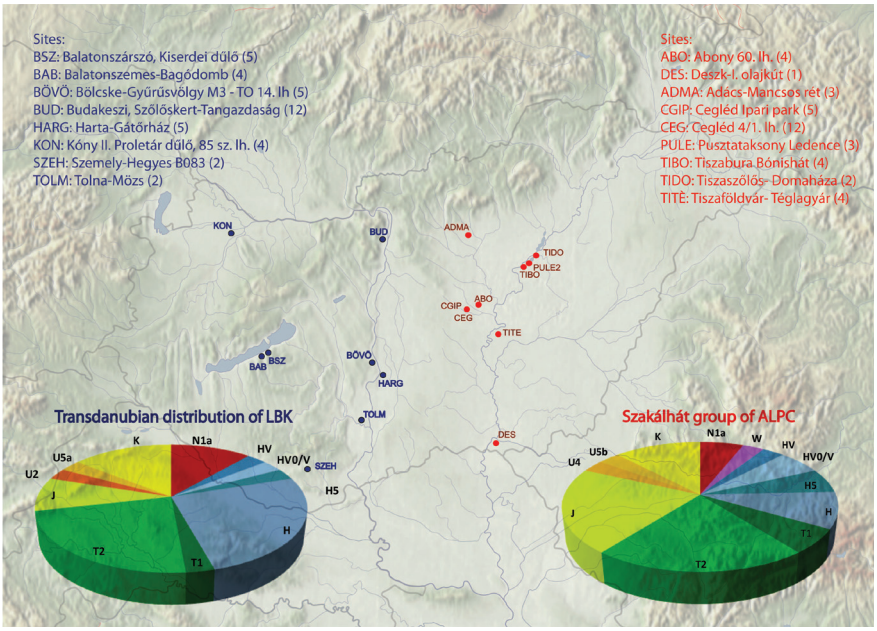

Fig. 1: Map of the Carpathian Basin showing the sites of the two Neolithic cultures discussed here and diagrams of the distribution of haplotypes (after Szécsényi-Nagy, A. – Keerl, V. – Jakucs, J. – Bánffy, E. – Alt, K. W.: Ancient DNA from middle Neolithic Hungary suggests a common ancestry of LBK in Central Europe. Poster presented at the conference "Early Farmers: the view from Archaeology and Science", Cardiff University, May 14–16, 2012)

collections, as well as the archaeologists, museum specialists and anthropologists working there all kindly provided access to their material and assisted our colleagues in taking samples.[2]

The analysis always began with a traditional physical anthropological examination of the skeletal remains in order to determine age and sex, as it was especially frequent in the case of burials unearthed during the course of more recent large-scale excavations that the – even preliminary – anthropological assessment of the human remains had not been performed yet.[3] This was followed by the precise archaeological assessment of the site and its environment, the settlement burials and the grave groups because it is impossible to draw meaningful conclusions from an archaeometric study without a precise knowledge of the archaeological context. In some cases, it was not possible to determine the archaeological context of the skeleton (i.e. its cultural association) either because the grave did not contain pottery or other artefacts that are typical for a particular period, or because its previous association with a securely identified and dated grave cluster became questioned. In these cases, age determination was performed by radiocarbon dating in order to eliminate even the possibility of an erroneous cultural attribution.

The cultural/archaeological assignation of earlier excavated skeletal remains was preceded by a review of the available archival data and the reports published in the archaeological literature.[4] It must be repeatedly emphasised that a genetic analysis can only yield meaningful results if we are certain that the skeleton selected for sampling indeed originates from a particular site and that it indeed dates from the Neolithic. (A few shockingly erroneous results were recently published following the genetic analysis of a few skeletal samples believed to date from the Neolithic because the samples had actually been taken from skeletons that were younger by six millennia.[5])

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[2] The obtainment of official permissions for sampling and the necessary co-ordination between the institutions and the researchers participating in the project was performed by János Jakucs, a junior research fellow in the Archaeological Institute. Sampling was conducted by geneticists Anna Szécsényi-Nagy and Victoria Keerl, and bone chemist Marc Fecher. The control samples from animal bones were collected by Éva Ágnes Nyerges, a junior research fellow in the Archaeological Institute. The physical, logistical and scientific co-ordination of the research conducted in the Hungarian and German institutions was undertaken by anthropologist Balázs Gusztáv Mende, director of the Archaeogenetics Laboratory in the Archaeological Institute, who has participated in several collaborative projects with Mainz University over the past few years. His expertise most certainly contributed to the success of this research project.

