

# CLASSIFICATION OF ARCHAEOLOGICAL ADHESIVES FROM EASTERN EUROPE AND URALS BY ATR-FT-IR SPECTROSCOPY AND CHEMOMETRIC ANALYSIS

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The use of resins and tars has a long history going back to as far as the Paleolithic in various ways: hafting composite tools, decorating, lining and repairing ceramic vessels [1]. Attenuated total reflection-Fourier transform-infrared spectroscopy (ATR-FT-IR) analysis of 100 adhesive samples from different prehistoric composite artefacts, pottery and amorphous lumps across Eastern Europe and Urals were conducted to establish a fast analytical screening method for adhesive assignment.

ATR-FT-IR analysis allowed the identification of major chemical components of the adhesive samples which were assigned to three main groups: birch bark tar without major additives, birch bark tar with additives and minor/non-birch bark tar samples [2]. ATR-FT-IR spectra were further classified using principal component analysis (PCA)-based discriminant analysis (DA) [3]. The ATR-FT-IR-DA classification were confirmed by analyzing a selection of samples with gas chromatography-mass spectrometry (GC-MS).

Results demonstrate that ATR-FT-IR-DA classification allows fast and reliable preliminary identification of the major components in archaeological adhesives as such it is a considerable and faster alternative to more laborious GC-MS analysis, especially in the case of very small samples..

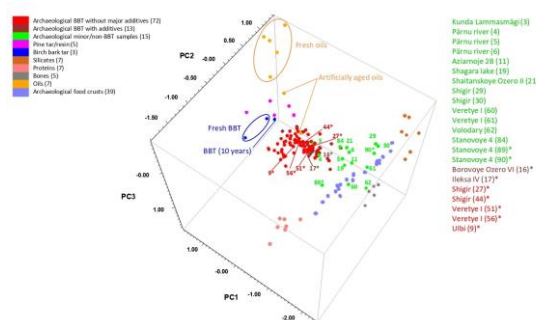


Fig.4 PCA graph for all the ATR-FT-IR spectra of the samples and reference materials using three principal components (PC1, PC2, PC3). Samples analyzed with GC-MS are highlighted with \*.

## References

1. M. Bjørnevad *et al.*, 2019, *Estonian Journal of Archaeology*, 23(2), 103–125
2. C. Daher *et al.*, 2013, *Analytical Methods* 5, 6583-6591
3. P. Peets *et al.*, 2017, *Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy*, 173, 175–181



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