Title: Degradation preserved as spectral shifts: FTIR analysis of experimentally degraded adhesives

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Abstract:

This study evaluates the potential of Fourier-Transform Infrared Spectroscopy (FTIR) to detect and interpret chemical changes that occur in resin-beeswax adhesives resulting from short-term burial in diverse depositional environments. Within a controlled experimental framework, spruce resin and beeswax admixtures adhered to flint flakes were buried for three years under varying conditions, including sand, clay and loess sediments in both open-air and cave settings. They were then subsequently analyzed using FTIR. The resulting spectra reveal subtle but consistent chemical transformations such as oxidation and matrix-related alterations, which differentiate degraded adhesives from their pristine counterparts. The findings highlight FTIR's sensitivity to post-depositional degradation patterns and its ability to identify transformation processes preserved as spectral shifts. These results have direct implications for archaeological residue analysis, demonstrating that environmental exposure leaves diagnostic spectral signatures that can inform on both the composition and taphonomic history of hafting adhesives. This work contributes to a growing methodological foundation for the identification and interpretation of ancient residues with FTIR, emphasizing the value of experimental studies in archaeological science.