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Characterisation of Organic Matter Preserved in Earths Using Micromorphological and Chemical Analysis. Initial Results from Two Prehistoric French Sites : Les Bossats and Régismont-le-Haut.

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The Upper Paleolithic (ca. 40 – 10 Ka BP) of Western Europe coincides with the emergence of what are often termed "fully modern" human cultures in a glacial environment (Late Pleistocene, Weichselian glaciation). During this period the increasing structuration of living-spaces, as well as favorable preservational contexts, allows for the investigation of the spatial organization of habitats. Within this field of research hearths have traditionally played a key interpretational role through the use of ethnographic analogy. While such analyses do provide reasonable hypotheses little is known about the precise use and function of hearths during remote prehistory and thus such analogies should be treated prudently..

Using two open-air sites currently being excavated in France, Régismont-le-Haut (Aurignacian) and Les Bossats (Gravettian), we applied a multi-scale and multi-step analysis to a sample of prehistoric hearths. The main objectives of this study were to underline mechanisms involved in the conservation (taphonomic processes) and the operation (anthropogenic technical processes) of these structures. Ultimately, the aim is both a chronological and evidence based palethnological interpretation of these remains through the integration of our results with ongoing research at sites. As hearths are a ubiquitous archaeological feature spanning a multiplicity of contexts and variables, we concentrated here only on those affected by organic matter conservation in the hopes of revealing activities previously invisible to standard archaeological investigation.

Field observations of these hearths show the preservation of structured organic matter (eg. charcoal, burned bones) and in some cases a darkening of the associated sediments.. Micromorphological and experimental investigations led to the attribution of this to an impregnation by amorphous organic matter in a semi-liquid state as it percolates through sediments. Microcontextual observations confirm the in-situ character of this feature and its direct association with hearth use.

Following these observations we sampled several structures and facies in order to characterize this amorphous organic matter at the molecular scale. We first used C/N Elemental Analysis to quantify the organic carbon contained. The most promising samples have been selected for further detailed analyses (including pyrolysis, gas chromatography, mass spectrometry, and lipid analysis) in the hopes determining their exact molecular composition. Preliminary results indicate the conservation of long chain fatty acids, probably linked to higher plants, and cholesterol, so of animal origin. While the former can probably be explained by the nature of the fuel used (wood), the latter may in fact be implicated in the impregnation of sediments by amorphous organic matter.

Although this research is still in its early stages, preliminary results are extremely encouraging. Our methodology seems effective as analysis at multiple scales allows us to trace features from the field to the lab and avoid on-site contamination issues. The flexibility of this methodology is also extremely positive, as analyses can be modified in view of the preceding step's results.

Keywords : Micromorphology ; Organic chemistry ; Organic matter preservation ; Prehistoric hearths ; Upper Palaeolithic