Session title: BIOARCHAEOLOGY OF INDIVIDUAL LIFE HISTORIES

Organizers: Marek Zvelebil, Department of Archaeology, University of Sheffield, UK
Andrzej Weber, Department of Anthropology, University of Alberta, Canada

Time: Thursday all day

Room:

Session abstract:

The field of archaeological science is rapidly expanding. This growth includes laboratory methods for examination of human skeletal remains such as stable isotope ratios of carbon, nitrogen, oxygen, and strontium, as well as ancient DNA analyses. Together with equally advancing methods of macroscopic and microscopic studies, these new techniques, combined with the investigation of artefacts and other cultural remains, allow us for the first time to reconstruct individual life histories from birth to death, reflected in human skeletal and dental tissues and the associated grave goods. A number of archaeological projects have made examination of individual life biographies their focal points. The session will review this research from the perspective of the theoretical, methodological and practical matters involved in the development of this new subfield of bioarchaeology. The format of this session will include paper presentations focused on recent major mortuary complexes dated to the postglacial history of Eurasia, from the Mesolithic to the Modern period, ending with a round table discussion organized over one full day. Depending on the number and kind of submissions, the organizers foresee the possibility of publishing session materials in a separate volume.

Paper abstracts:

INTRODUCTION

Marek Zvelebil, Department of Archaeology, University of Sheffield, UK
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Together with new and expanding methods of archaeological science, new sociological concepts have now been introduced into archaeology, highlighting personal identities and the acquisition of cultural knowledge through inter-generational transmission and learning through contact with other groups and individuals. Each of us, in the present or in the past, posses not one but several identities and occupy a number of social roles that are socially constructed and often relate to our gender and age. Through life, we symbolize these social roles and identities strategically, in relation to a broader changing social situation; in death, our social roles and identities can be symbolized in burial as signatures of our life biographies. Life biography approach is designed to tell us as much as we can know
about the person as an individual: what his or her ancestry was (through DNA studies), where people were born (through elemental and isotope analyses), what their diet was in childhood and in adulthood (through bone chemistry, micro and macroscopic studies of skeletal remains), what was their health like, what was their lifestyle, and how they died (using a combination of methods). We can cross-link this information with individuals’ social status, roles and identities based on the analyses of burial rite and burial goods. In this way, the identity and life history of a person long dead comes alive.

In our introduction we outline the scientific brief and methodological programme of bioarchaeology, and biosocial archaeology in particular. We discuss the importance and implications of reconstructing individual life histories as individual records of human lives as markers of social identity and social standing within community, as signatures of ancestry, population mobility and partner exchange, and as indicators of individual and collective patterns of health, disease and demography. In concluding the introduction, we highlight the importance of the approach for understanding the patterns of cultural transmission, the composition of individual settlements and communities, and the constitution and the meaning of archaeological culture.

STRONTIUM ISOTOPE PERSPECTIVE ON HUNTER-GATHERER COMMUNITY STRUCTURE, MIGRATIONS, MOBILITY, AND SUBSISTENCE: A MIDDLE HOLOCENE CASE STUDY FROM THE BAIKAL REGION, SIBERIA

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Strontium isotope ratios ($^{87}\text{Sr}/^{86}\text{Sr}$) were tested in the first, second, and third molars as well as femur samples of twenty-five individuals from the Khuzhir-Nuge XIV cemetery in the Baikal region of Siberia. The results suggest that during the Bronze Age, the Little Sea area witnessed entire hunter-gatherer families migrating there from other parts of the Cis-Baikal, such as the Angara and upper Lena valleys. The examined group of individuals appears to consist of equal proportions of persons born locally and outside of the area. The cemetery features three distinct clusters—West, Centre, and East—and two types of grave arrangements—rows of graves and scattered graves. The data suggest that more locally born individuals were interred in the West Cluster, while more non-locals were buried within the Centre Cluster. The mortuary protocols characterizing the three clusters are also quite distinct. Finally, individuals in some clusters or rows show similar strontium isotope signatures, suggesting that they shared similar mobility patterns over their respective lifetimes. As each cluster was likely used over an extended period of time, this further implies that territories, or foraging areas, were maintained by social units (such as families) across multiple generations.

