Archaeology of Death
6 Stable Isotopes & Mobility studies
Diet reconstruction

Jan Turek

turekjan@hotmail.com

https://cuni.academia.edu/JanTurek

c___t____s_____

Stable Isotopes Analysis

The questions that are addressed within the field of Archaeology most commonly relate to the study of diet and mobility in past populations. While most people are familiar with isotopic analysis related to the study of radiocarbon dating (14C) fewer are familiar with the analysis of other isotopes that are present in biological material such as human or animal bone. The isotopes most widely studied to address these questions are Carbon-13 (^{13}C), Nitrogen-15 (^{15}N), Oxygen-18 (^{18}O) and Strontium ($^{87}Sr/^{86}Sr$). The stable isotopes of ^{13}C, ^{15}N and ^{18}O differ from the analysis of ^{14}C in that they do not steadily decay over time, thus there is no "half-life." Rather, they remain constant over time, hence the term *stable* isotopes. The exploration of isotopic identifiers of mobility, environment, and subsistence in the past also has contemporary relevance in that it can aid in informing policies relating to heritage protection, resource management and, sustainability and perhaps most significantly, help us to learn more about the remarkable ability of our own species to adapt and survive in any number of environmental and cultural circumstances.

Isotope Analysis Methods

In order to investigate stable isotopes from human and animal bones, a very small sample of bone is needed for the analysis. Due to advances in accelerated mass spectrometry (AMS) a small sample which can range from 200 milligrams to 1gram of bone can be used. When archaeological bone material is poorly preserved there may not be enough surviving biological material left for the analysis to be reliable. However, in cases where the bones are well preserved, the isotopic signatures are considered to be representative of the individual specimen (either human or animal) that is being studied.

The small bone sample is then treated through a set of chemical procedures, depending on the particular analysis in question. For example, for analysis of carbon and nitrogen stable isotopes, the bone is washed in hydrochloric acid (HCl) for an appropriate period of time until the bone sample is ready for the next chemistry steps. These processes are carried out to extract the "pure" bone collagen from additional components that make up bone, such as lipids and proteins.

Once the collagen is extracted this is prepared and weighed for analysis in the mass spectrometer. The mass spectrometer works by measuring the masses and relative concentrations of atoms and molecules. These are compared using standard reference materials that are set by the International Atomic Energy Agency in Vienna. The use of global and national (NIST) standards as reference material means that isotopic results can be compared across archaeological sites. However, it is important to remember that the isotopic values of a particular time and place must also be determined in order to understand the various local processes (environmental and cultural) that are constantly at work.

Reconstructing ancient diets

Archaeological materials, such as bone, organic residues, hair, or sea shells, can serve as substrates for isotopic analysis. Carbon, nitrogen and zinc isotope ratios are used to investigate the diets of past people; These isotopic systems can be used with others, such as strontium or oxygen, to answer questions about population movements and cultural interactions, such as migration, trade etc.

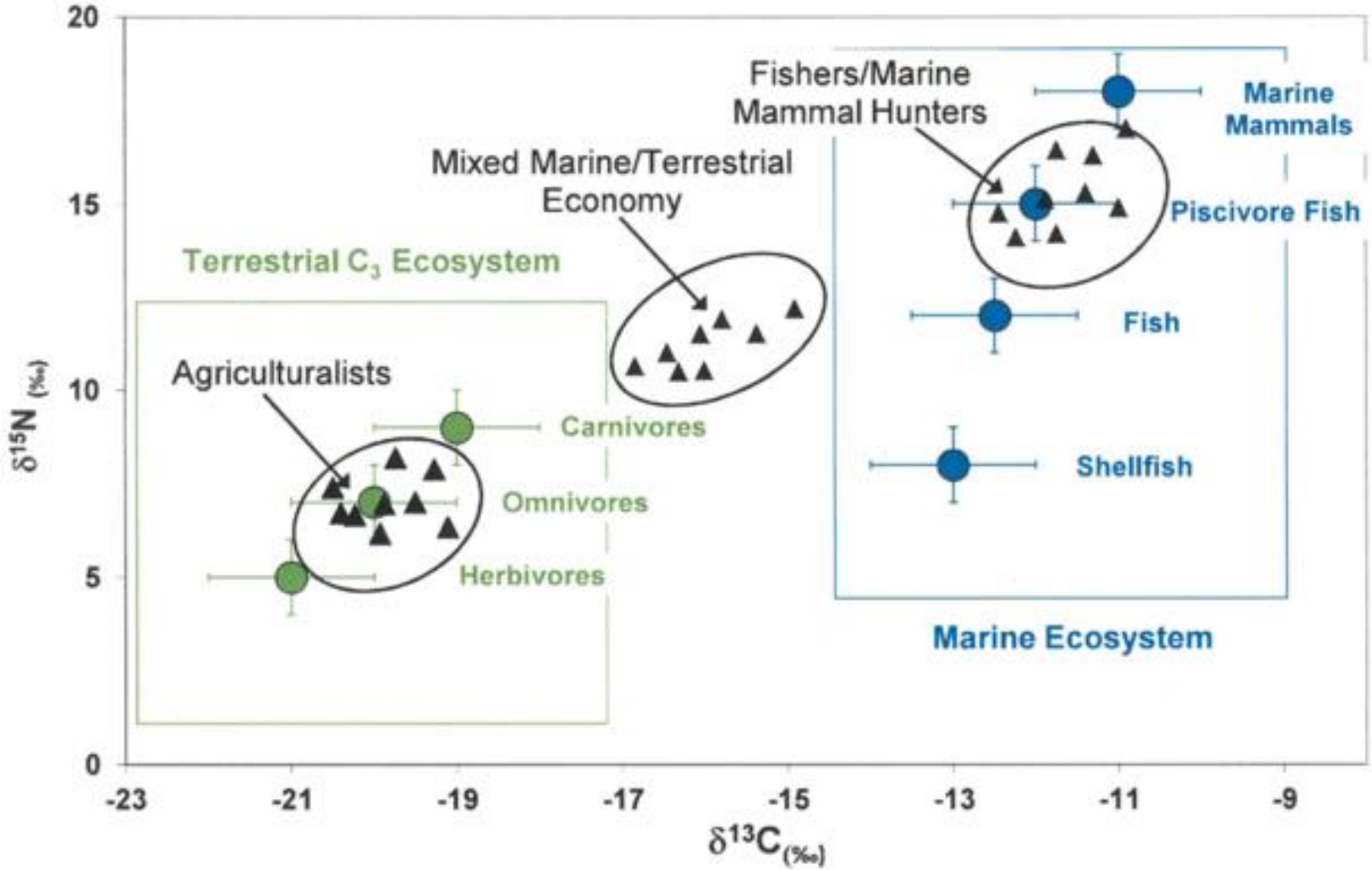
Carbon isotopes are analysed in archaeology to determine the source of carbon at the base of the foodchain. Examining the 12C/13C isotope ratio, it is possible to determine whether animals and humans ate predominantly C3 or C4 plants. Potential C3 food sources include wheat, rice, tubers, fruits, nuts and many vegetables, while C4 food sources include millet and sugar cane.[3] Carbon isotope ratios can also be used to distinguish between marine, freshwater, and terrestrial food sources.

Carbon isotope ratios can be measured in bone collagen or bone mineral (hydroxylapatite), and each of these fractions of bone can be analysed to shed light on different components of diet. The carbon in bone collagen is predominantly sourced from dietary protein, while the carbon found in bone mineral is sourced from all consumed dietary carbon, included carbohydrates, lipids, and protein.

To obtain an accurate picture of palaeodiets, it is important to understand processes of diagenesis that may affect the original isotopic signal. It is also important for the researcher to know the variations of isotopes within individuals, between individuals, and over time.

Dietary analysis

In the 1980s scholars realised that different ratios of, carbon and nitrogen isotopes in human bones can provide information on the type of diet individuals consumed. For example, in carbon stable isotopes can distinguish between certain types of plants, so-called C_3-plants, which make up the vast majority of land plants and C_4-plants, which notably include maize. In the earliest applications of the isotope method, this was used to trace the introduction of farming (maize agriculture) in North America. In Europe, where there were very few C_4 plants in antiquity, carbon stable isotopes are mostly used to distinguish terrestrial from marine foods (fish and shellfish). Combined with nitrogen isotopes ratios, which increase the higher an individual is on the food chain and can therefore give an indication of the amount of animal products in the diet. Crucially, the method cannot distinguish between meat and dairy (see bellow). For example, studies of our eating habits in the past have revealed that Neolithic populations consumed practically no fish, a very drastic change from the preceding Mesolithic, while high status medieval Bishops consumed significantly more fish, associated with fasting, than their congregation.



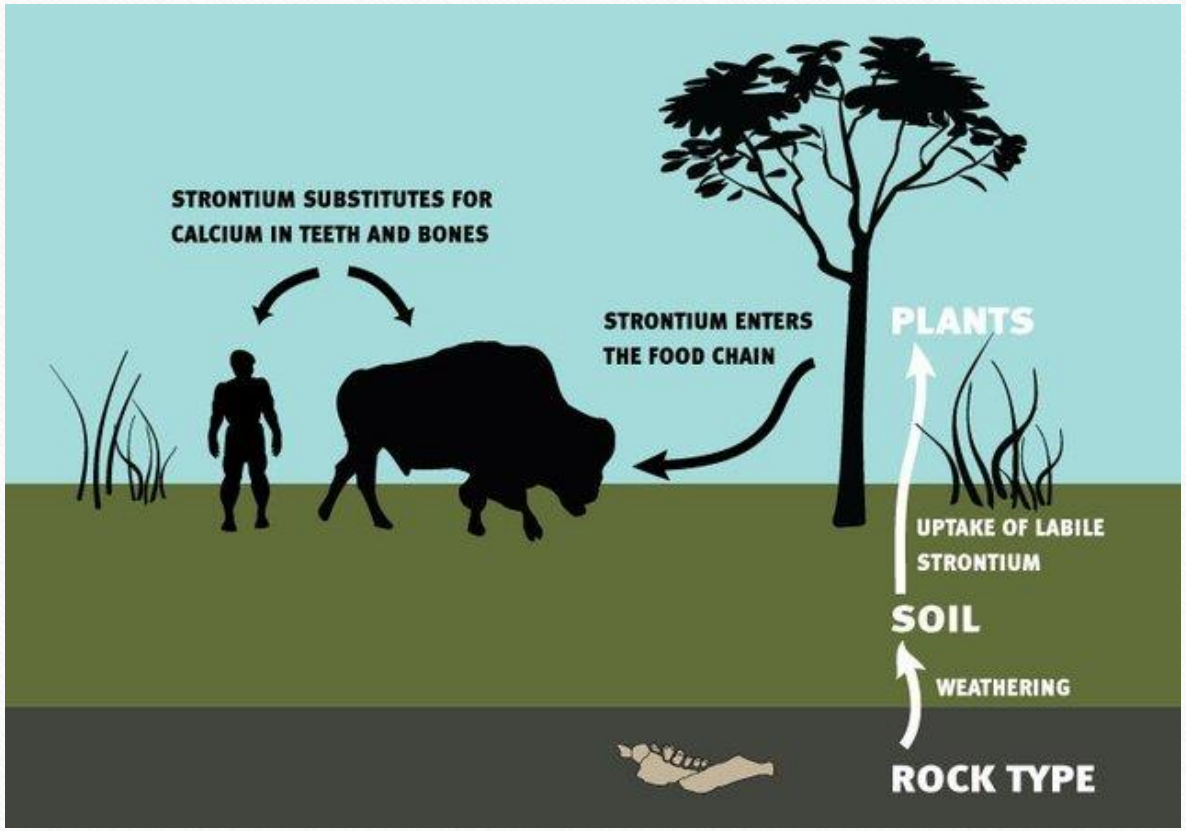
Typical bone collagen stable isotope ratios for Northwest Europe, illustrating the principle of dietary reconstruction. © Müldner 2009, University of Reading

Isotopes and palaeodiet reconstruction

The study of the diet of prehistoric peoples is an essential part of understanding how past communities were able to survive and adapt within particular environmental and social settings. The investigation of past diet or palaeodiet provides clues as to how our ancestors made use of natural resources and even how they modified their own environments in order to produce food. For example, one of the most widely studied aspects of human diet in North America has been the investigation of the introduction and development of maize agriculture (farming) as a major form of subsistence in the New World. Carbon and nitrogen stable isotopes are those most widely used for dietary reconstructions. These isotopes have been used most commonly to study diets of marine versus terrestrial (land based) animals and the intake of particular types of plant resources (for example maize and millet).

Isotopes can be used to assess diet because a direct relationship exists between the type of food being consumed and the corresponding isotopic "signature" found in the bone collagen of both humans and animals. For instance, when an animal such as a cow or sheep eats a certain type of grass or plant they will exhibit an isotopic value in their bones or teeth that is representative of that particular type of grass or plant. In addition, as humans consume animal protein, from resources such as terrestrial animals (e.g., cows, sheep, or goats) and aquatic resources (e.g., fish and shellfish) they will exhibit isotopic values that situate them within a particular "trophic level." A trophic level is most simply explained as where an organism (human or animal in these cases) is situated within a particular food chain.

Variation and adaptation in subsistence (or diet) can be stimulated by developments in socio-political and economic circumstances, as well as by climate and ecological transitions and even by individual choice. Changes in diet within a particular community can occur at both large and small scales, as well as rapidly or gradually over time. Unlike other avenues for paleodietary reconstruction, which are generally based on contextual archaeological, ethnographic and historical evidence, stable isotope analysis provides a way to *directly* investigate dietary composition through the analysis of the bones themselves.



