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Poster Presentation Number 58, Session 3, Friday 2:00-3:00 pm

The long life of Mesolithic bone/antler projectile points from the North Sea

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In the past decades, hundreds of bone/antler points were recovered on the Dutch North Sea coast. These finds, related to the Mesolithic occupation of the now submerged Doggerland, are interpreted as arrowheads and spearheads for hunting activities based on their shape and size [1,2]. As pointed out in previous morphometric and traceology studies [3,4], some points provided evidence, such as binding impressions and adhesive remains that may be related to hafting. To further explore this issue, a sample of 17 bone/antler points with potential hafting traces were selected for a detailed examination at Delft University of Technology and Leiden University.

The tools were analysed with light microscopy to detect macro and microscopic traces of production, use and post-deposition wear. Potential hafting residues were first morphologically characterized and described through microscopy and then inspected with non-destructive and destructive chemical techniques (micro-FTIR, Raman, SEM-EDX, XRD, GC-MS). Before the points were subjected to destructive sampling, 3D models were generated to create permanent records of the objects. In addition, to create a reference collection of relevant hafting traces an experimental program was carried out on bone points.

The functional analysis of the points provided evidence of the long use-life of these tools. Reshaping, reuse, and repair attempts were documented on most of the artefacts. The fractures observed on tools' tips and bases are comparable with impact fractures generated from use as projectiles. The examination of the proximal area of the points revealed a combination of macro and microscopic traces and residues connected to different hafting designs. Based on these data, it is therefore likely that these tools were hafted with the aid of bindings and adhesives with various hafting arrangements.

The results of our comprehensive analysis that integrates examination of use-wear traces and residues – encompassing morphological and chemical identification of residues – and experiments allow us to write a complete biography of these tools and gain insights into their use-life cycle. During their long life, these points were used, reuse, curated, and rehafted many times before being discarded or lost. Their long use-life may be connected to their changing use from spear/atlatl to arrow points. In addition, material selection, e.g., human and brown bear bones [5], may also underline that these points embedded specific cultural and symbolic meaning and therefore used for a very long time by their Mesolithic owners.

References: [1] Amkreutz, L., Spithoven, M., 2020. Hunting beneath the waves. Bone and antler points from North Sea Doggerland off the Dutch coast. Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein und im Ostseeraum 10, 383-404. [2] Verhart, L.B.M., 2000. The Function of Mesolithic Bone and Antler Points. Anthropologie et Préhistoire 111, 114-123. [3] Spithoven, M., 2018. Mesolithic Doggerland, where the points are small: A functional analysis of the small barbed bone points. Unpublished MSc-thesis. [4] Verhart, L.B.M., 1988. Mesolithic barbed points and other implements from Europoort, the Netherlands. Oudheid-kundige Mededelingen uit het Rijkmsueum van Oudehden 68, 145-194. [5] Dekker, J., et al. 2021. Human and cervid osseous materials used for barbed point manufacture in Mesolithic Doggerland. J of Arch. Science: Reports 35, 102678.

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Poster Presentation Number 1, Session 1, Wednesday 2:45-3:45 pm

Paleoenvironmental insights by stable isotopes and phytoliths at Simbiro III Monumental Section (~1.2-1.3 Ma) (Melka Kunture, Upper Awash, Ethiopia)

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Stable isotopes and phytoliths analysis have been widely used in archaeological research, providing key information in the study of paleoclimate and paleoecology, and allowing to test hypotheses on adaptation and habitat changes in Africa during human evolution.

Here, we report on both stable isotopes (^{13}C, ^{18}O) (14 fossil teeth samples) and phytoliths (12 sediment samples) from Simbiro III Monumental Section, investigating the plants' signal and the dietary patterns of herbivores.

The so-called Monumental Section (MS) of Simbiro III is part of the Melka Kunture cluster archaeological sites on the Ethiopian highland, at ~2000 m a.s.l. The MS looks like a ~5 meters-high cliff. It includes the impressive remnant of multiple layers deposited before ~0.9 Ma and currently dated at ~1.2-1.3 Ma, and which were cut by natural erosion and left in full view. The archaeological levels investigated here are from top to bottom Levels A, B, C, and C' from MS, and Level D adjacent to MS.

Isotopic results on bulk enamel samples from the archaeological levels (except levels C and C', due to the lack of fossil faunal remains) indicate that hippopotamids, bovids, and equids were mainly grazers, consuming C_4 plants all through their lifetime. Isotopic carbon data, accordingly, point to C_4 grassland developing in the area. Intra-tooth analysis carried out on a hippo tusk indicates stable C_4 diet and water conditions during the growth of the tusk. Pleistocene hippopotamids, however, were more opportunistic than the other analyzed mammals, and also include an amount of C_3 plants in their diet. Fossil phytolith assemblages from levels B and C' are rich in grass and sedge phytoliths (60% on average). Forest indicators including conifers and woody dicots phytoliths do not exceed 20% and are particularly abundant in level B. Especially in samples from level C', diatoms of the pennate type, sponge remains, and/or *Chrysophyte* cysts were also present suggesting open or marsh wetland. In the time interval sampled here, around the MS graminoids were dominant, growing in an area seasonally underwater. Forests or woodlands including broadleaved trees and shrubs, and conifers, likely developed at some distance. The grass phytolith assemblages indicate that dominant grasses were likely mesophytic *Panicoideae* (which include many C_4 species but also species using the C_3 photosynthetic pathway), and C_3 high-elevation *Pooideae*, while xerophytic C_4 grasses were rare at Simbiro III MS.

Our results show how stable isotopes results from mammal teeth indicate a C_4 diet which is the outcome of ecological factors and behavior, including the selection of preferred plant species. Instead, phytoliths analysis allows characterizing the distribution of local plants at the time of deposit formation. Accordingly, the data are complementary to each other, allowing to reconstruct both the environment "on spot", and the vegetation landscape at a slightly larger distance.