Paper

Molecular Analysis of Plant Resin by Gas Chromatography-Mass Spectrometry (GC-MS)

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Abstract

Plant resin is an organic material that has been utilised by humans throughout the past for a number of purposes, including hafting stone tools, sealing pots, burning as incense and for torches. It is composed mainly of terpenes, which have both a volatile and a non-volatile fraction. The ratio of these fractions determines the viscosity of the resin, from fluid oleoresins to the hard copals. Although the volatile fraction is often lost over time, causing aged resin to become brittle, the non-volatile fraction preserves exceptionally well for an organic substance, and is often found in archaeological contexts.

Archaeological resins have previously been analysed using a number of scientific techniques, most often Raman Spectroscopy, Fourier Transform Infra-Red Spectroscopy (FTIR) and Gas Chromatography. Combined Gas Chromatography-Mass Spectrometry (GC-MS) produces by far the most sensitive and comprehensive analysis of resin, providing a quantified molecular fingerprint for each compound. These fingerprints can then be compared with modern examples to identify their botanical source as well as any technological alterations caused by heating, or separating or mixing compounds, plus any products and losses that have occurred due to degradation. In some cases, biomarkers have been identified, which can indicate particular resins, but this approach is currently very limited in its application.

I will present two case studies that use GC-MS for archaeological investigation, comprising analyses of a collection of archaeological resins from Niah Cave in Borneo, and a collection of ethnographic resins originating from Australia and Oceania that are housed in the Pitt Rivers Museum in Oxford, England. Both of these case studies focus on the nature of past resin use and the technological choices made in this regard, including the purpose of the resin as a material and the type of artefact it is used on.

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