BIOARCHAEOLOGY, SOCIAL IDENTITY AND LIFE BIOGRAPHIES OF THE MESOLITHIC HUNTER-GATHERERS IN THE BALTIC
This contribution discusses the evidence for cultural variation in grave goods and mortuary ritual from three cemeteries in the Baltic region: Skateholm, Vedbaek and Zvejnieki, and compares them with the biological and isotopic analyses of the skeletal material from these burial locations. On the basis of this evidence, we attempt to reconstruct social identities and life biographies of Mesolithic hunter-gatherers dated to about 7000 – 5000 BP, and discuss the implications for the social organisation and mobility patterns of the late Mesolithic hunter-gatherers in the Baltic region.

**BIOARCHAEOLOGY AND LIFE BIOGRAPHIES OF THE LBK COMMUNITY AT VEDROVICE**

Paul Pettitt, Department of Archaeology, University of Sheffield, UK

The LBK settlement and associated cemetery at Vedrovice, Moravia, was occupied throughout the 53rd century BC. Falling just outside the core area of formation of the LBK, and slightly after the period of its initial expansion, it is particularly pertinent to the first main phase of spread of LBK into Central Europe. In order to reconstruct individual life biographies from this early agricultural hamlet, we undertook an international collaborative project employing several analytical techniques on the skeletons, namely physical anthropology and palaeopathology (M. Lillie and M. Dockalova); AMS radiocarbon dating (P. Pettitt and R. Hedges); DNA sequencing (B. Bramanti); stable isotope dietary analysis (M. Richards and V. Smrcka); strontium and lead analyses (J. Montgomery and M. Richards); and dental microwear studies (P. Nystrom and I. Jarosova). We were surprised at the extent to which the synergy of results allowed us to reconstruct life biographies from people who lived in the early Neolithic. We discuss some of our major results, including in- and out-migration, heritage, and differences in health, diet, and status. The results show that this Early Neolithic gateway community was socially complex in its derivation, organisation, and world view.

**MULTIFACTORIAL ANALYSIS TO INVESTIGATE POTENTIAL SHIFTS IN INDIVIDUAL DIET WITH AGE.**

Pia Nystrom, Department of Archaeology, University of Sheffield, UK

Knowledge about the diet adaptation of past human populations is important because it can, among other things, inform on the health and wealth of individuals. In addition, when examining the transition from one economy to another, diet adaptation holds decisive clues. There are many different approaches to glean information on diet, relying on both direct and indirect evidence. Attempts to correlate the results using different methodologies may present a set of interesting contradictions that may relate to different dietary/lifestyle regimes at different time periods over the human lifespan. In this paper, I want to explore the possibility of using results from different methodologies to examine the potential shifts in diet
with age. As a case study I will examine the diet adaptation of an early LBK population from the site of Vedrovice, located in southern Moravia in the Czech Republic.

**BIOARCHAEOLOGY, ANCESTRY AND LIFE BIOGRAPHIES OF THE LBK COMMUNITIES: VEDROVICE IN A BROADER CONTEXT**

Marek Zvelebil, Department of Archaeology, University of Sheffield, UK

The combination of analyses afforded by the biosocial approach has enabled us for the first time to reconstruct biographies for a number of individuals from the 53rd century BC from Vedrovice. In addition to the excitement of bringing individuals from prehistory into focus, the biosocial approach is allowing us to understand the social complexities of this early Neolithic community, and to redefine the meaning archaeological cultures generated by people such as those at Vedrovice. Rather than being a collective expression of ethnic identity for otherwise anonymous people (such as the “LBK folk”), archaeological cultures now become broad social traditions, a combined record of shared cultural practices and shared individual knowledge and a historical record of learning and knowledge acquisition on the one hand, and, on the other, of individual life histories of many individual identities and group differences. Together, they all underlie the cultural heterogeneity within uniform social traditions such as the Linear Pottery Culture. In my contribution, I discuss the findings from Vedrovice and compare them with other studies carried out so far in the context of other LBK communities in Central Europe, focusing on the questions of ancestry, cultural transmission, inter-personal contact, and population movement within the LBK tradition.