[3] Anthropologist Kitti Köhler came to our help in these cases.

[4] This work was performed by János Jakucs.

[5] Bánffy, E. – Brandt, G. – Alt, K. W.: "Early Neolithic" graves of the Carpathian Basin are in fact 6000 years younger. Appeal for real interdisciplinarity between archaeology and ancient DNA research. *Journal of Human Genetics* 57 (July 2012), 467–469. Accessible online at http://www.nature.com/jhg/journal/v57/n7/full/jhg201236a.html

Fig. 2: Sampling bone (photo by János Jakucs)

No earlier European archaeogenetic project has worked with samples from such a high number of skeletons. A part of the 700 (!) skeletons from which samples were taken can be assigned to the Körös and Starčevo cultures, two major Early Neolithic complexes flourishing in the earlier 6th millennium BC. We also collected samples from their successors, the populations of the Transdanubian (Central European) Linear Pottery culture and the Alföld Linear Pottery culture. Some of the sites in question had been excavated earlier, but we also collected samples from recently investigated sites and a few rare, extramural (independent) burial grounds. The largest number of samples from the 5th millennium BC came from the burials of the Late Neolithic Lengyel culture, many of which were taken from the graves of the Alsónyék cemetery, one of the most significant prehistoric sites in Europe. We drew a symbolic chronological boundary in the later 5th millennium BC, the time of the Copper Age cultures. The examination of the population of the Baden culture, an archaeological complex distributed over the greater part of Europe, will perhaps be the subject of a similarly large-scale, future research project.

The main goal of the research project was to gain a better knowledge of how the Carpathian Basin was colonised during the Neolithic, as well as of the main cultural trajectories and dynamics of this process using various scientific analytical procedures. The physical anthropological examination yields information on biological metric data, the visible pathologies and the possible shared traits of the studied population, while the archaeogenetic analysis provides insights into structural changes. Biochemical analyses reveal much about the diet and whether the sampled individuals had lived all their lives in the place where they were buried or whether they had arrived from some other region while still young. In other words, these analyses provide clues regarding the origins, the life-style and the mobility of a given population group. The archaeogenetic evidence must always be collated with the archaeological record on possible cultural changes because only thus can we gain a reliable picture of the studied populations.

DISCUSSION

Let us now see a few preliminary results. The first comprehensive genetic analyses focused on the origins and the contacts of the earliest Transdanubian Neolithic groups. Another goal was the comparison of their genetic makeup with that of the Neolithic populations of Central Europe. Unfortunately, the burials of the indigenous forager-hunter population are virtually unknown: only a single Mesolithic sample is currently available. Anna Szécsényi-Nagy began the analysis with samples from the northern Croatian burials of the Starčevo culture, the earliest farmers living near Hungary's southern border in the earlier 6th millennium BC. She continued her study with the assessment of the Starčevo sites in Transdanubia and the burials of the Transdanubian Linear Pottery culture in the ensuing period. Although the distribution of the 109 samples between the geographic regions and the successive periods of the Neolithic was uneven, this study marked a major advance because previously only a single piece of Neolithic data published in 2005 was known from Hungary.[6] Anna Szécsényi-Nagy set her data on the genetic makeup of the Neolithic populations of Hungary into a wider South-East European and Ancient Near Eastern context. Her findings left no doubt that the earliest farmers of Transdanubia had close genetic ties with the South-East European population, as well

[6] Haak, W. – Forster, P. – Bramanti, B. – Matsumura, S. – Brandt, G. – Tänzer, M. – Villems, R. – Renfrew, C. – Gronenborn, D. – Alt, K. W. – Burger, J.: Ancient DNA from the First European farmers in 7500-year-old Neolithic sites. *Science* 310 (2005), 1016–1018.

as with the later groups of the Linear Pottery culture in Central Europe and Germany. Even though the genetic record calls for further, more detailed studies, it is obvious from the preliminary findings that the genetic results are wholly congruent with the currently accepted archaeological models. The assessment based on the genetic evidence will no doubt be refined if, in addition to the graves of the Balkanic immigrants, burials of the Mesolithic hunter-gatherer groups will be found that can also be analysed. It would be important to know the genetic traits (haplotypes) of the indigenous Mesolithic population in order to assess their impact on the Neolithic population of Transdanubia and their descendants.