SPONSORED DOCUMENT FROM
JOURNAL OF ANTHROPOLOGICAL ARCHAEOLOGY
ELSEVIER
FREE Full-Text Article

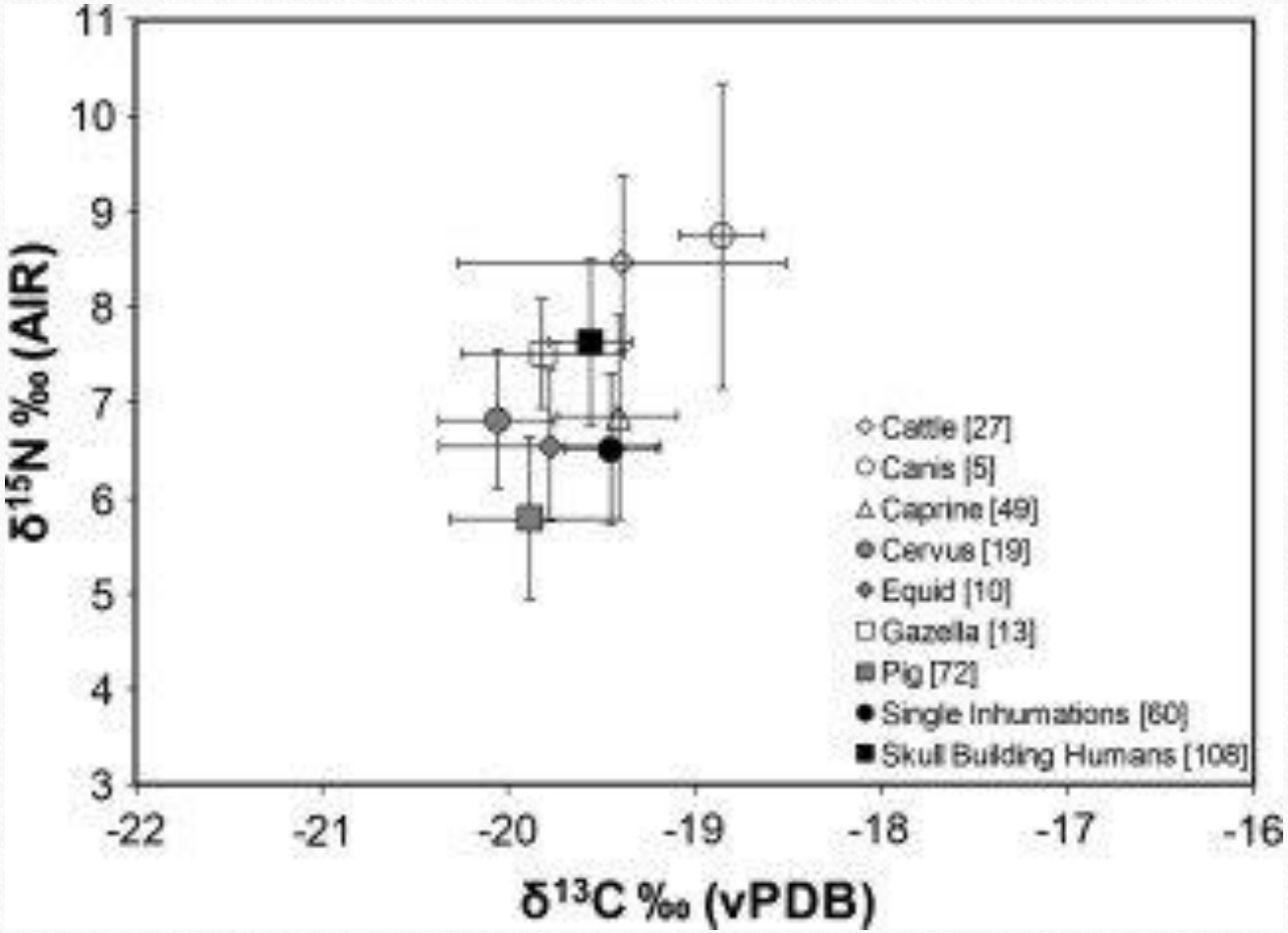
J Anthropol Archaeol. 2013 Jun; 32(2): 180–189.
doi: 10.1016/j.jaa.2013.01.002

PMCID: PMC4066944
PMID: 24976671

Food and social complexity at Çayönü Tepesi, southeastern Anatolia: Stable isotope evidence of differentiation in diet according to burial practice and sex in the early Neolithic

Jessica Pearson,[a,*] Matt Grove,[a] Metin Özbek,[b] and Hitomi Hongo[c]

The identification of early social complexity and differentiation in early village societies has been approached in the past most notably through the evaluation of rituals and architectural layouts. Such studies could be complemented by an approach that provides data about everyday behaviours of individuals. We took 540 human and animal bone samples for stable carbon and nitrogen isotope analysis from the Neolithic site of Çayönü Tepesi in southeastern Anatolia. The inhabitants at this site chose to bury their dead in two different ways at different times during its occupation: beneath the floors of their houses, but also inside a public mortuary building known as the Skull Building. This variation provides an opportunity using isotope methods to test whether there was evidence for structuring of daily activities (diet in this case) that might serve to reinforce this change in burial practice. We show that when the inhabitants of Çayönü Tepesi changed their architecture and operated different burial practices in conjunction, this coincided with other aspects of behaviour including socially-constituted food consumption practices, which served to reinforce social identities.

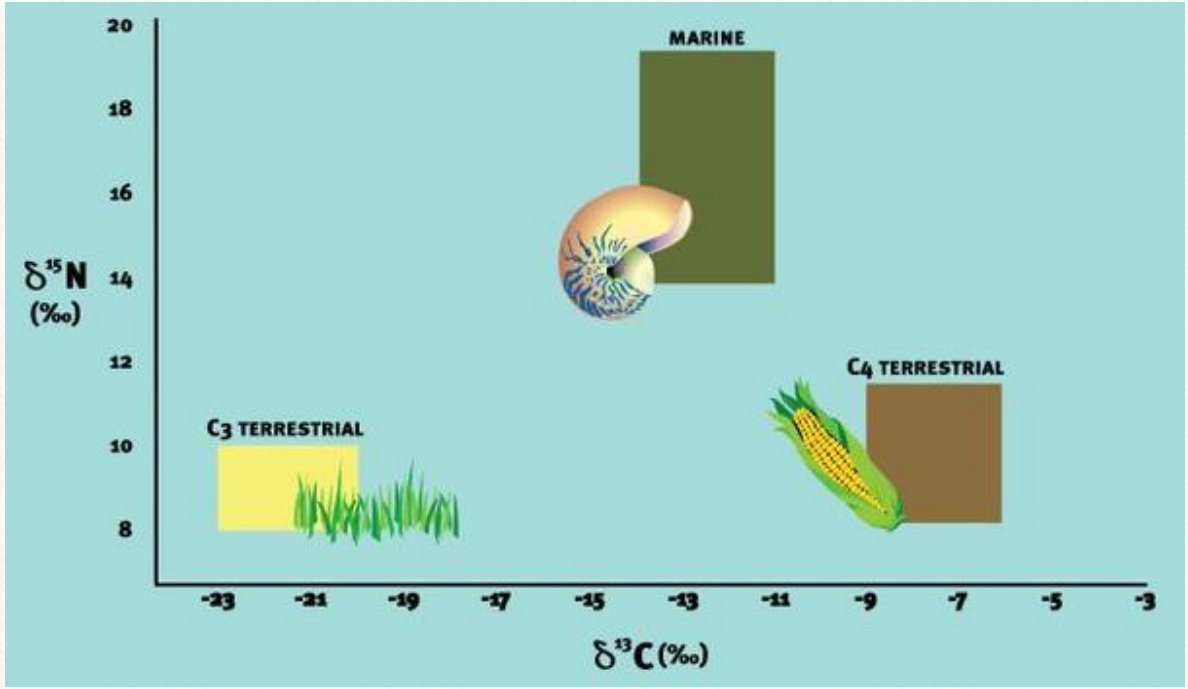


Carbon and nitrogen stable isotope data for all humans (separated according to burial at single inhumations beneath house floors and Secondary inhumation in the Skull Building) and fauna from all sub-phases at Çayönü Tepesi. Data are given as the mean and 1 sd (error bars). Potential duplicated humans in the Skull Building not removed.

Isotopes and the Study of Mobility

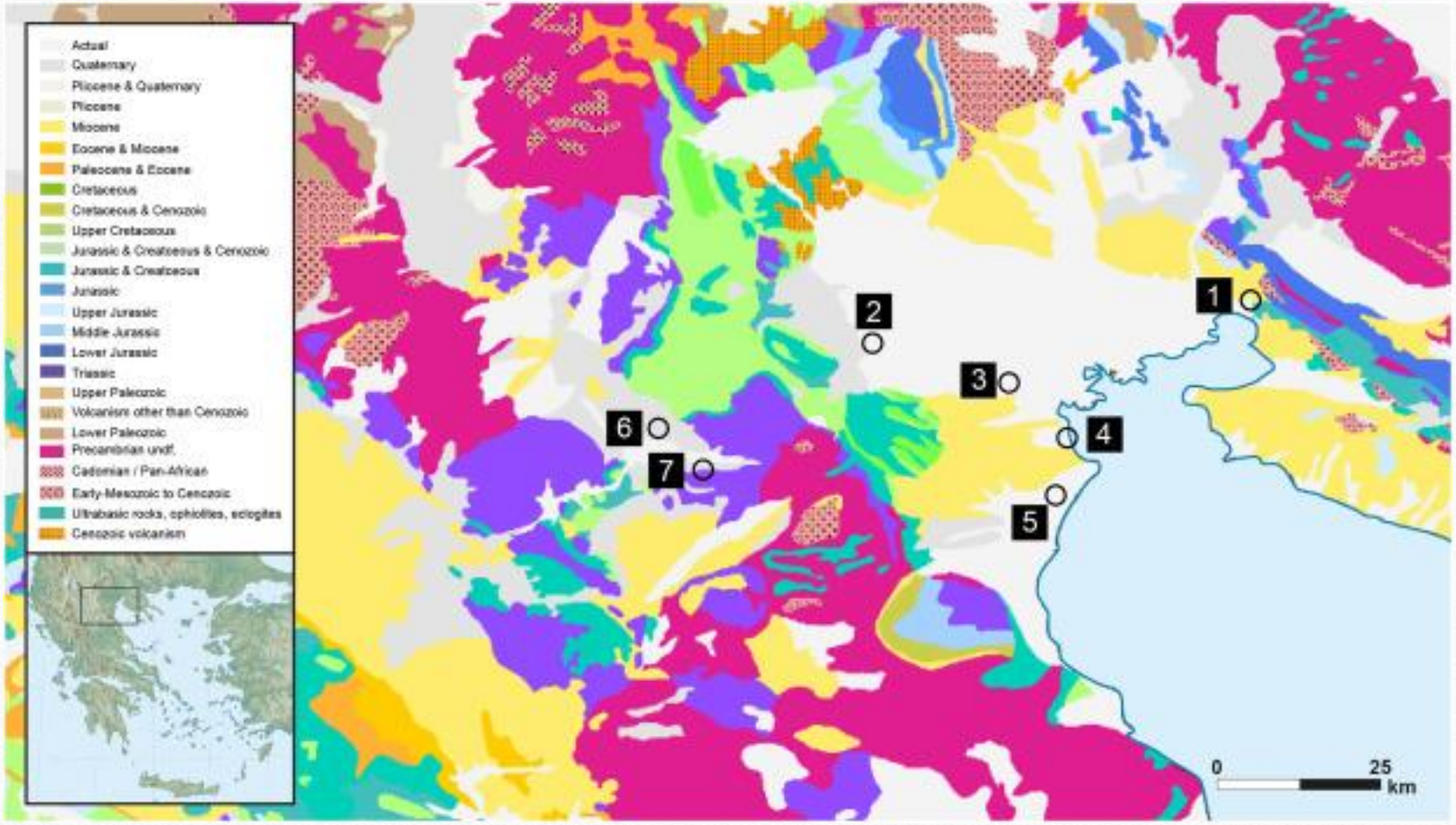
The study of mobility and migration in the past can be approached through a number of different archaeological methods, such as provenance studies of glass, ceramics and metal artefacts and in some cases even through the study of ancient DNA (aDNA). Humans move for many different purposes. They may move in search of more optimal resources, for marriage, warfare, trade, and a host of other reasons. Strontium (87Sr/86Sr) and oxygen (18O) isotopes are most commonly used to reconstruct past movements of both people and animals within a particular time and place. When investigating mobility, these isotopes are used to determine if a person or animal is "local" to a particular area by comparing the isotopic values from bone and dental enamel of the specimen with local isotopic values that must be established for that specific geographic location. The "local" values of a specific place are determined by studying the underlying geology of a particular place, in the case of strontium, and through the analysis of local groundwater resources and precipitation (rainfall and snow), in the case of oxygen. Under this assumption it is taken that if an individual displays isotopic values that are the same or within the range for the region in which they were discovered (or buried) then it may be possible to suggest that they were from the area originally.

In humans and animals, the isotope ratios of bone and dental enamel reflect the geological substrates on which their dietary intake (plant, animal, and water) were sourced. Strontium isotope values from human bone and teeth can be used to determine the possible place of childhood residency for an individual when the range of local values has been comprehensively established for a particular area. Some studies have investigated the dental enamel of individuals, which forms in early childhood, and compared the isotopic values with the bone values of the same individual. When the two results vary greatly, it can be determined that they spent a least a portion of their childhood in a geographic location that differed from where they were buried and eventually recovered through archaeological investigations.