**FUNERAL PRACTICES AND FOODSTUFF BEHAVIOR: WHAT DOES EAT MEAT MEAN? STABLE ISOTOPE ANALYSIS OF MIDDLE NEOLITHIC POPULATIONS IN LANGUEDOC REGION (FRANCE).**

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The aim of this study is to reconstruct dietary pattern and economic behaviour of Neolithic populations in Northwestern Mediterranean using isotopic and archaeological data. Burials come from 4 sites located in Languedoc-Roussillon region in French Mediterranean area. These sites are dated from the Middle Neolithic period (ca. 4500-3500 BC). They represent the Chasséen culture, characterized by regional features, as economy management, resulting from territories control. For this investigation, stable isotope ($\delta^{13}C$ and $\delta^{15}N$) method has been used on 29 human bone collagen and 18 associated animal bones. This method
provides direct dietary information on the protein consumed including the relative amounts of marine vs. terrestrial and animal vs. plant protein in diets. Isotopic results are mainly compared to archaeological data to understand economic distinctions and possible different social status between different groups using specific funeral practices, i.e. stone-cist or chamber graves vs. burial silos pits. Results provide that the deceased of stone-cist or chamber graves and those buried in silos pits have not the same dietary pattern. This result suggests a possible differentiation between two socio-economic groups divided in consumers of resources from breeding and from farming. No aquatic food seems to be daily consumed by these individuals despite a relative close proximity to the sea and freshwater sources. Moreover, these outcomes let us think that (1) funeral practices could be linked to specific economy and/or (2) to different social status and that (3) burial type and foodstuff could be an expression of religious worship. Perspectives could be an enlargement of data from other area as Spanish Catalonia in which funeral structures are close to Languedoc stone cist graves.

This work was supported by the CNRS in a research program (ACR) directed by J. Vaquer.

REVELATIONS FROM A PASSAGE GRAVE – DIET, IDENTITY AND INTERACTION ON ÖLAND DURING THE NEOLITHIC AND EARLY BRONZE AGE

Elin Fornander, Archaeological Research Laboratory, Stockholm University, Sweden

A passage grave in Resmo on the island of Öland in the Baltic Sea marks the focus for this paper. Radiocarbon dates from 30 analysed individuals show that the tomb has been in use throughout the Neolithic and well into the Early Bronze Age. Stable carbon and nitrogen isotope analysis together with substantial radiocarbon data from Öland show that the island has been exploited by two coeval groups throughout the Middle Neolithic, further identifiable through differences in material culture and burial practices: the Pitted Ware Culture, with a distinct marine diet common for Pitted Ware groups around the Baltic Sea, and a population associated with burials in megalithic tombs, represented here by the Resmo tomb. The latter group, of which the earlier dates can be associated with the Funnel Beaker Culture, seem not to have engaged in agricultural activities to any substantial extent during the Middle Neolithic, although the mixed terrestrial/marine diet of these individuals clearly separate them from the Pitted Ware population. During a period of some hundred years before the identified shift to predominantly terrestrial resources, taking place in the Late Neolithic, a marked turbulence in intra-individual dietary practices can be observed in the Resmo material. Further, strontium isotope data reveals the presence of individuals moving to Öland from other regions during this turbulent phase. There are also indications of non-local individuals being buried in the tomb during the Bronze Age.

THE DIET OF INDIVIDUALS BURIED IN COLLECTIVE GRAVES OF THE NEOLITHIC AND THE BRONZE AGE IN POLAND
This paper attempts an anthropological interpretation of collective graves by searching for variation at the level of macro- and microelements accumulated in teeth in the context of seemingly insignificant biological and environmental differentiation of the individuals examined. Collective graves were explored in Bronocice (Neolithic Funnel Beaker-Baden culture; 24 individuals), Bocheniec, Gustorzyz, Dacharzów (Bronze Age Trzciniec culture; with 31, 20, and 9 individuals, respectively). The age of the individuals ranged from Infans I to Senilis. An analysis was also performed on soil samples from the grave cavity and the trophic background of animal teeth which had been recovered from grave pits. The paper shows variability in the concentrations of Ca, Sr, Ba and their ratios. The focus of the paper is on the inter-individual variability of the osteological material subjected to a chemical analysis and on changes with age of an individual in the concentrations of macro- and microelements and their ratios. The above issues are relevant because the archaeological literature indicates no signs of elitism in the form of rich grave-goods of the Trzciniec culture. Those communities were either egalitarian or low-ranking.

