Integrating zooarchaeology and ZooMS to understand Neanderthal subsistence.

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Bone fragmentation complicates the analysis of past human subsistence behaviour. Palaeolithic faunal assemblages are highly fragmented by numerous taphonomic agents such as carnivores and humans. This prevents taxonomic identification using traditional morphological criteria, and could potentially exclude a large quantity of archaeologically valuable data. As previous studies of past human behaviour rely solely on morphologically identifiable fauna, how representative of the whole assemblage is this identifiable portion? How can the unidentifiable bone component complement our understanding of past human subsistence behaviour?

Collagen type 1 (COL1) peptide mass fingerprinting through ZooMS (Zooarchaeology by Mass Spectrometry) is a minimally destructive proteomic method. It focuses on unidentifiable bone fragments and provides comparable zooarchaeological datasets allowing for fresh insight into subsistence patterns.

We have used untargeted ZooMS analysis to investigate bone fragmentation and faunal composition within various levels at Late Pleistocene sites. Through detailed recording of a range of comparable taphonomic attributes (e.g. weathering, carnivore marks, human modifications), we can assess the role and importance of specific hominin behaviours.

New excavations at Bacho Kiro Cave (Bulgaria) have provided large faunal assemblages, dominated by Ursidae and Bos/Bison. The excellent bone preservation permitted the application of traditional and biomolecular zooarchaeology. The analysis of bone surface modifications among faunal and ZooMS assemblages shows a gradual shift in the proportion of human and carnivore modifications between the Middle and Initial Upper Palaeolithic, suggesting a shift in site occupation patterns.

At Fumane Cave (Italy), the complementary approach used to investigate final Mousterian and Uluzzian contexts show discrepancies in species abundance between the two components, highlighted by a six-fold increase in the quantity of Bos/Bison remains in the ZooMS portion. The higher frequencies of percussion marks suggests that these bone specimens have been intentionally fragmented by human activity, and more so than other taxa, providing new data to our understanding of subsistence behaviour related to faunal carcass processing.

By combining ZooMS with traditional faunal analysis on highly fragmented bone assemblages, we can provide a more complete picture of past human behaviour related to prey selection and the treatment of faunal carcasses. It allows us to reconstruct the butchery practices and subsistence patterns of Neanderthals and assess similarities and discrepancies with Upper Palaeolithic *Homo sapiens*.

Our work on Fumane has been published in Nature Scientific Reports:
https://www.nature.com/articles/s41598-019-48706-z