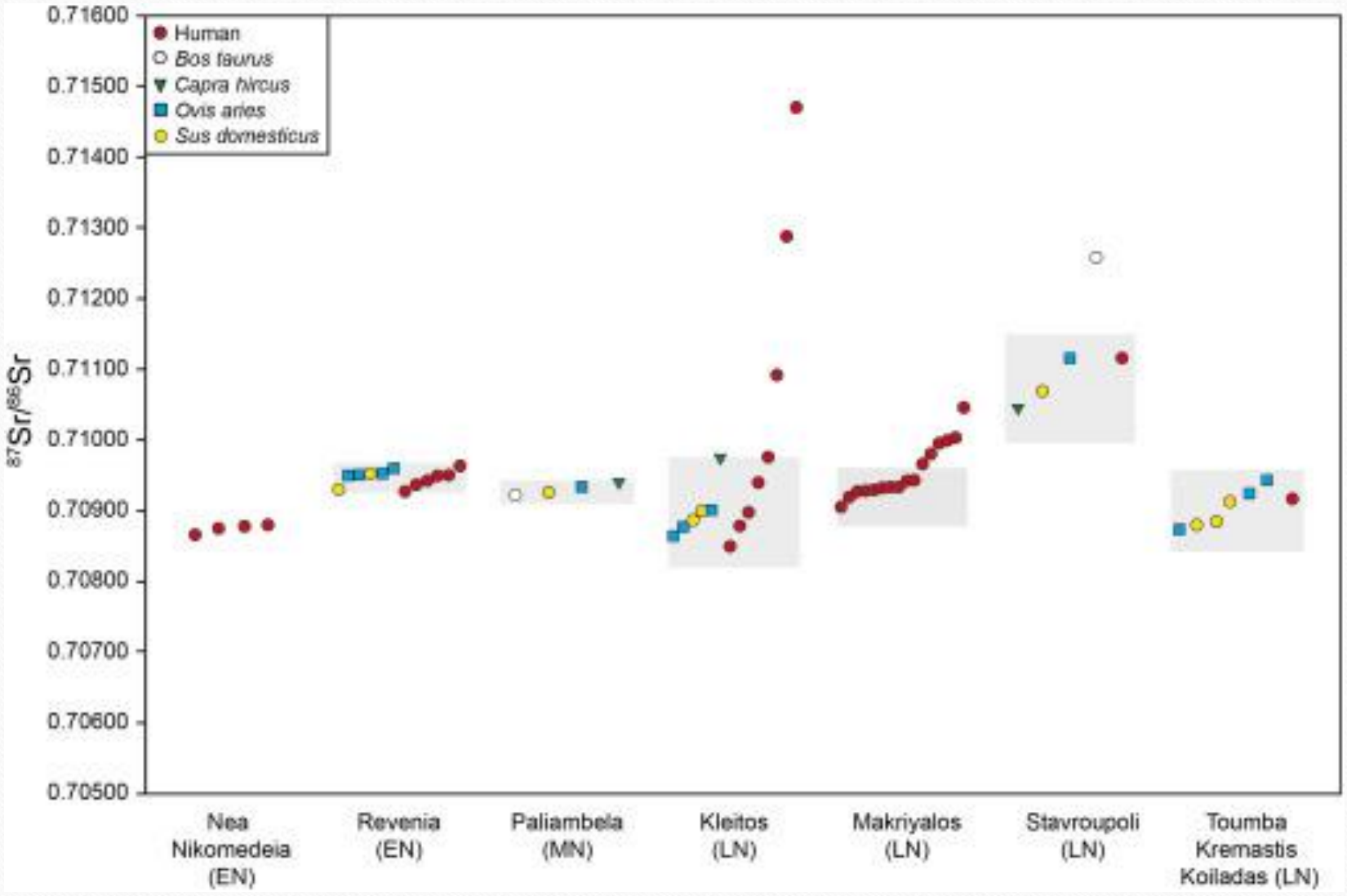


H. L. Whelton et al 2018: Strontium isotope evidence for human mobility in the Neolithic of northern Greece, Journal of Archaeological Science: Reports, Volume 20, August 2018, Pages 768-774
https://doi.org/10.1016/j.jasrep.2018.06.020

Strontium isotope ratios are widely used in archaeology to differentiate between local and non-local populations. Herein, strontium isotope ratios of 36 human tooth enamels from seven archaeological sites spanning the Early to Late Neolithic of northern Greece (7th–5th millennia B.C.E.) were analysed with the aim of providing new information relating to the movement of humans across the region. Local bioavailable $^{87}Sr/^{86}Sr$ signals were established using tooth enamel from 26 domestic animals from the same Neolithic sites. $^{87}Sr/^{86}Sr$ values of faunal enamel correlate well with predicted strontium isotope ratios of the local geology. This is consistent with animal management occurring at a local level, although at Late Neolithic sites strontium isotope values became more varied, potentially indicating changing herding practices. The strontium isotope analysis of human tooth enamel likewise suggests limited population movement within the Neolithic of northern Greece. Almost all individuals sampled exhibited $^{87}Sr/^{86}Sr$ values consistent with having spent their early life (during the period of tooth mineralisation) in the local area, although movement could have occurred between isotopically homogeneous areas. The strontium isotope ratios of only three individuals lay outside of the local bioavailable $^{87}Sr/^{86}Sr$ range and these individuals are interpreted as having spent their early lives in a region with a more radiogenic biologically available $^{87}Sr/^{86}Sr$. Mobility patterns determined using Sr isotope analysis supports the current evidence for movement and exchange observed through studies of pottery circulation. Suggesting limited movement in the Early and Middle Neolithic and greater movement in the Late Neolithic.



Geological map of the study area with the location of settlements. 1. Stavroupoli (LN), 2. Nea Nikomedeia (EN), 3. Paliambela (MN), 4. Makriyalos (LN), 5. Revenia (EN), 6. Kleitos (LN), 7. Toumba Kremastis Koiladas (LN) (base map from US Geological survey 1:1.5M world geology map, 2017).



Scatterplot displaying the variation of human and faunal $^{87}Sr/^{86}Sr$ values with the local bioavailable $^{87}Sr/^{86}Sr$ ratio through the EN to LN of northern Greece. The shaded area represents the local bioavailable $^{87}Sr/^{86}Sr$ range defined using strontium isotope ratios of the faunal teeth ($\bar{x} \pm 2SD$).

Further reading

Bentley, R.A., 2006**. Strontium isotopes from the earth to the archaeological skeleton: a review**. *Journal of Archaeological Method and Theory* 13: 135–187.

Bentley, R. A. 2013: **Mobility and the diversity of Early Neolithic lives: isotopic evidence from skeletons**, *J. Anthropol. Archaeol.*, 32 (2013), pp. 303-312

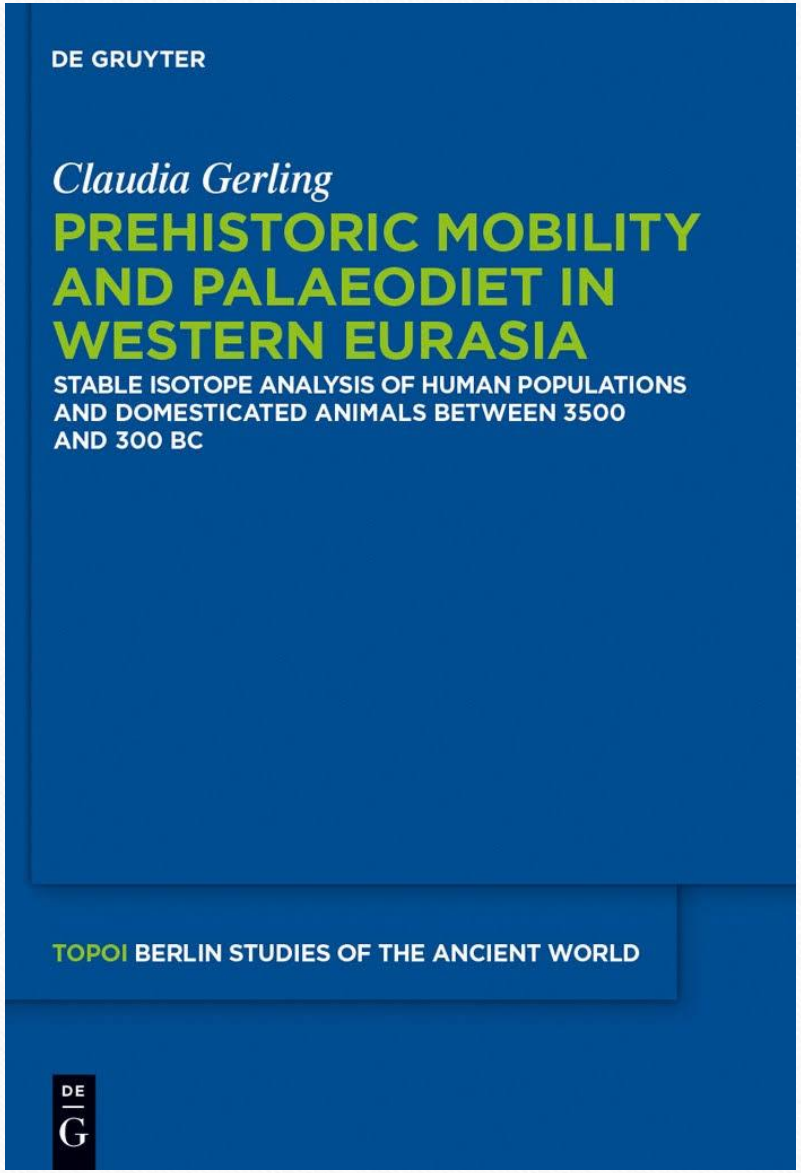
Boric, D. and Price, T.D. 2013: **Strontium isotopes document greater human mobility at the start of the Balkan Neolithic**, *Proc. Natl. Acad. Sci. U. S. A.*, 110 (2013), pp. 3298-3303

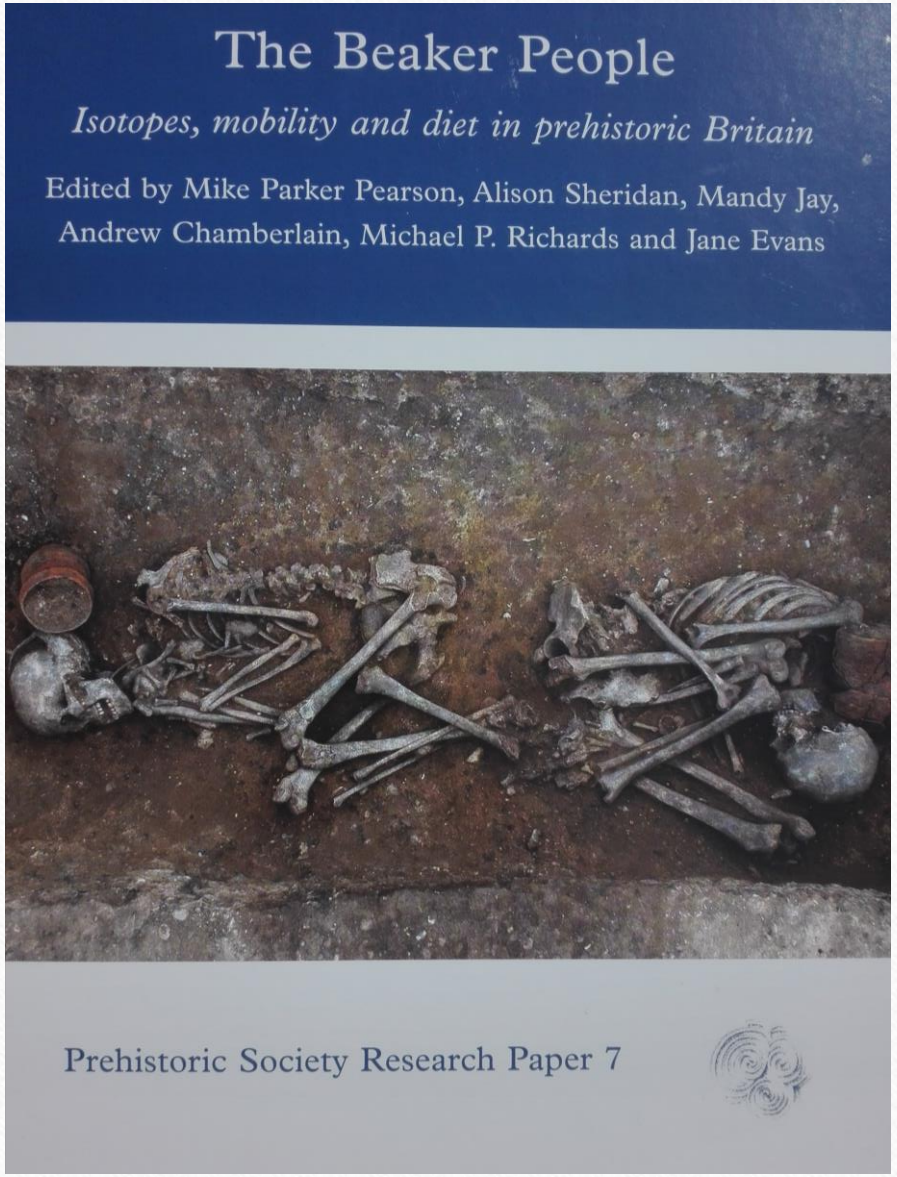
Frei, K. M. & Price, D. 2011: **Strontium isotopes and human mobility in prehistoric Denmark**, *Archaeological and Anthropological Sciences* 4(2), 103-114, DOI: 10.1007/s12520-011-0087-7

Haak, W. G. et al 2008: **Ancient DNA, strontium isotopes, and osteological analyses shed light on social and kinship organization of the later Stone Age**, *Proc. Natl. Acad. Sci. U. S. A.*, 105 (2008), pp. 18226-18231

Price, D.T. 2008. **Isotopes and human migration: case studies in biogeochemistry.** In: H. Schutkowski (ed.) *Between Biology and Culture.* Cambridge: Cambridge University Press.