THE BIOLOGICAL STATUS AND PALEODIETARY STRATEGIES WITH AN ANALYSIS OF TRACE ELEMENTS IN TEETH FROM THE BRONZE AGE AND LATE ROMAN PERIOD NECROPOLIS IN OPATÓW (POLAND)

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Studies into the reconstruction of paleodiet that take account of social stratigraphy are an important source of information necessary for explaining the complicated relationships between biology and the social status of individuals representing historic and prehistoric human populations. The research was carried out on human odontological material containing 77 teeth in all, derived from the burial site in Opatów (southern Poland) – a necropolis used in the Bronze Age by Lusatian culture populations and later on, in the period of Roman influences, by Przeworsk culture populations. Concurrently, the fauna co-occurring with the burials studied was analysed. To verify possible diagenetic changes, a physico-chemical assay of the soil collected from the closest burial neighbourhood was performed. On that bi-ritual, unique archaeological site, diverse types of contemporaneous burials (skeletal, cinerary urn-crematory, cavitary-crematory, crematory with bones deposited in an organic container, layered and grooved burials) were discovered. The present study was aimed at analysing a possible relationship between the social stratigraphy, expressed by diversified grave furnishings, and the reconstructed dietary strategies of the populations of those two cultures at the times when the necropolis was in use (the Lusatian culture ca. 1200-600 BC; the Przeworsk culture ca. 150-400 AD). That
problem was elucidated on the grounds of an analysis of the relationships between the levels of selected chemical elements such as strontium, barium, calcium or phosphorus and the Sr/Ca and Ba/Ca ratios and the grave furnishings (rich/poor) in the aspect of age, sex and culture affiliation of the individuals under study. The content of the analysed elements was determined by a spectrophotometric method using an ICP AES “PLASMA - 40” Perkin Elmer spectrophotometer, on the basis of the mean derived from three consecutive measurements. The standard error of determination did not exceed 1%, and the lower detectability limit was 0.1µg/ml. The standardization of determinations was carried out using the reference samples of ground animal bones H5 IAEA. For a statistical analysis, single- and multi-variate analyses of variance, the nonparametric Kruskal-Wallis test and a cluster analysis were used, while for interpreting the obtained results an analysis of the observed ratio (OR) was also employed. No differences were found in the values of the examined diet indicators expressed by the inter-elemental ratios Sr/Ca and Ba/Ca in relation to sex, age and the richness of grave furnishings. The above results seem to suggest homogeneity of the nutritional modes within the groups under analysis.

Against the background of comparative studies, the OR indicator shows a substantial share of high-calcium products in the diet of either group examined; at the same time, in individuals belonging to the chronologically earlier Lusatian group its value is lower than in representatives of the late Roman Przeworsk culture. The findings of the present pilot study seem to point to a considerable degree of egalitarianism in respect of dietary strategies within the groups examined on the one hand, and to a possible but not necessarily significant decrease in the quality of nutrition in populations inhabiting the same ecumene on the other. To sum up, they were most probably egalitarian populations that had been functioning in optimum, but possibly also deteriorating environmental conditions. Such an assumption can be confirmed by the parameters presented in death rate tables.

INDIVIDUAL FEATURES OF APPEARANCE RECONSTRUCTED FROM DNA: $MC1R$ ALLELES ASSOCIATED WITH RED HAIR COLORPHENOTYPE (RHC) IN MEDIEVAL POPULATION – PRELIMINARY RESULTS

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$MC1R$ is one of the key genes controlling pigmentation. One of more than 80 alleles encodes biologically active or inactive melanocortin 1 receptor protein. Inactive melanocyte membrane protein results in extended feomelanogenesis (yellow/red pigmentation) over eumelanogenesis (black/brown pigmentation), via low intracellular cAMP level.

We have attempted to identify individual’s feature, i.e. RHC (red hair color) impossible to elucidate with classical anthropological methods. This phenotypic feature has been studied as characteristic DNA sequences of ancient templates, withdrawn from remains. Analyzed alleles simultaneously represent both feature necessary to reconstruct outward appearance of individual (pigmentation) and the predisposition to the disease (skin cancers).

