Contribution ID: **24** Type: **Talk**

Raw material characterization or provenance identification? Different levels in the research of polished stone tools by PGAA

Tuesday, November 21, 2023 3:15 PM (25 minutes)

Determination of chemical composition can be a useful tool in provenance research of archaeological finds. The two fundamental levels of archaeometric investigation are the material characterization (i.e., the type of the matter) and the provenance identification (i.e., the source of the matter). Polished stone artefacts are especially appropriate subjects for the provenance approach since their chemical-mineralogical composition has usually not altered during their lifetime. By comparing the petrological-chemical features of archaeological objects with those of the potential raw materials, we can find how the archaeological items correlate directly with the raw materials and indirectly with the potential geological sources. Obviously, when investigating precious objects of cultural heritage, non-destructive methods are strongly preferred.
Prompt-gamma activation analysis (PGAA) is a non-destructive method for the determination of the bulk elemental composition (mostly major, a few minor and some trace elements) of different archaeological materials. The comprehensive research of polished stone tools has been performed since the 1990s, aimed of mapping the raw material procurement and the circulation as archaeological items in Hungary and surroundings from the Neolithic to Early Bronze Age (e.g. Szakmány 1996, Starnini & Szakmány 1998, Szakmány & Kasztovszky 2004, Szakmány et al. 2011, Bendő et al. 2019, Váczi et al. 2019, Szilágyi et al. 2021, Kereskényi et al. 2020, 2023). On the material characterization's level, the main discriminative chemical constituents proved to be in general some of the major and minor elements (Si, Ti, Al, Fe and Mg) by applying Principal Component Analysis (PCA) on the PGAA dataset. On the provenance identification's level, major elements of alkali metals, Al, Fe and Ti could give further clue. Depending on the occurring rock types, raw material characterization and provenance determination can be done with medium-to-high certainty with the help of PGAA. Although PGAA proved to be a powerful non-destructive method to identify serpentinite, 'white stone'and hornfels, for other rock types it has limited success and requires complementary –sometimes destructive –methods (e.g. magnetic susceptibility, microscopic petrography, scanning electron microscopy).
The varieties of 'greenish metamorphic rocks'(greenschists, contact metabasites, amphibolites, blueschists, nephrites, high-pressure metaophiolites) can be characterised with similar chemical compositions, but with moderate differences in Ti, K, Mg, Mn and Fe. For example, blueschist implements proved to be originated from the Meliatic unit (Slovakia), while amphibolites are from the Gemericum-Veporicum (Slovakia). Five groups of nephrite were possible to be distinguished among the artefacts discovered in Hungary, most of them can be originated from the Lower Silesian Jordanów (Poland), while the origins of other four groups are uncertain (probably Alpine sources). High-pressure metaophiolites can be connected to the Alpine type eclogite facies metamorphites (Italy). Chemical overlapping of the 'greenish metamorphic rocks'can be found with magmatic rocks. The tools made of basic magmatic (or their slightly metamorphic varieties) rocks (basalts, metadolerites) can be connected to larger regional raw material units (SW Hungarian basaltic rocks of Mecsek Mts., NW Hungarian basalt types of Balaton-Highland, Kisalföld and the Novohrad-Gemer (Nógrád-Gömör) area) without exact raw material sources, mostly based on their elevated Ti and Fe content. Dolerite-microgabbro-metadolerite-metamicrogabbro lithic tools can be potentially connected to the Szarvaskő and Maros-valley geological sources. Serpentinites are Mg-Si-rich lithotypes with variable Cr or Ni content. Hornfels artefacts can be separated from other rock types by their Ca, Si, Ti and Fe content, and their provenance is related to the Maros-valley. 'White stone'is a term for a rock type with diverse but mostly Mg-Si- and/or Ca-rich composition. Serpentinites, nephrites, hornfels and Mg-Si-rich subgroup of 'white stones'comprise clearly distinguishable clusters.

Bendő et al. 2019. Archaeological and Anthropological Sciences 11: 1643–1667.
Kereskényi et al. 2020. Journal of Archaeological Science: Reports 32: 102437.
Kereskényi et al. 2023. Archeometriai Műhely XX/1: 1–22.
Starnini & Szakmány 1998. Acta Archaeologica Academiae Scientarium Hungaricae 50: 279-342.
Szakmány 1996. In: Makkay et al. (eds.) Excavations at Bicske-Galagonyás (part III). The Notenkopf and Sopot-Bicske cultural phases. Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia, Quaderno 6. Trieste: 224-241.
Szakmány & Kasztovszky 2004. European Journal of Mineralogy 16/2: 285–295.
Szakmány et al. 2011. European Journal of Mineralogy 23: 883–893.
Szilágyi et al. 2021. Archeometriai Műhely XVIII/3: 237–260.
Váczi et al. 2019. European Journal of Mineralogy 31/5-6: 905–917.

Primary author: SZILÁGYI, Veronika (Centre for Energy Research)

Co-authors: KASZTOVSZKY, Zsolt (Centre for Energy Research); KERESKÉNYI, Erika (Bay Zoltán Nonprofit Ltd. for Applied Research); PÉTERDI, Bálint (Supervisory Authority for Regulatory Affairs); SÁGI, Tamás (Eötvös Loránd University, Centre for Energy Research); SZILÁGYI, Kata (Christian-Albrechts-Universität zu Kiel); T. BIRÓ, Katalin (Hungarian National Museum); SZAKMÁNY, György (Eötvös Loránd University)

Presenter: SZILÁGYI, Veronika (Centre for Energy Research)

Session Classification: Provenance Research

Track Classification: Default track