Schwarcz, H.P., White, C.D., and Longstaffe, F.J. 2010. **Stable and Radiogenic Isotopes in Biological Archaeology: Some Applications.** In: J.B. West, G.J. Bowen, T.E. Dawson, and K.P. Tu (Eds.) *Isoscapes: Understanding movement, pattern, and process on Earth through isotope mapping.* New York: Springer Science + Business Media B.V.


DE GRUYTER
Claudia Gerling
PREHISTORIC MOBILITY AND PALAEODIET IN WESTERN EURASIA
STABLE ISOTOPE ANALYSIS OF HUMAN POPULATIONS AND DOMESTICATED ANIMALS BETWEEN 3500 AND 300 BC
TOPOI BERLIN STUDIES OF THE ANCIENT WORLD
DE G

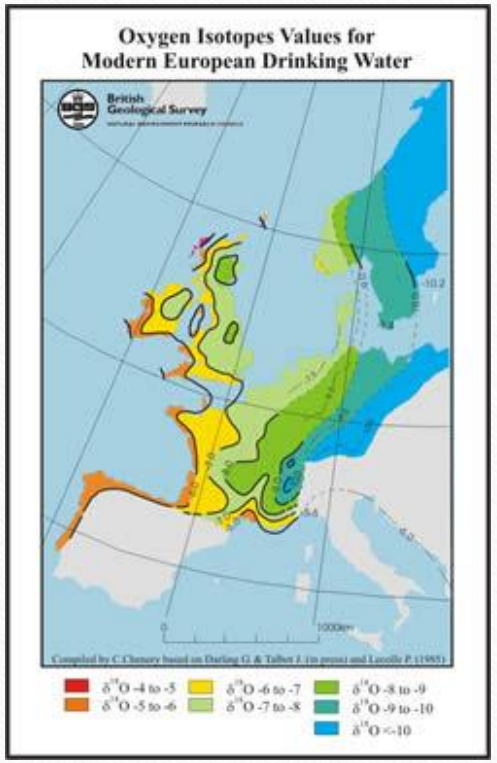

The Beaker People
Isotopes, mobility and diet in prehistoric Britain
Edited by Mike Parker Pearson, Alison Sheridan, Mandy Jay, Andrew Chamberlain, Michael P. Richards and Jane Evans
Prehistoric Society Research Paper 7

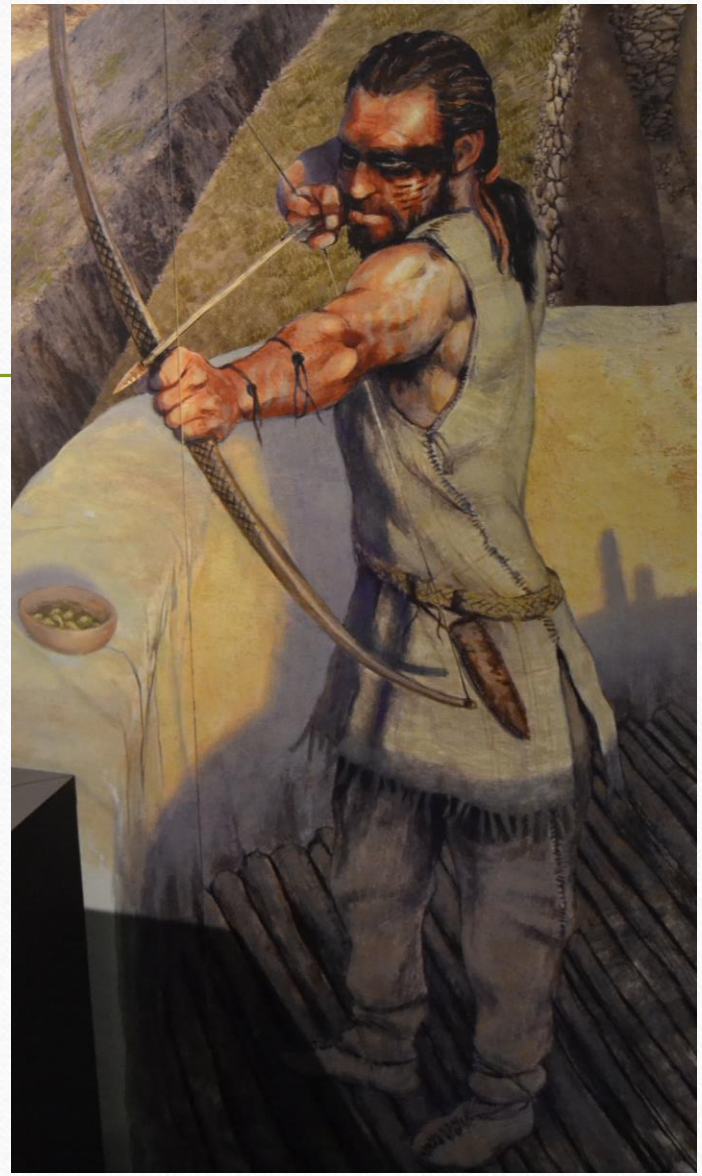
CASE STUDY
Story of Surmir, the archer

Gothic architecture & Beaker Phenomenon

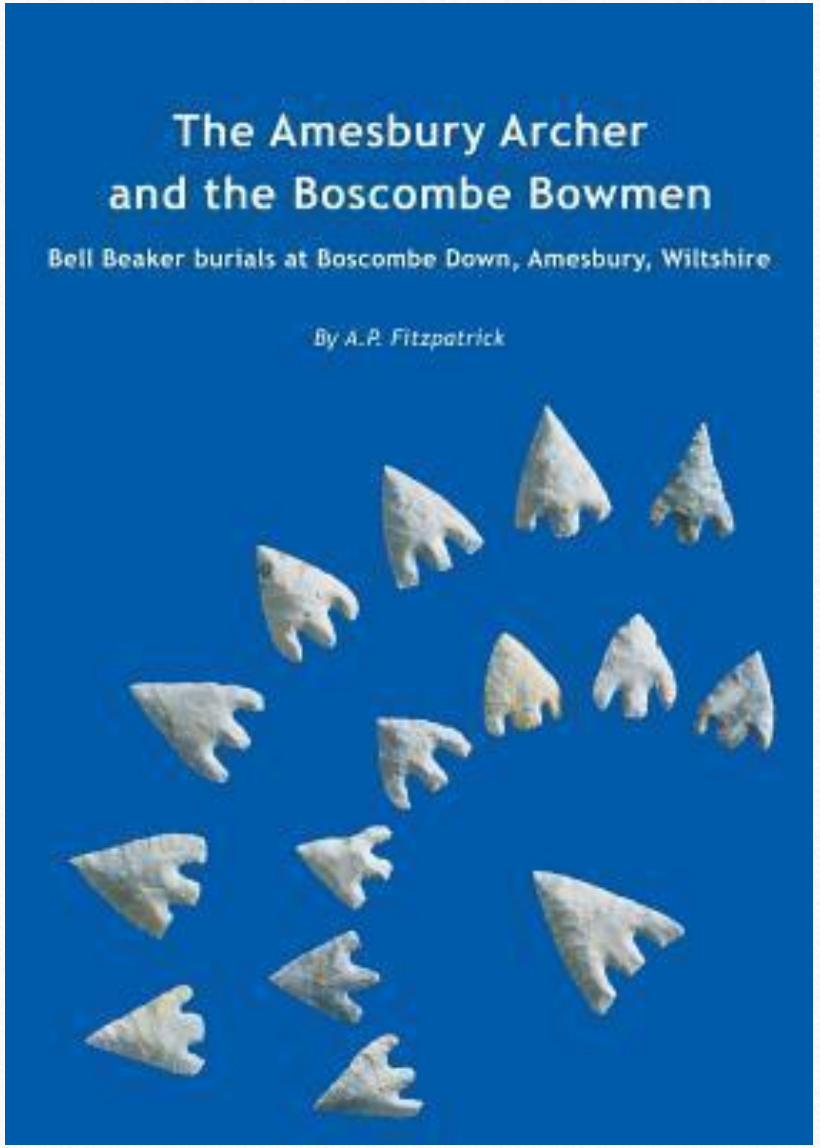
Introducing Surmir

Sex: *Male*
Occupation: Big Man, archer, prospector, metallurgist, priest?
Date and place of birth: *2470 BC., Sion, Canton Vallais, Switzerland*
Marital status: *Married*
Died: 2425 BC., *Amesbury, Wiltshire, England*





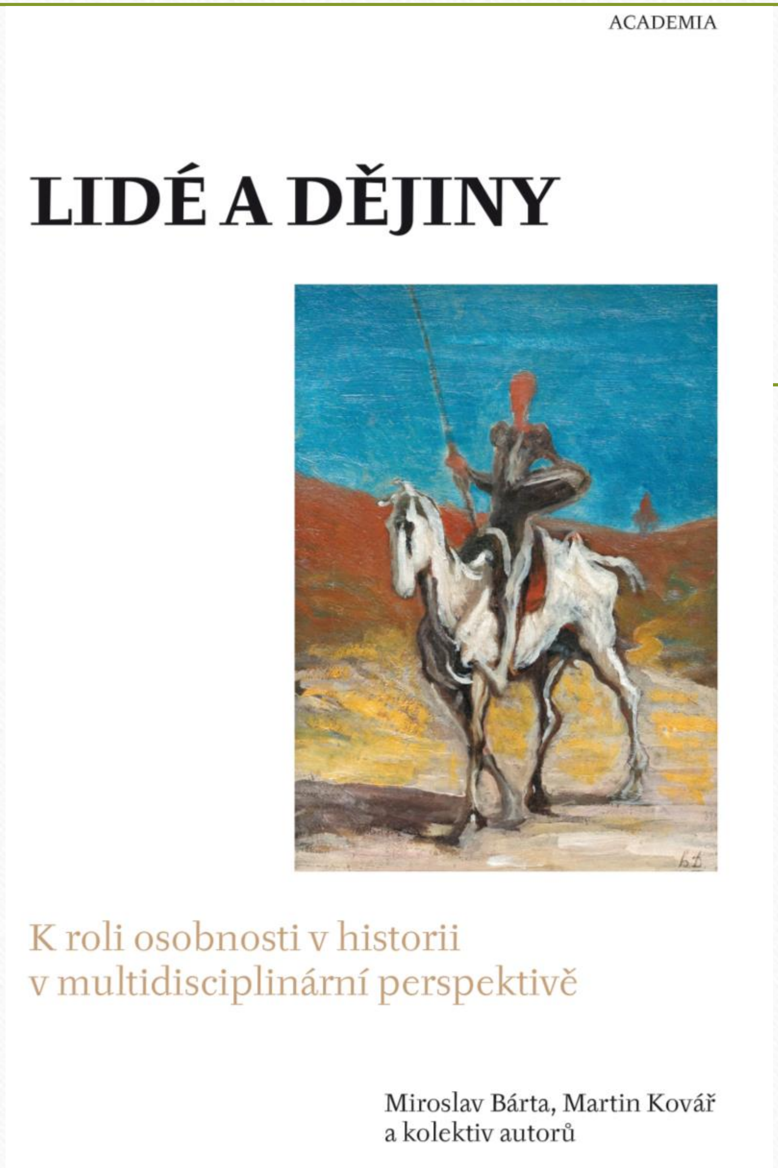
Surmir – literary character based on Amesbury Archer



Fitzpatrick, A. P. 2013: ***The Amesbury Archer and the Boscombe Bowmen***, Wessex Archaeology Report, Salisbury
ISBN10 1874350620

‘There and back again‘

The Amesbury Archer might have made one journey or many.



Surmir‘s life story

https://www.academia.edu/34749497/Jan_Turek_2017

Lukostřelec Surmir (polovina 3. tisíciletí př. Kr.)

Doba okouzlená mědí[1]

Jan Turek

V této kapitole budeme sledovat životní příběh muže, o kterém v podrobnostech mnoho nevíme, jehož osud se ale před námi vynořuje v mlhavých obrysech archeologických dokladů. Neznáme jeho skutečné jméno, datum ani přesné místo jeho narození, ani kolika let se přesně dožil. Jeho životní příběh skládáme jako velmi torzovitou mozaiku, která vystupuje a zase mizí v šeru počínající doby bronzové. Proč tedy chceme vyprávět příběh kohosi, o kom toho víme tak málo? Současná archeologie disponuje vědeckými metodami, o kterých jsme ještě před několika lety neměli ani tušení a díky nim rozkrývá některé dříve netušené vztahy a souvislosti, jež bychom v předhistorické minulosti, tedy před vynálezem písma, jinak nezjistili. Vyvstávají před námi tak alespoň některé obrysy života významného Evropana 3. tisíciletí před Kristem a jeho příběh nám skýtá možnost propojit informace založené na studiu artefaktů a archeologických dat s nimi spojených s naším modelem společenských vztahů a duchovního života této – v mnoha ohledech zlomové – doby.