aDNA templates have been isolated from medieval specimens excavated at three archaeological sites: two located in Central Poland (Brześć Kujawski,
Dziekanowice), and one situated on western Polish border (Cedynia). Content of collagen in studied teeth was never lower than 2%, depending rather on archaeological site. After physical/chemical cleaning and powdering of teeth in specially designed lab, DNA was extracted semi-automatically on biorobot MagNa Pure Compact (Roche). All necessary mock controls, cloning and sequencing of obtained products, were applied to authenticate templates. 57 specimens studied so far, produced amplifiable aDNA templates. Three alleles of MC1R gene confirming RHC phenotype were typed: (a)-C451T, (b)-C478T and (c)-G880C. Restriction analysis of respective amplification products allowed recognizing authentic aDNA sequences with simultaneous allele identification. 98 bp product was analyzed for HhaI-(a) and KspI-(b) restriction sites and 88 bp product for TaqI-(c). Contemporary living individuals who exhibit RHC phenotype served as a control of genotype/phenotype association. Beside the possibility of RHC phenotype recognition, also allele frequencies of the studied alleles were calculated tentatively. Comparison among studied medieval populations and between them and modern people showed significant differences of which mechanism is not elucidated yet.

EFFECTS OF HIGH AND LOW INTENSITY ACTIVITY AND AGE ON THE EXPRESSION OF MUSCULOSKELETAL STRESS MARKERS

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Musculoskeletal stress markers (MSM) are widely used to reconstruct activity patterns and labour intensity of past populations. Age and size have been found to correlate with MSM and these aspects should therefore be considered in activity reconstructions. Our aim was to find out how much age effects per year on MSM with different levels of activity. Skeletal material used in this study was Helsinki Natural History Museum material (N=108) where actual age and occupation of the individuals are known. MSM were scored for pectoralis major, deltoid, teres major, latissimus dorsi and biceps brachii. These scores were combined for further analysis. Geometric mean of humeral measurements was used as a size indicator. Age ($r^2=0.536$) and humeral size ($r^2=0.244$) correlated with combined MSM score. Relevance of age, muscle size (as radial tuberosity insertion), size, sex, labour and handedness as covariates explaining combined MSM score were studied using ANCOVA. Only age ($p<0.01$) was a significant covariate. Effects of labour intensity, sex and side (left or right) were studied using linear regression. Mean ages for the groups were from 45 to 51 years. Comparison of parameter estimates of different groups revealed that MSM scores are higher in the heavy labour group, but the increase per year is lower than in light labour group. Similar results were found between sexes and sides. These tendencies remained also after size adjustment. The result of this study indicates that light and heavy physical labour cannot be separated after the age of 59 where the regression slopes intercept.

THE GENETIC HISTORY OF THE DUTCH TOWN VLAARDINGEN
How to study the genetic continuity of a community over a long period of time? By combining ancient and modern DNA research it was possible to get an idea of the genetic variety in medieval Vlaardingen (The Netherlands) and continuity of certain genetic features within the city of Vlaardingen from 1000 AD to present day. For this purpose three sample groups were analysed: 41 skeletons from 1000-1050 AD, 88 living male participants who could prove they had roots in Vlaardingen, by pedigrees going back to around 1500 AD, and 17 anonymous male blood donors from Vlaardingen, sampled in 2000.

From all three sample groups autosomal STR's, Y-chromosome STR's and SNP's and the mitochondrial HVR1 were typed. The STR’s and SNP’s and the mtHVR1 in the modern sample groups were typed using conventional PCR and sequencing methods. The mtHVR1 in the ancient skeletons was typed using the recently introduced Parallel Tagged Sequencing protocol (Meyer, Stenzel and Hofreiter 2008) on the 454 Life Sciences Genome Sequencer FLX System from Roche Diagnostics. During the presentation the continuity of the above discussed genetic features from the middle ages until present times will be discussed, including some additional information concerning the methods and techniques used for the aDNA work on the samples from the skeletons. Although the three sample sets are relatively small and therefore not necessarily representative, it proved to be possible by means of suitable statistics to give a reliable insight in the genetic composition of the Vlaardingen population over time.

