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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 Rijksmuseum van Oudeheden* 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.



Poster Presentation Number 32, Session 2, Thursday 2:15-3:15 pm

Taphonomic approach to the faunal assemblages of the Middle Pleistocene sites of Oxígeno and Santa Elena (Manzanares Valley, Spain)

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The valleys of the Manzanares and Jarama rivers preserve one of the largest concentrations of Pleistocene sites in Europe, and feature plenty of discoveries of lithic industry and faunal remains that have taken place since 1862 [1]. The sites Oxígeno and Santa Elena are located in what is known as the Complex Terrace of Butarque (CTB) downstream from Madrid, to the last stretch of the Manzanares river, where it flows into the river Jarama. In this area the stepped terraces system disappears and gives way to the CTB, thanks to the dissolution of an underlying karst subject to a synsedimentary subsidence process, which gives rise to the thickening of the alluvial deposits, which can reach several tens of meters [2]. Different numerical dates obtained in several spots of the CTB visible base suggest that the bottom of the CTB was deposited during MIS 6 or even MIS 7 [1].

The lithic series of Oxígeno (9,440 pieces) and Santa Elena (2,556 pieces), although fairly unpublished [3], have been described as Large Flake Acheulean on flint, and possible Middle Palaeolithic industries [4]. The presence of handaxes with broad bilateral and bifacial configuration, which occasionally show retouch and edges conformed with soft hammer, and among which amygdaloidal silhouettes predominate, is outstanding both in Oxígeno (4%) and in Santa Elena (6%). Trihedrals and cleavers are also present in both series. Retouched elements are more common in Oxígeno (13%) than in Santa Elena (8%), with scrapers the best represented (37% of the retouched pieces of Oxígeno and 24% of Santa Elena).

This taphonomic study, the first complete one for both collections [5], brings to light a complex taphonomic history when trying to understand these faunal accumulations. 445 fossil elements have been recorded at Oxígeno, consisting of remains of *Bison priscus*, *Bos cf. primigenius*, *Bos/Bison sp.*, *Cervus elaphus*, *Equus caballus*, *Equus hydruntinus*, *Elephas antiquus*, *Elephas sp.*, *Mammuthus sp.*, *Megaloceros matritensis* and *Stephanorhinus sp.* The most commonly represented element are cranial fragments of *Elephas sp.* (24,71%); as well as teeth and mandibular fragments of *Bos cf. primigenius* (12,58%). With regard to Santa Elena, 130 fossil elements have been recorded, which have been identified as those of *Bos cf. primigenius*, *Bos/Bison sp.*, *Cervus sp.*, *Equus caballus*, *Equus sp.*, *Elephas antiquus*, *Mammuthus sp.*, *Megaloceros sp.*, *Stephanorhinus hemitoechus* and *Stephanorhinus sp.* Here, the best represented elements are fragments of *Bos/Bison sp.* (25,38%) horns and of *Elephas sp.* (23,84%) tusks, although taking into consideration the number of molars and premolars, the most abundant taxon (NISP) is *Equus caballus*. Taphonomic processes of weathering, abrasion, rounding, concretion and trampling, among others, have been identified in both assemblages. The incidence of processes related to fluvial transport is higher in Oxígeno than in Santa Elena, where abrasion and rounding are virtually absent. In both sites post-cranial bones are better represented than cranial bones, and their preservation is better. Dismemberment cut marks have been identified on a humerus of *Bos cf. primigenius* in Santa Elena. No cut marks have been preserved in Oxígeno. However, the preservation of the bone surfaces is not good, and therefore the lack of human action cannot just be assumed. Additionally, despite carnivore remains not being identified among the fossil elements, several tooth marks of that type of animals have been recorded: small pits and scores at Oxígeno; as well as pits and furrowing on *Bos cf. primigenius* and *Megaloceros sp.* bones at Santa Elena. The presence of human and carnivore activity makes it even more complicated to interpret the origin of the accumulation of these faunal assemblages associated with Acheulean industries.

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