Fig. 3: The deformation of the spine of the burial in Feature 4027 in Trench 10B of the Alsónyék-Bátaszék site was caused by tuberculosis (after Köhler, K. – Pálfi, Gy. – Molnár, E. – Zalai-Gaál, I. – Osztás, A. – Kirinó, K. – Bánffy, E. – Kiss, K. K. – Mende, B. G.: A Late Neolithic Case of Pott's Disease from Hungary. International Journal of Osteoarchaeology, Published online at http://onlinelibrary.wiley.com/doi/10.1002/oa.2254/pdf)

Another blank spot is also now being eliminated from the prehistoric DNA map of Europe. Victoria Keerl has analysed 72 samples from the burials of the Szakálhát culture in the Hungarian Plain and thus the findings of Anna Szécsényi-Nagy's research on the population of the Transdanubian Linear Pottery culture could be compared to the genetic makeup of a contemporaneous group in the Hungarian Plain. The Szakálhát groups and the population of the late Linear Pottery culture in Transdanubia living at the close of the 6th millennium BC appear to have had a similar genetic makeup, and the archaeological record too indicates that there was some sort of contact between them. The similar DNA patterns probably reflect a shared, South-East European ancestry.

These results are based on the analysis of mitochondrial (mt) DNA samples. Mitochondria are almost exclusively inherited from the mother; mtDNA samples are well suited to analysis, but because they contain maternal DNA, they can only testify to the maternal lineage. Advances in the assessment of the paternal genetic inheritance and in the research on Y chromosomes, currently still calling for very elaborate analytical procedures, will no doubt make significant contributions to our knowledge of prehistoric populations.

The research project involved several other analyses in addition to archaeogenetics and the examination of a population's genetic composition. I have already mentioned radiocarbon dating in order to establish the exact age of the samples. Stable isotope analyses too can make important contributions on the finer details of the lifestyle of a particular population. Changes in the diet can be traced through ^{13}C and ^{12}C, as well as ^{14}N and ^{15}N ratios. The analyses performed by Marc Fecher revealed the importance of stockbreeding and also indicated the amounts of meat consumed in addition to cultivated plants. Stable isotope analyses can also shed light on the types of protein consumed, e.g. whether aquatic resources such as mussels and snails had figured on prehistoric menus.

Strontium isotope analyses (^{86}Sr and ^{87}Sr) opened other new vistas. Tooth enamel preserves the strontium isotope signature of the region where an individual was born and raised because strontium is absorbed during the consumption of local plants and water. If the tooth enamel of a person preserves a markedly different geological strontium isotope signature than that of the region where the burial took place, it is a clear indication that the individual was an immigrant and had grown up somewhere else. In exceptionally lucky cases, we can also pinpoint the region whose imprint is preserved in the tooth enamel, i.e. where the individual's homeland lay. Control samples for these analyses are usually collected from animal remains because domestic animals obviously lived their short lives in the same place. The general picture of the migrations of an individual or of smaller groups provided by strontium isotope analyses offers important additional information regarding the network of contacts outlined by archaeological finds. Marc Fecher's

studies have furnished evidence that some members and groups of the Transdanubian population had arrived from the south. These are only preliminary results; obviously, the mapping of the interactions and population blends will no doubt yield a more complex picture. This many-hued tapestry will be woven from the numerous colourful strands that preserve different facets of life in prehistoric times – a similar canvas can generally be painted from the examination of archaeological find contexts, various artefacts and contact networks.