BIOMECHANICAL CHARACTERISTICS OF HUMAN LUMBAR VERTEBRAE; TEMPORAL TRENDS FROM MEDIEVAL TO MODERN DAY

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Lumbar vertebrae in humans support the weight of upper body and all the loads lifted producing significant loading stress to vertebral bodies. Because of loading stress, trauma based vertebral fractures are common especially among elderly people in both modern and archaeological samples. There are several mechanisms that affect the appearance of vertebral fractures. Bone mineral density (BMD) and bone mineral content are traditionally connected to pathogenesis of bone fragility. The role of reduced vertebral cross sectional area (CSA) as a risk factor for vertebral fractures is widely recognized. The aim of this study was to determine the factors that could have affected to the prevalence of trauma based vertebral fractures from medieval to present and to develop appropriate analyzing techniques to different temporal samples. In this study the biomechanical-, morphological and densitometric characteristics of vertebral bodies were measured and analyzed from the 4th lumbar vertebra in chronologically differentiating samples. These analyses were performed using magnetic resonance imaging (MRI), standard measuring calibers, pQCT, uCT and universal materials testing system. Modern sample consisted of modern Finns and archaeological
samples of medieval Swedes and Britons. According to this study there are clear morphological modifications in biomechanical characteristics of vertebral body from medieval period to modern days. These modifications have possibly affected to the appearance of trauma based spine fractures in modern times.

**LIFE HISTORIES OF MEDIEVAL LONDONERS: MULTI ISOTOPIC EVIDENCE FOR DIET AND MIGRATION.**

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Jane Evans, NERC Isotope Geoscience Laboratory, British Geological Survey, Keyworth, Nottingham, UK
Angela Lamb, NERC Isotope Geoscience Laboratory, British Geological Survey, Keyworth, Nottingham, UK
Roberta Gilchrist, Department of Archaeology, University of Reading, Reading, Berkshire, UK

London was the metropolis of medieval England and one of the largest cities in medieval Europe. It had an expanding population with a wide catchment area and therefore a dynamic population. This presentation will examine the life-histories of medieval Londoners, using a multi-isotopic approach (C,N,Sr,O). Individuals from two sites in medieval London have been analysed, the priory hospital of St Mary Spital and the parish of St Nicholas Shambles. The different locations and functions of these two sites suggest that the populations buried within each were very different, and therefore represent individuals of different walks of life. Carbon and nitrogen isotope analysis indicate some interesting dietary observations with respect to sex and grave type within each site. Overall, however Londoners consumed a diet that was isotopically similar to that of other late medieval populations in Britain. This diet is characterised by the significant consumption of marine fish by the majority of the country due to religious and/or economic motivations. Nevertheless, there are a number of individuals in the data-set whose $\delta^{13}C$ and $\delta^{15}N$ values suggest little or no contribution of marine protein in their diet. Values like these are uncommon for the medieval period however, they have been observed predominately at the rural parish site of Wharram Percy, Yorkshire. Is it possible then, that the dietary signal seen in these London 'outliers' shows evidence for the migration of people from rural locations, perhaps the surrounding countryside, into London. In order to test this hypothesis strontium and oxygen analysis of tooth enamel has been conducted on a small group of individuals from St Mary. This paper will report the findings of these analyses.

**“THEO THE PIPE SMOKER”: ANTHROPOLOGICAL AND HISTORICAL IDENTIFICATION OF A PERSON FROM 19TH CENTURY BASLE (CH)**

Gerhard Hotz, Natural History Museum Basel/Institute for Prehistory and Archaeological Science IPAS, Basel, Switzerland
In 1984 a rescue excavation near St. Theodor’s church in Basle unearthed 22 skeletons. One of them, a man of 36 to 39 years, was clearly an excessive pipe smoker, as can be seen by the two round holes in his teeth. For the project we nicknamed him 'Theo'. A team of anthropologists, historians and archaeologists is now trying to identify this yet unknown person from Basel. The graveyard was used only for 54 years from 1779 – 1833. In this time 4'334 people died in the parish of St. Theodor and were listed with their name, profession and age at death in the parish record. With the help of different methods only 24 names remain now on our 'identifying list'. With a certainty of 95% 'Theo' is one of these and we try to prove this with the help of aDNA-analysis of the skeleton and the possible descendants of ‘Theo’.

The main goal of our project goes still further. Together with natural scientific analysis (e.g. stable isotopic analysis, face reconstruction) and the historical sources (e.g. parish records) and images (as records of social and cultural history) we are trying to reconstruct his personal life history and shed light on its socio-economic context. At the moment fourteen international institutions are participating in our project.

**CONCLUSION**

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In conclusion, we summarise the key points made in the session’s presentations, link them to the key themes of the session, and suggest the main areas of interest for the roundtable discussion that will follow the papers.