Archeologové zkoumající pravěkou společnost se nejčastěji zaměřují na otázky společenských vztahů a kulturních a sociálních procesů. Osobnost jednotlivce v tomto hodnocení zpravidla chybí. Zachycení charakteru a soukromých osudů konkrétní osoby na základě analýzy hmotné kultury je velmi nesnadné, ne-li přímo nemožné. Je však třeba mít na paměti, že i v pravěké společnosti byli jedinci nositeli změn kulturních norem a teprve na jejich působení navazovaly širší společenské

[1] Tato kapitola vznikla v rámci Programu rozvoje vědních oblastí na Univerzitě Karlově č. 14: Archeologie mimoevropských oblastí, podprojekt: *Výzkum civilizace starověkého Egypta: Kulturní a politické adaptace severoafrického civilizačního okruhu v průběhu starověku* (3. tis. př. Kr. – 1. tis. po Kr.).

41

This paper uses the fictional figure of Surmir the Bell Beaker archer and noble man as kind of guide through the archaeological reconstruction of society and culture of mid-3rd Millennium BC in Europe. The life story of Surmir was narrated to bring the reality of life in the Copper Age to the general public (Turek 2017a). How can we follow the life story of a man we do not know much about in details, whose fate emerges in the hazy contours of fragmentary archaeological record? We do not know his real name, the date or exact place of his birth, or how many years he has lived. The role model of Surmir is so-called Amesbury archer discovered near the Stonehenge in 2002 (Fitzpatrick 2011) and his hypothetical birthplace was in the foothills of Alps at Sion (Switzerland). His life story is composed of a very torsion-like mosaic that emerges and submerges in the dusk of the Bronze Age.

When examining prehistoric society, we most often focus on issues of social relations and cultural and social processes. The personality of an individual in this evaluation is usually missing. It is very difficult, if not impossible, to capture the character and the personal fate of a particular person on the basis of a material culture analysis. However, we should bear in mind that even in prehistoric society, individuals have been inducing changes in cultural norms and only then they have been followed by wider social processes (Neustupný 1997). Therefore, we should not forget about the role of individuals - personalities in the observation of cultural and social processes. Post-processual archaeology even prefers telling stories of the past on the principle of subjective approach and "personal history" (Trigger 1989).

The narrative part of the text (in Turek 2017a) has always been supplemented by the interpretation of archaeological reconstructions and scientific procedures that archaeologists have led us to these conclusions. Here I am presenting part of the narrative about Surmir in order to clarify some important processes in the prehistoric society, as well as to reflect the results of our research in relation to the non-professional public. In this respect, questions are raised: Are we able to tell a comprehensive life story of someone living in the Copper Age? Are our discoveries relevant to the current public? Are our reconstructions understandable and meaningful? I believe that such a reflection and broad discussion can be useful for our future work and for formulating new questions in our research.

Creation of the Beaker World

The geographic spread of artefacts and decorative styles is not depending solely on migration of people. In this paper I am going to discuss motives that caused rapid spread of cultural uniformity during the 3rd Millennium BC in Europe. The ways of the spread of "Beaker Package" over most of Central and Western Europe might have been different from region to region. The prestigious artefacts were circulated through trading, migration by infiltration, interregional marriages and mobility of individuals. This, however, does not explain why people from geographically and culturally distant regions suddenly shared certain uniform style and symbolic system. The new symbolic system and set package of significant artefacts helped to reinforce the collective identity and maintained range of spiritual activities. Within the individualized funerary practices people emphasized the communication with ancestors and presentation of the social status, as well as, confirmation of social hierarchy and reinforcement of genealogical system of hereditary wealth of individuals and families. I believe that this unification and rapid spread of shared uniformity occurred due to the shared ideology that used the new assemblage of Beaker Package as formal expression of symbolical and cosmological unity (Turek 2015 with further references).

What does the Bell Beaker phenomenon actually comprise? First of all, it is not an archaeological culture, as defined by the traditional cultural-historical paradigm. This concept was set up at the time of the migrationists model of dissemination of material culture and cultural identity, when images of massive migrations prehistoric populations prevailed. In recent decades, there is an increasing number of references to the spreading of the Bell Beaker style as cultural uniformity. But again, this interpretation does not explain the true nature of the rapid spread of cultural uniformity, which, in fact may have been ideologically and perhaps also cosmologically inspired. In the first place, it should be emphasized that the Bell Beaker phenomenon is essentially synthetic, i.e. composed of multiple artefactual elements, culturally stylistic local traditions and a symbolic system, which originated in different places in Europe and possibly also in Northwest Africa.

The ideologically disseminated cultural uniformity was granted a wholly new level of quality by synthesizing several elements, whether innovative or locally traditional. I compare the emergence and spreading of the Bell Beaker phenomenon in Europe with a similar process undergone by the European Gothic style. Between 1140 and 1144 AD, a new choir was built in the St. Denis Abbey near Paris, with its layout quite different from earlier Romanesque buildings. The building featured three main elements that became typical for the newly emerging architectural style: sharp-pointed Gothic arch, flying buttress and rib vault. Neither of these architectural elements, however, was a Gothic invention. They had been occasionally used before. But it was the deliberate combination of these motives that resulted in a new aesthetic quality. If we compare this process with the origins of the decorative Bell Beaker style, we can notice a similar combination of spatially and genetically distant elements. I am fully aware of the considerable difference in the complexity of the society toward the end of the Eneolithic and in the High Middle Ages, but I think that these are two very similar processes in terms of the theory of culture and the dissemination of cultural influences.

Another interpretive inspiration can be found in the way the Gothic style was spreading further. The new style was primarily driven by religious orders, which represented a very limited community in terms of quantity, established in a culturally and linguistically foreign environment. When the Cistercians, for example, founded a new monastery in a foreign land, their architectural style was first very pure and compact, much different from the local cultural tradition. Only later we can see influence of some Cistercian architectural elements on the style of the local religious as well as secular architecture. I do not think that the spreading of the Beaker Package in the 3rd millennium BC was in any way related to a sect worshipping a prehistoric cult, but I find it very useful to note how a small migrant community can contribute to the expansion of a certain style, in particular if that style is part of the presentation of its spiritual tenets. We can use the example of the spread of the Gothic art to demonstrate that the expansion of material culture does not necessarily require major population shifts and that the contacts and political decisions of individuals were often enough to adopt a new style. In case of the Bell Beaker Period, such cultural transfer can be represented for example by Surmir - the Amesbury Archer who was probably a major figure who came to the British Isles with the knowledge of the important and sought-after technology of copper production. We may assume that he was a prospector, metallurgist, merchant and magnate and a powerful man. As we know from early historical societies, social power was often intertwined with a major role in a cult and in religion. Surmir, therefore, may have been one of a group of "high priests" spreading the “Beaker faith” throughout Western Europe (?).

Copper Age Ceremonial Warfare

Specialized weapons and the beauty of warfare was crucial for maintaining the structure and hierarchy of the Copper Age/ Early Bronze Age society (Turek 2017a with further references). During the 3rd Millennium BC the archery symbolism spread together with the Bell Beaker Phenomenon over most of the European continent (Turek 2015 with further references). To introduce this Copper Age Global Issue I quote part of my story about the life of Surmir, the Beaker warrior, archer and big man as it was published in the book of biographies of world historical personalities (Turek 2017a).

…"Part of the social status of Surmir's father was the role of warrior. This privilege was hereditary, so it was predestined also for Surmir as the eldest son. Part of the honour and social standing of the great men was to regularly give an impression of their strength, bravery, warrior's skills and the beauty of their weapons. Several times a year, men took part in the archery competition during their religious holidays. The men competed together, but their goal was not to kill the opponent. They were meant to strike a distant target from different locations and distances, which was part of the customary archery ritual. The chief judge of such a struggle was the community shaman, an old wrinkled man whose face carried the traces of elusive disease and painful rituals and wisdom. The ultimate proof of courage was to face the enemy's shooting. Only the best of the previous games have gone through this stage of the ritual. Surmir's father was unbeatable in archery, and his son went in his footsteps. When Surmir reached five years, his father carved an oak tree bark wristguard and strained a string into a small bow. For Surmir, archery was the best play, it is true that his arrows did not have flint arrows, but rounded ends, but Surmir that did not prevent his daily hunting of singing birds, which he then carried to his mother and proudly laid them on the doorstep like a cat the mouse she just caught. Later, when he was seven, his father began to teach him to shoot with a big bow and real arrows. He hunted his first hare, he was proud of it, and he was still perfecting his archery technique. Unfortunately, fate did not deny his father to experience Surmir's initiation, and it did not even happen in the native valley, but far away on the shore of the ocean. His father was a real warrior. During Surmir's childhood, his father took part in several warships into the confined valleys. Mostly, there were grazing disputes, and copper brokers broke up once. Surmir's father never murdered unnecessarily, but was always ready to defend his loved ones. The attack and murder of whole villages at that time was not exceptional. Once in the battle Surmir's uncle was killed, his father brought his body on his back to the village. Archery was the most important war activity.

.Ever since he was a little boy, Surmir listened to the myths of the archery genius god of the sun. When Surmir was small, he watched with admiration as his father tightened his decorative stone wristguard, fastened the flint tips into the arrows, sharpened and polished his copper dagger, and preparing for the festive decoration of his body. On his equipment and decorations, it was immediately visible that he was the greatest warrior in whole valley, brave and powerful. His father did not have to fight as some young warriors, it was enough when he show off his beautiful war gear and danced the war dance and his position was confirmed.

Later, after his father's death, Surmir inherited one of his father's wristguards. It was made of red stone and it was the most beautiful of all. It was a gift of gods. Only the most powerful ones could wear a red plate. Surmir then retained this plate for rest of his life….

…When his father died….Surmir went to the cemetery where his family had their dolmen, a family tomb, with stelae of ancestors lying face down in front of the entrance. Father's stone stood there since the time he became a "big man". There was Surmir's uncle was already there and together with shaman was preparing his father's stela for his funeral. Stela was a big flat stone slab portrayed father's body. Uncle was holding an axe and a chisel and added rays of the sun on shoulder of father's statue, the symbol of his departure for eternity. Down below was depicted all father's gear, his rich belt, daggers, bow and arrows. Surmir stroked the surface of father's grave stone, glittering dust of the freshly carved relief clung on his palm. His uncle grabbed him around his shoulders and hugged him tightly. The next day, they laid father's body ceremonially in the tomb, embellished the statue reminiscent of his glory and power, and prepared it for the future rite of passage. Throughout the year, Surmir, his mother and little brother came and brought the sacrifice. Mash in a bowl, beer in a cup, and meat on a large burdock leaf. When a year has passed since his death, the ritual of the liberation of the soul took place. The family and all the friends gathered in front of the dolmen, danced, sang and drank beer. Then the men approached the father's gravestone, tied the ropes to them, and for a few pulls they refuted it away and pulled its face to the ground. It was the definitive end of the father's power in the world of living. Surmir was convinced that he had caught sight of his father's soul as it left the tomb, and with the thunder of falling stela it flew up to the sky. The Father's soul finally went out among the ancestors." (Turek 2017b).

Symbolic expression of archery

Human culture is deeply structured by variety of symbols and rituals. Some artefacts of originally practical function might have gain prestigious and symbolic meaning, especially in the time of introduction of important technological innovations or in the context of social ceremonies and warfare ritual activities. During the 3rd millennium BC the warfare symbolism became extremely important in the representation of social power, status and gender categories. Weapons were presented during the funerary ceremonials, as well as, in the world of the living as symbolical attributes of power and prestige. Such signifying artefacts were also used during the ceremonial warfare contests in order to emphasize male strength, fighting skills and accuracy and reinforce the position of individual contestants within the community (Sosna 2011; 2012; Turek 2015; 2017; Nicolas 2017). The prestigious weapons were also depicted on figural grave stones (such as at Petit Chasseur, see fig 1) or on some rock art (e.g. Cemmo at Val Camonica, see fig. 2 and 3). Archery became decisively important in the symbolic expression of warfare during the Bell Beaker Period.

The Bell Beaker archery symbolism interrupted the preceding tradition of battle-axes as main warfare symbols. At the beginning of the Third Millennium BC, after more than a millennium of production and celebration of battle-axes these merely symbolic artefacts gained an even more important role in burial rites, social prestige and perhaps even cosmology. During the Corded Ware period (2900 – 2500 BC) in Central and Eastern Europe, stone tools and weapons played an important socio-symbolic role, as attributes of power and warfare in burial equipment, but probably also in living society (Heath 2017, 39). In the Corded Ware material culture the weapons are mainly stone battle-axes (fig. 4) and mace heads (fig. 5), representing the male gender category in terms of symbolic representation of prestigious objects that were playing a decisive role in the social competition (Turek 2017b).

The Bell Beaker depiction of a bow on the figural grave stones (an example: 157 cm high, 85 cm wide, see fig. 1) from Petit Chasseur (Gallay 2011) has a predecessor in the Corded Ware tomb interior incised decoration from Leuna-Göhlitzsch (Merseburg District) showing a bow and quiver with arrows (194 cm long, 95 cm wide, see Behrens 1973; Probst 1991, 403). The growing social importance of archery is commonly demonstrated within the Bell Beaker burial customs (Turek 2004). In the Bell Beaker Eastern Province occurred the archery sets consisting of arrows with flint arrowheads, stone wristguards, quivers and bows (both yet undiscovered). Antler re-touching tools and sets of flint flakes are representing the craft of arrowhead production symbolically represented in the burial context (Turek, 2003). Another symbolic artefact emphasizing the prestige of archery is the bow shaped pendant mainly made of wild boar tusk (Hájek 1957; Piggot 1971; Turek 2004; Růžičková 2009). These decorative artefacts are perhaps connected to those made of halved wild boar tusks that were probably used for processing of bow surface. Another Bell Beaker artefacts indirectly connected to archery were sandstone arrow shaft smoothers known also from burial context.