The researchers of the Archaeological Institute have contributed the findings of their physical anthropological, demographic and palaeopathological studies to the research project. One sensational result was the demonstration of tuberculosis in the Lengyel community buried at Alsónyék, reflected both by bone deformations and molecular analyses. This is one of the earliest documented incidences of this disease.[7] Finally, we made every effort to place the archaeometric findings into the appropriate archaeological context and thus provide a new, multi-faceted picture of the cultural history of the Neolithic.

The preliminary findings of the research project will be presented to the international academic community at the annual conference of the European Association of Archaeologists (EAA) to be held in Pilsen in the Czech Republic. However, we believe it is equally important to describe our work and its results to our colleagues in Hungary who generously provided the samples for our work, as well as to the broader Hungarian archaeological community. We therefore plan to organise a one-day conference in the Archaeological Institute in November 2013, when the researchers participating in the project will give illustrated presentations of their work.[8]

Recommended literature

Mende, Balázs Gusztáv
Possibilities and limits of the archaeogenetical analysis on the ancient human remains. *Archeometriai műhely* 3 (2006)/1, 29–33. www.ace.hu/am/2006_1/AM-2006-1-MBG.pdf

Haak, W. – Forster, P. – Bramanti, B. – Matsumura, S. – Brandt, G. – Tänzer, M. – Villems, R. – Renfrew, C. – Gronenborn, D. – Alt, K. W. – Burger, J.
Ancient DNA from the First European farmers in 7500-year-old Neolithic sites. *Science* 310 (2005)/5750, 1016–1018.

Ammerman, A. J. – Pinhasi, R. – Bánffy, E.
Comment on "Ancient DNA from the First European Farmers in 7500-Year-Old Neolithic Sites". *Science* 312 (2006)/5782, 1875–77.

Haak, W. – Balanovsky, O. – Sanchez, J. J. – Koshel, S. – Zaporozhchenko, V. – Adler, Chr. J. – Der Sarkissian, C. S. – Brandt, G. – Schwarz, C. – Nicklisch, N. – Dresely, V. – Fritsch, B. – Balanovska, E. – Villems, R. – Meller, H. – Alt, K. W. – Cooper, A.
Ancient DNA from European Early Neolithic Farmers Reveals Their Near Eastern Affinities. *PLOS Biology* 8/11 (2010) e1000536; doi:10.1371/journal.pbio.1000536
link: http://www.plosbiology.org/article/info%3Adoi%2F10.1371%2Fjournal.pbio.1000536

[7] See the study by Kitti Köhler, Balázs Mende and Annamária Pósa in the present issue of Hungarian Archaeology.

[8] I would here like to thank Balázs Mende and János Jakucs for their insightful comments on the draught version of this article.

Bánffy, E. – Brandt, G. – Alt, K. W.
"Early Neolithic" graves of the Carpathian Basin are in fact 6000 years younger. Appeal for real interdisciplinarity between archaeology and ancient DNA research. Journal of Human Genetics advance online publication, 7 June 2012; doi:10.1038/jhg.2012.36 http://www.nature.com/jhg/journal/v57/n7/full/jhg201236a.html

Szécsényi-Nagy, A. – Keerl, V. – Jakucs, J. – Bánffy, E. – Alt, K. W.
Ancient DNA from middle Neolithic Hungary suggests a common ancestry of LBK in Central Europe. Poster presented on the "Early Farmers: the view from Archaeology and Science". Conference held in Cardiff University, 14–16 May 2012 http://www.academia.edu/3522624/Szecsenyi_A._Jakucs_J._Keerl_V._Banffy_E._Alt_K._W._Ancient_DNA_from_middle_Neolithic_Hungary_suggests_a_common_ancestry_of_LBK_in_Central_Europe

Köhler, K. – Pálfi, Gy. – Molnár E. – Zalai-Gaál, I. – Osztás, A. – Kirinó, K. – Bánffy, E. – Kiss, K. K. – Mende, B. G.
A Late Neolithic Case of Pott's Disease from Hungary. *International Journal of Osteoarchaeology,* Published online in Wiley Online Library (wileyonlinelibrary.com); doi: 10.1002/oa.2254