

Poster

A novel non-destructive identification method of prehistoric hafting adhesives with DHS-GC×GC-TOFMS

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It is well-known that prehistoric people were gifted stone workers making most of their tools from stone. Moreover they invented ways to attach a handle to those stone tools transforming the stone tools into powerful knives spears and arrows etc. this skill is called hafting. The handle is often made from wood or antler and can be attached with an adhesive (resin birch tar) or with bindings (animal or vegetal) or a combination. Evidence is scarce as the handles were made from organic materials which perish over time. Luckily hafting leaves traces on the stone tools which are preserved under optimal conditions and providing us with indirect evidence. The first evidence of hafting without adhesive is found from about 250000 years ago[1] and from 80000 years onwards presence of adhesive is more prevalent[2].

Chemical identification of those adhesives is challenging but important. Challenging because the sample size is tiny and each artefact is unique due to degradation. Important as it might reveal the technical expertise of prehistoric man and to what natural resources they had access to[3]. Currently the most accurate identification technique is gas chromatography coupled to mass spectrometry (GC-MS). Unfortunately GC-MS requires solvent extraction and derivatisation destroying (most of) the adhesive. As a result only a few artefacts with enough adhesive preserved have been identified with GC-MS[4]. Therefore research for a new powerful but non-destructive technique is crucial.

In this study a new non-destructive identification technique is investigated; dynamic headspace coupled to a two-dimensional comprehensive gas chromatography-time-of-flight mass spectrometer (DHS-GC×GC-TOFMS). Headspace techniques are known to be clean non-destructive and fast. Generally DHS is one of the most sensitive headspaces techniques. Several different adhesives are measured with DHS to test the versatility of the method. Subsequently a library including these adhesives is made to assist with the identification of unknown residues on archaeological artefacts.

[1] Rots V. Insights into early Middle Palaeolithic tool use and hafting in Western Europe. The functional analysis of level IIa of the early Middle Palaeolithic site of Biache-Saint-Vaast (France). *Journal of Archaeological Science* 2013 40 497–506.

[2] Cnuts D. Perrault K. A. Stefanuto P. H. Dubois L. M. Focant J. F. Rots V. Fingerprinting Glues Using HS-SPME GC×GC–HRTOFMS: a New Powerful Method Allows Tracking Glues Back in Time. *Archaeometry* 2018 60 1361–1376.