As we are going to observe further how archery and its symbolism played an important role amongst prehistoric societies not only as a hunting method, but also mainly as warfare phenomenon. In different cultures of the World the archery shooting contests carried out as a part of the ceremonial warfare presentation became also an important feature of cosmology.

Third Millennium Ceremonial Warfare – battle-axes and archery prestige

I have repeatedly presented the concept of ceremonial warfare and the role of symbolic weapons in ritual combats and ceremonies, including the funerary practices of the 3rd millennium in Central Europe (Turek 2005; 2007). Here I want to discuss the possible procedures of the warriors' competition known as ceremonial warfare in two different Copper age contexts. The Corded Ware (2900-2500 BC, see map – fig. 6) phenomenon is renowned for its battle-axes and mace heads (fig. 4 and 5). These weapons suggest some kind of man-to-man combat during the ceremonial fighting. Besides the skills, fighting strategy and handling the weapon the physical strength would be required from the successful combatant. The competition might have been different in the Bell Beaker Period (2500-2300/2200 cal. BC, see map – fig. 6 and fig. 9). The bow and arrows offered some distance between combatants and for the ceremonial competition within the same community it may be well possible that warriors were involved in some kind of ceremonial archery shooting contest, without threatening each other at all. Such competition would rather test ones accuracy and skills than strength and could possibly be opened also to female (fig. 10) archers (Turek 2011a).

It is likely that in the case of Corded Ware funerary artefacts we encounter some symbolic forms of weapons that within the prehistoric society fulfilled a labelling function reflecting the social status of a particular social category (warriors). Within prehistoric communities such objects apparently played the same or similar role as real functional weapons and symbolically represented the principle of "ceremonial warfare" (Neustupný 1998, 27-30). Neustupný further states: "This kind of warring, however, demonstrates that those who waged such wars were somehow related to each other: the warring parties apparently accepted certain ceremonial rules for which symbolic weapons were appropriate. … Thus, we come to the point that ceremonial fighting took place between communities joined by the relationship of otherness, it was not meant to divide them. …Ceremonial fighting by means of ceremonial weapons was an occasion for individuals to display their bravery. They risked being killed, but their fight was rather a ceremony than defence of one's life." (Neustupný 1998, 28-29). Such a form of ceremonial weapons and ritual matches might well suit the imitation of weapons made of soft rock (Turek – Daněček 2001). Based on the currently available evidence (Turek 2011b) it is not clear whether these imitations were used only as funerary goods, or even in a living society as objects used on more regular basis for a variety of social activities.

Wristguards in action

Such as it is in the present day sport archery, wristguard was an important part of an archer's equipment also in the past. The existence of some kind of protection for archer's wrist may be presumed for most prehistoric periods. However, we have to bear in mind that the Asian method of archery with an arrow right of the bow makes the protection of archer's wrist pointless as during the shooting the string is not at all in contact with the wrist (Korfmann 1972, 217). For the European prehistory, it is possible to presume the prevalent shooting with arrow left of the bow (Vencl 1984). It would be more precise to say with arrow near to the wrist, as in the case of a left-handed archer would be arrow right of the bow, but here will be still the need of protecting the right wrist. Throughout different prehistoric periods specific artefacts occurred (usually made of bone or an antler) that may be interpreted as wristguards. However, only at time of the end of Eneolithic Period and beginning of Bronze Age Reinecke A1/2 (c. 2500 – 1700 cal. BC), is well documented the use of stone wristguards (Turek 2004; Fokkens et al 2008). Bearing in mind the importance of the protection of archer's wrist we have to assume, that there was a common use of such protective devices that might have been made of various organic materials (leather, wood, bark, textile etc.) as it is documented within some present day pre-industrial societies. These artefacts are however not likely to be documented by archaeological methods. For example the Marind-Amid people of Papua New Guinea use grass bracers protecting archers forearms (Fokkens et al. 2008, fig. 11). Such organic artefacts unfortunately did not survive from the European prehistory. The Inuit wristguard made of a walrus tusk was of similar arched shape and system of binding with four holes (Fokkens et al. 2008, fig. 12). An example case how practical wrist protection became a prestigious artefact may be demonstrated on the Navajo leather wristband with a decorative silver board attached (Fokkens et al. 2008, fig. 13). The silver ornament have not enhanced the protective function of the wristguard, but turned it into an archers ornament. Question on the use of stone wristguards (fig. 7 & 8) is related to the way of their wearing and fastening on an archer's wrist. H. Fokkens et al (2008) carried out an analysis of locations of wristguards in funerary contexts in relation to the buried person's anatomy. All wristguards were found on or nearby the left forearm.

Fokkens further studied the position of wristguards on forearms analysing a collection of 31 graves from England and Central Europe that offered relevant archaeological records. About 60% of wristguards were found on the outer side of the wrist (Fokkens et al 2008, 113, fig. 2, 116). Despite of possible shifting of wristguards during the post-depositional processes it seems that most buried individuals had the wristguard on the outer wrist. Fokkens is further interpreting this position as evidence that wristguards were worn as a decorative attachment on a leather (?) bracer (Fokkens et al 2008, 118, Fig. 10). In addition to Dutch colleague's interpretation it may be possible that this might have been the common way of wearing and displaying the decorative stone wristguard: the method of hafting on the forearm made it possible to turn the wristguard into the inner wrist position when needed for shooting an arrow (as suggested in the post-mortem position on wrist of buried individual). Thus, it would be natural that at the time of funeral most of the individuals had their wristguard in the "presentation" position and not in the "ready to shoot" position. Many of these questions seems different when we view them through the analogies of the ethnoarchaeological observations. While discussing the role of archery and warfare in traditional societies it is useful to view the reality of archery combat in ethnographic context. Therefore, I am going to retell the highly inspiring description of tribal war between Kapauku people of Papua New Guinea Highlands as it was observed and recorded in 8 mm film by Leopold Pospisil in 1950s (L. Pospisil, personal communication 1991). As one of first westerners Pospisil had a unique opportunity to live with Kapauku People and study their law and societal structure (Pospisil 1963). One of his recorded observations was a tribal war between two currently antagonised communities. He describes the event as seemingly chaotic combat taking place in high grass zone where men of both sides were hiding and ever so often raised and shot an arrow at the enemy. There were only few warriors on both sides and no fatal casualties. It seems that the killing of the enemy was not the priority and there were no physical contact and man-to-man combat between warriors. Women were fearlessly walking amongst warriors, collecting arrows and pulling the injured men off the battleground. No one of the enemy would hurt the women as they would for the rest of their life become the target of mockery and contempt for other men of the community. This observation represents rather the model of fighting for pride and presentation of strength and bravery, rather than the war that aims to kill the enemy and murder whole their community.

Archery Mythology and Beaker Identity

Archery played an important social role in the ancient civilisations. Legendary archers acted decisive roles in some stories of Medieval Europe, such as the legends of William Tell or Robin Hood. The 4th Century BC scene on the famous electron vessel of the Scythian Kurghan Kul Oba depicts the legendary figure pulling the bow string in competition. References to the prestige of archery skills may be found in Homer's Iliad and Odyssey. The legends of mythical archers are, however, not exclusively a European prerogative. Much earlier are the Hindu epic mythological stories such as Mahabharata, telling the story of the decisive battle of the Kurukshetra War between Kauravas and the Pandavas Bharata lineages and Ramayana describing the battle between Rama and daemon Ravana, who kidnapped his wife Sita. The battle of Ramayana supposedly happened in 3102 BC and despite the fact that the written text date falls into the 1st Millennium BC, the story itself is much earlier. In these stories archery was related to virtues and values such as noble descent, bravery, strength and accuracy (Parakash 1998; Bhasin 2007). Such symbolism was perhaps valued also by European Prehistoric farmers. Within a system of ascribed hereditary status (Turek 2015) archery became an important symbol of power, wealth and identity. This was perhaps also connected to the role of archery in ceremonial warfare. Warfare symbolism structured Prehistoric society more significantly than some important agricultural means of production, such as the plough, team, or sickle that never appear in the Copper Age burial assemblages. Also the significance of archery as a symbol of hunting is not very likely for the European Copper Age society. As we know from the archaeozoological analysis of rare Bell Beaker settlement finds in Central Europe, the percentage of wild species is generally very low, so people did not produce all their archery arsenal for wild game hunting (Turek 2005). We also have to bear in mind that the microscopic trace wear analysis suggests that only about 20% of flint arrowheads from the studied Bohemian collection show traces of shooting (Sosna 2011). This means that the majority of Bell Beaker arrows was only used as prestigious symbol or even produced for ceremonial or funerary purposes.

It is very likely that during the Bell Beaker period archery symbolism was connected to the Beaker Ideology that together with the prestigious objects package and copper metallurgy spread over most of Western and Central Europe. It is also possible that archery symbolism and a solar cult as the core values of the 'Beaker mythology' might have been (Turek 2005) shaping the Bell Beaker cosmology. Unfortunately, the true nature of such cosmology remains a mystery. New ideology or religion was perhaps the engine of cultural transfer across the continent and Beaker archers (fig. 11) – elite men – might have been the 'missionaries' of the Beaker faith. Such cultural transfer can be represented for example by the Amesbury Archer (Fitzpatrick 2011). Andrew Fitzpatrick (2009, 176) described the burial context as: "*An individual who, according to an analysis of strontium and oxygen isotopes in his teeth and bone mass, came from Central Europe (Cheery - Evans 2011, 185-186) was buried with an abundance of artefacts in the south of England. The man we now call the Amesbury Archer lived between about 2,500 and 2,300 years BC (2470-2280 cal BC: OxA-13541; 3895±32 BP). He was buried 5 km south-east of Stonehenge in a small, below ground, timber chamber that may have been surmounted by a low burial mound. Standing 1.75 m tall, the Archer lived to be 35 to 45 years old, but for much of his life he had been disabled because of a traumatic injury to his left knee. At his death, his mourners buried him in the way that was typical for the Bell Beaker burial rite which was common across much of Europe. He was common across much of Europe. He was placed on his left side in a flexed position, slightly curled up as if he was asleep, with his head to the north-east. The offerings placed beside him – the accoutrements of a hunter or warrior and other symbols of status – are also typical of the time. Archery is represented by two stone wristguards and many flint arrowheads that are the equivalent of a quiver of arrows. Other offerings included two gold basket-shaped ornaments, perhaps used as hair tress ornaments, three copper knives, five Bell Beakers, four boars' tusks, many flint tools but also flint flakes or blanks for making new tools, and tools of stone and of antler, including an antler tool for pressure-flaking flint. A black stone, a so-called cushion stone, was a metalworker's tool.*"

Considering the structure of the artefacts found in his grave (Fitzpatrick 2011), we can assume that his arrival in Britain and his exclusive social status there were associated with the spread of the technology of copper and gold metallurgy, which had been previously unknown in the region. This important exportation of the strategic technology would not have, however, probably sufficed in itself to establish an entire archaeological culture within a territory with a long and strong cultural tradition. The model of infiltration (Neustupný 1982) was only viable given a high degree of preparedness of the local society for the adoption of a new culture and its sufficient motivation for such development. Even Neustupný (1982) argues that the success of infiltration was contingent upon the level of cultural and economic development of the newly infiltrated region. As far as the spreading of the Bell Beaker phenomenon was concerned, the communities in the British Isles were prepared not only to adopt a new technology they desired to master, but also to adopt the style of a new culture and probably also the concomitant ideology. Neustupný (1982, 289) further assumes that the infiltration must have been based on economic interests, but I believe that economic interests were just part of the two-way communication between communities and regions. In this respect, it is appropriate to note once again possibly analogical circumstances of the spread of an artistic style in the context of medieval religious orders that represented different spiritual approaches to faith and at the same time brought new way of life and economy into newly 'colonised' territories. Talking about the dissemination of Bell Beakers along with ideology, I do not therefore necessarily mean the spread of an entirely new cult, but more likely a new direction in the cosmology of European farmers. It is in this regard that we cannot ignore the importance of individual mobility for the dissemination of cultural norms and ideas. The already mentioned Amesbury Archer was probably a major figure who came to the British Isles with the knowledge of the important and sought-after technology of copper production (for the importance of specialization and the magical social importance of copper see Kuna 1989; Neustupný 1996; Brodie 1997). A great prospector, metallurgist, merchant and magnate, but perhaps he did not leave continental Europe for Britain only as a powerful man, but also as 'spiritual leader'. As we know from early historical societies, social power was often intertwined with a major role in a cult and in religion. The Amesbury Archer, therefore, may have been one of a group of 'high priests' spreading the 'Beaker faith' throughout Western Europe (Turek 2015).

Ceremonial warfare and genesis of early historic sports

Warfare played an important role within pre and proto-historical communities. Weapons were confirming the social status of individuals and as such they were depicted on grave stelae (fig. 1), in rock art (fig. 2 & 3), and were represented in funerary assemblages (fig. 10a-b). As discussed earlier (Turek 2017b), ceremonial fighting became part of social communication within and between communities. People were developing rituals of ceremonial man to man combat, archery shooting contests, horseraces and perhaps even ball games (Květina et al 2009). Such events became an important part of structuring the society as well as mediating relations to other communities and to supernatural powers. Creation of such traditions served several social, ideological and religious purposes. Many of these institutionalised modes of warfare became archetypes of ancient and modern sports. There is no doubt that most of the ancient Greek Olympic sports were related to the preparation of warriors for wartime engagements. Also later Medieval and Renaissance sports have focused on either man to man combat as demonstrations of individual strength and fighting skills, or on the strategic struggle of two communities. Such a sport was Florence's *Florentino Calcio* (the rules first recorded in 1580) or *La Soule*, a very violent French predecessor of rugby, in which one community attempted to bring the ball into the neighbouring village, even at the cost of occasional loss of life. Equestrian competitions, such as traditional *Paglio* in Siena, though of a non-combat character, have and still has a very violent background in fighting between supporters of local teams (personal observation 2007), such as it was in case of Polo, originating in ancient Persia, spread throughout central Asia and brought to Britain from India (Chehabi & Guttmann 2002). Also, the rudimental symbolic use of some ancient weapons survives to the present day. The example may be seen in halberds used by the Vatican Swiss guard or sabres used by ceremonial royal/presidential guards. The royal sceptre is also a very elaborate, decorative and purely symbolic version of a mace. Archery, foil, épée and sabre are still used in modern Olympic sports. The present-day military parades and army manoeuvres are also part of ceremonial propaganda showing off the most powerful and modern weapons, and are on the current end of the evolutionary trajectory of warfare that had started in Europe already during the Copper Age (Anglo 2000; Turek 2017b).

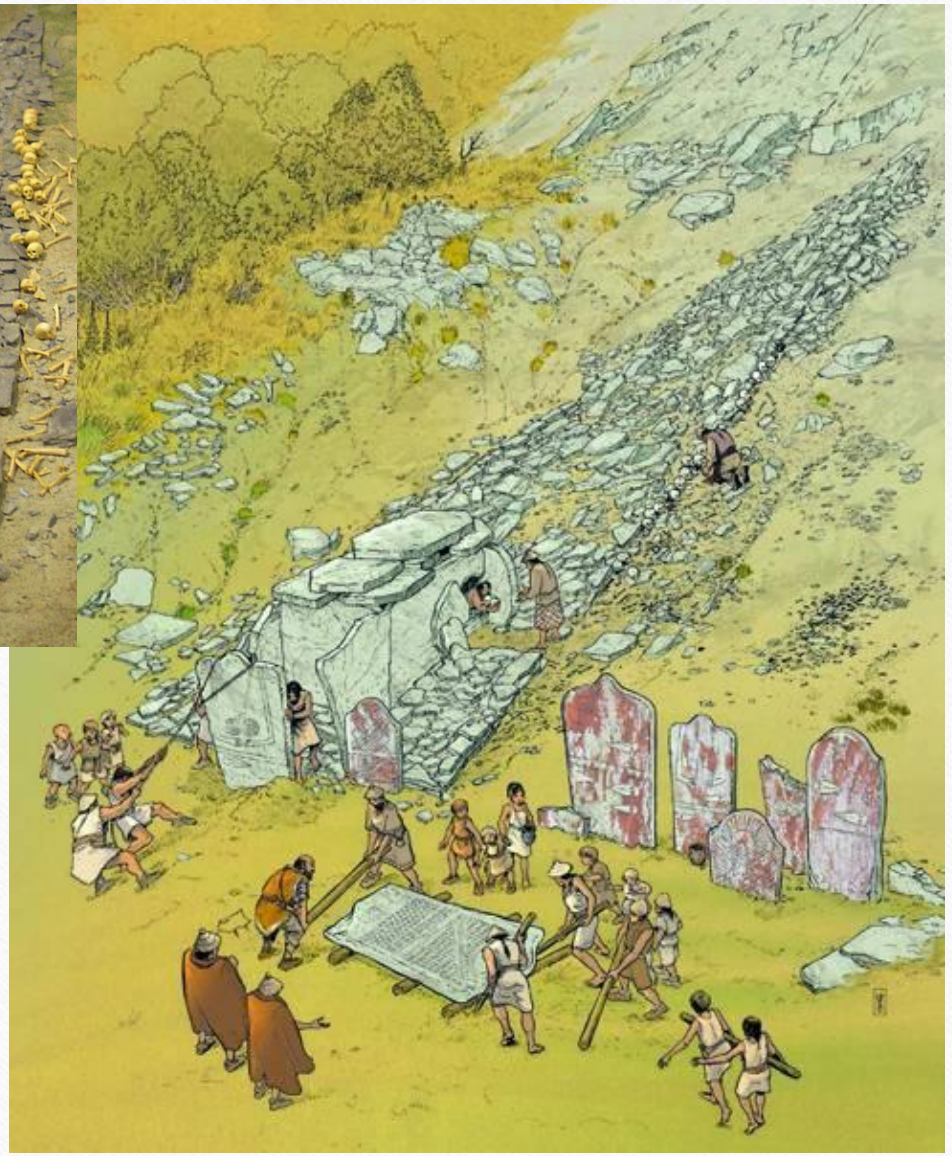
Surmir's native valley (Sion, Valais, CH)

A sacred cup of beer

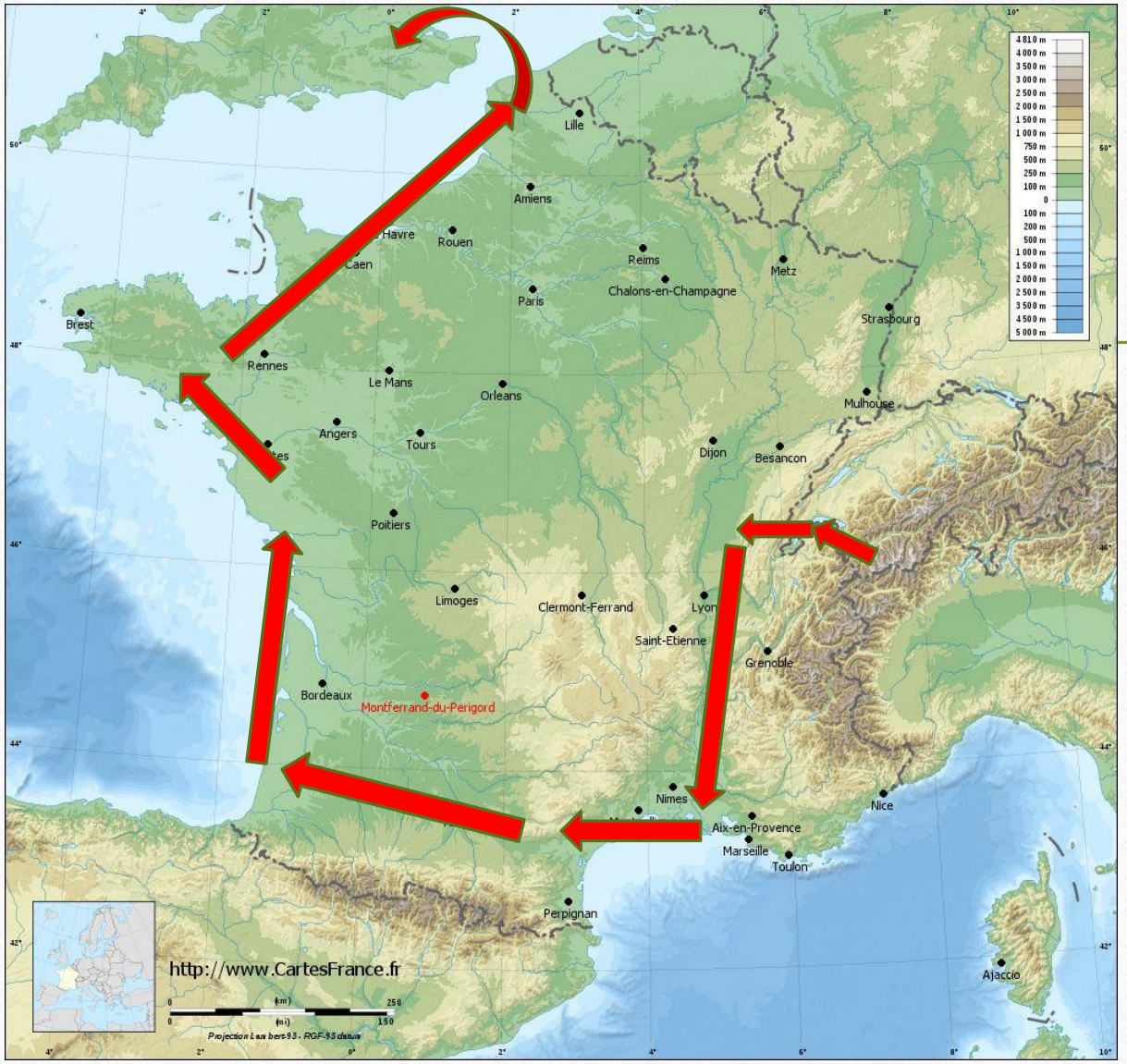
Archery
Ceremonial warfare

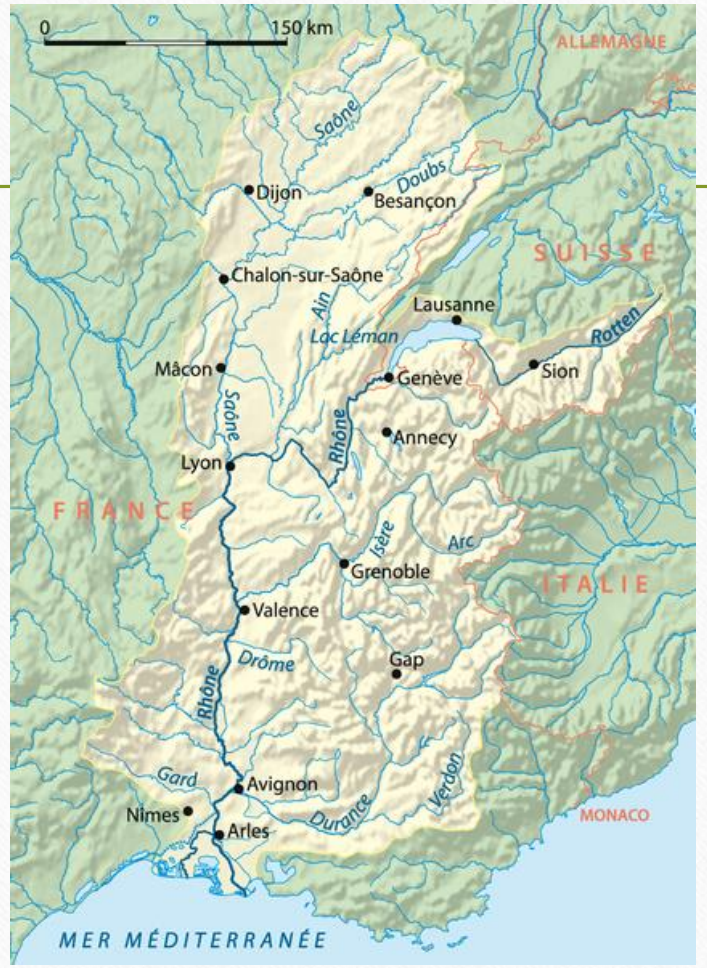
A divine gift of copper

Path to Eternity

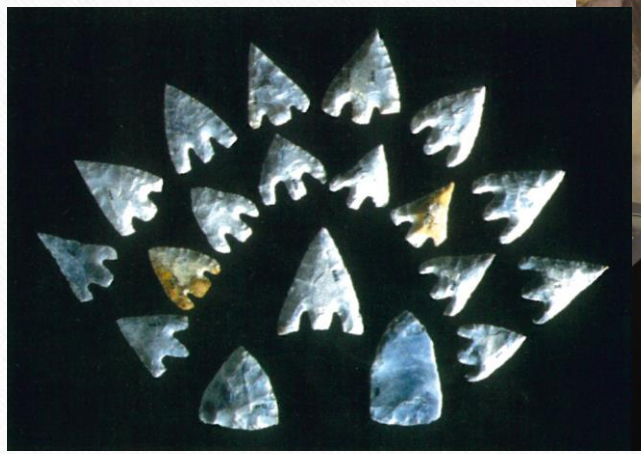


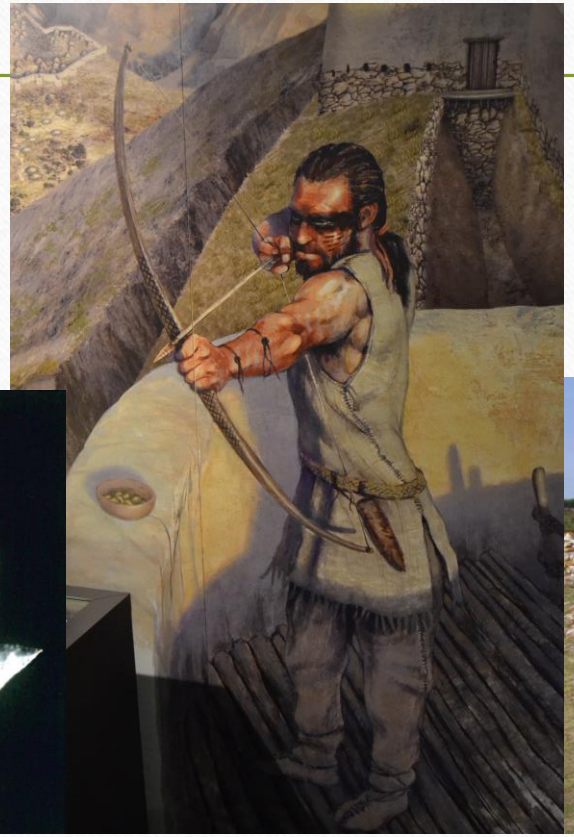
Long journey





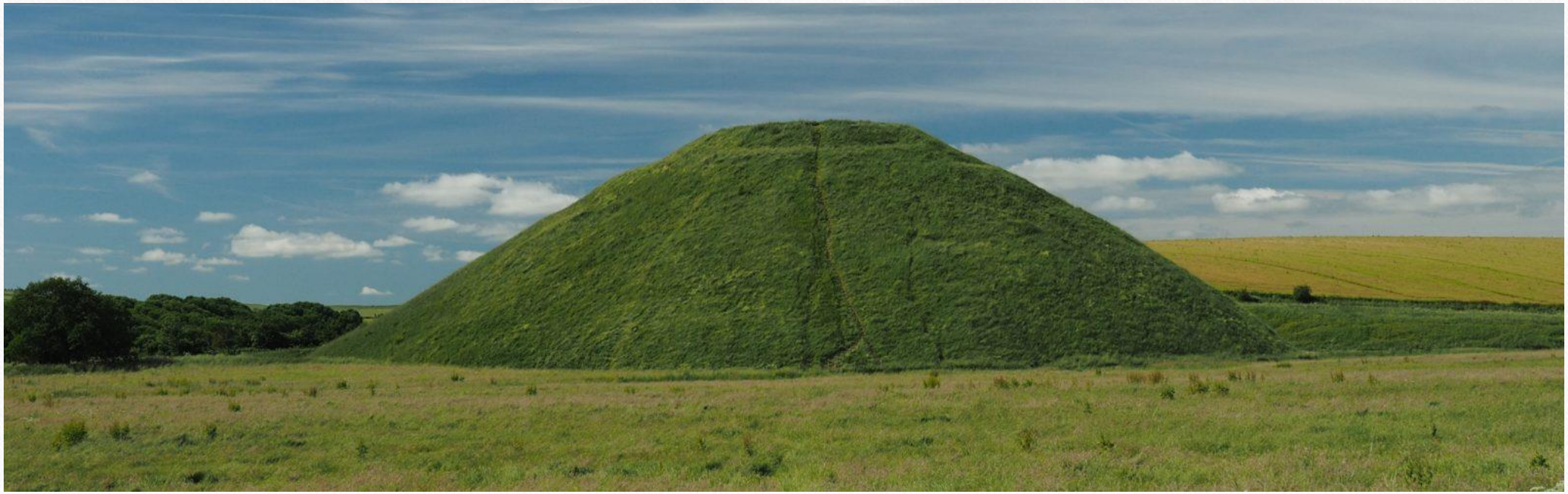
Friendship on the shores of the ocean





New home on the island

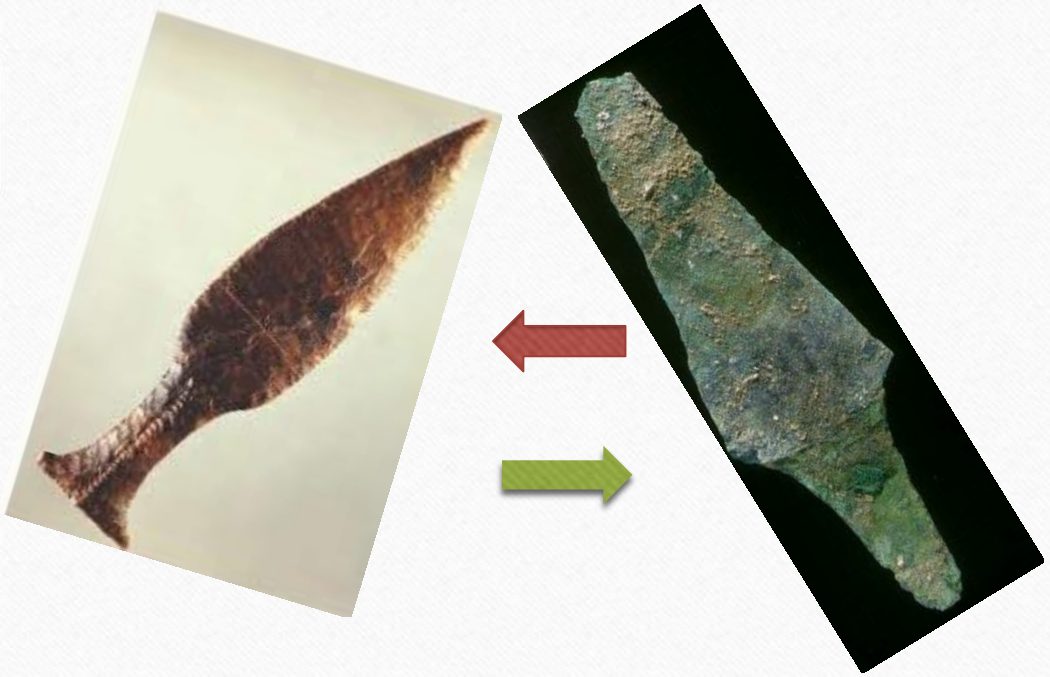
Wedding and Burial



Big man and supreme priest?

Magic Circle

Marriages across the ‘Chalcolithic Frontier‘ and back again



Death
The story goes on

Glorious return

What is the true nature of the Beaker Phenomenon ?

Spread of "Beaker Package" was probably different from region to region. The prestigious artefacts were circulated through trading, migration by infiltration, interregional marriages and mobility of individuals. This, however, does not explain why people from geographically and culturally distant regions suddenly shared certain uniform style and symbolic system. Package of significant artefacts helped to reinforce the collective identity and maintained range of spiritual activities. I believe that this unification and rapid spread of shared uniformity occurred due to the shared ideology that used the new assemblage of Beaker Package as formal expression of symbolical and cosmological unity.

Genesis of the Beaker Package and Gothic Architecture

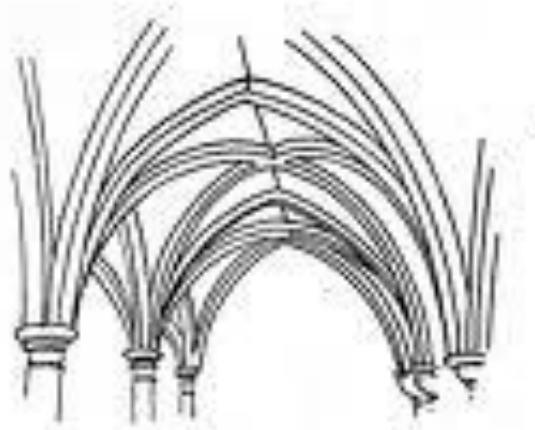
1144 AD

Sharp pointed arch

Ribbed vaulting with pointed arches

A flying buttress

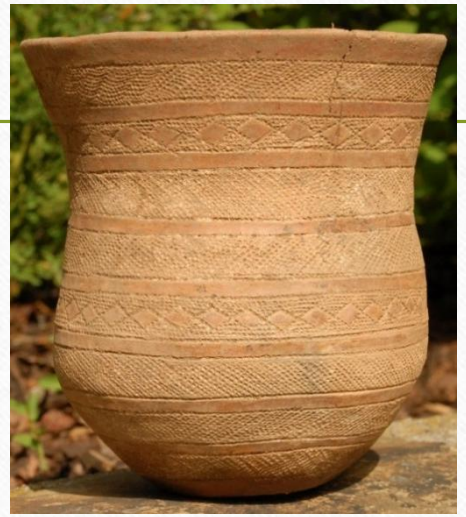
Flying buttress

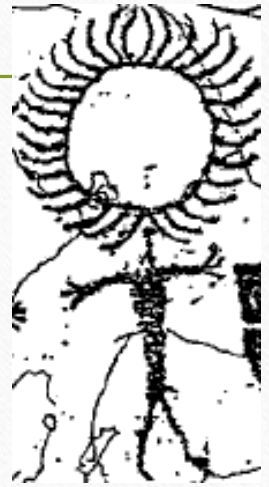


Aisle of Gothic church with ribbed vaulting

Rib vault

2500 BC





Neither of these architectural elements was a Gothic invention!

Spread of Gothic architecture

1144

1180

Since 1200

1340

1438-1710

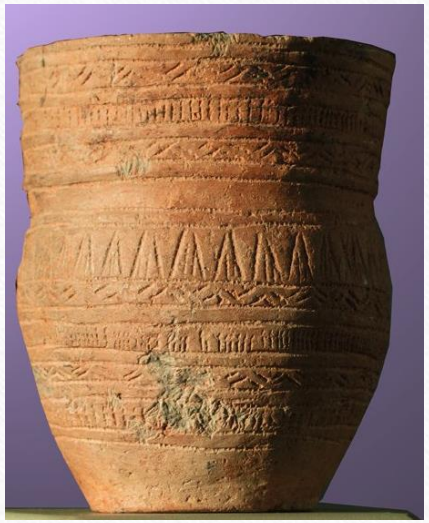
Bell Beaker impact in the Eastern Province

Bell Beaker Eastern Province:

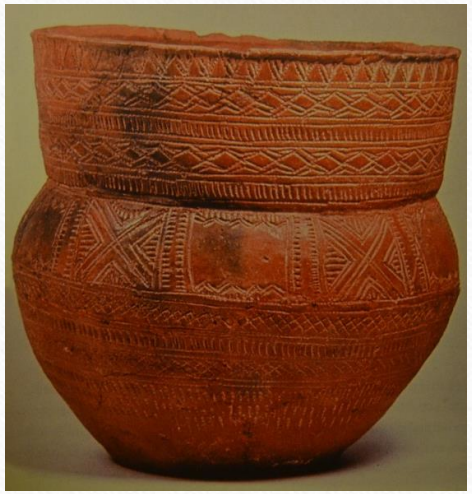
Sequence BB Begleitkeramik→A1 Únětice→A2 Věteřov

Netherlands Bell Beaker–Early Bronze Age Sequence

Maritime/AOO Beakers

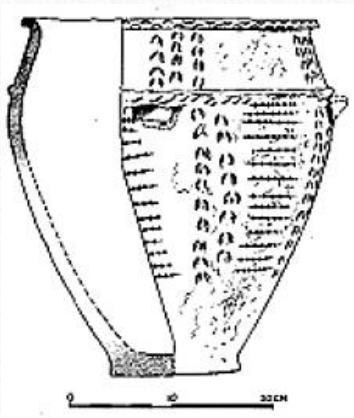


Veluwe Beakers

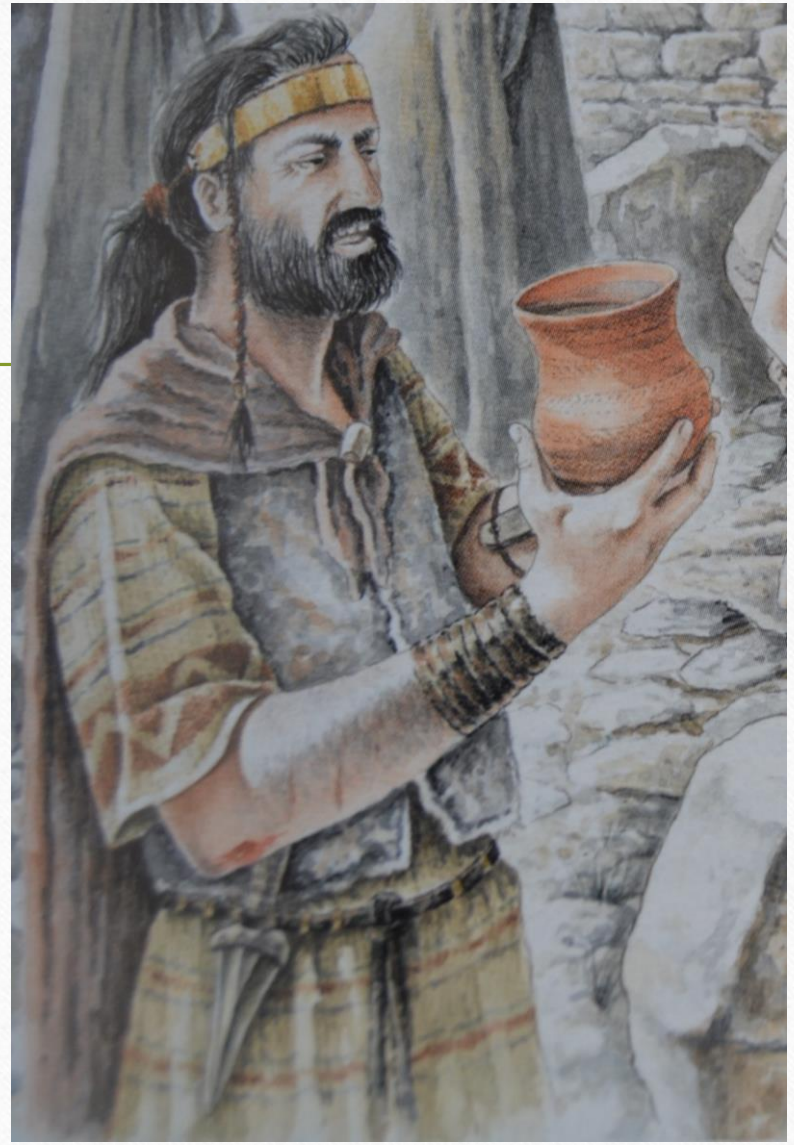


PFB tradition?

Hilversum EBA pottery



Beaker missionaries?
Beaker ideology?
Beaker worship?



Thank you
for your attention!

turekjan@hotmail.com
https://cuni.academia.edu/JanTurek