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### Redaktion:

Friedrich Koller, Institut für Geologische Wissenschaften, Universität Wien  
Geozentrum, Althanstraße 14, A-1090 Wien

Anton Beran, Institut für Mineralogie & Kristallographie, Universität Wien  
Geozentrum, Althanstraße 14, A-1090 Wien

Richard Tessadri, Institut für Mineralogie & Petrographie, Universität Innsbruck  
Innrain 52, A-6020 Innsbruck

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R. Tessadri (Innsbruck)

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**ABSTRACTS**



## PRE- AND POST-FIRING MINERALS IN ANCIENT CERAMICS

Ionescu, C.<sup>1</sup> & Hoeck, V.<sup>2,1</sup>

<sup>1</sup>Department of Geology, Babeş-Bolyai University, 1 Kogălniceanu Str., RO-400084 Cluj-Napoca, Romania

<sup>2</sup>Department of Geography and Geology, University of Salzburg, 34 Hellbrunnerstr., A-5020 Salzburg, Austria  
e-mail:corinai@bioge.ubbcluj.ro

Accurate determination of mineralogical composition is a pre-requisite for reconstructing the ceramic raw materials and firing technology. In this respect, the electron microprobe analyses (EMPA) are a useful tool, routinely applied in petrology but rarely in archaeometry. We will show here the advantages and limitations of this method, exemplified with Late Bronze Age ceramics from Ilişua (N Transylvania, Romania). The studied tableware fragments have a brownish colour and a semifine to coarse granulometry.

One of the characteristic features of the EMPA is their often observed low sum. This can be explained by fine porosity as well as by hydration and hydroxylation processes. Another problem is the extremely fine matrix, which varies in composition on a scale of less than 1-2 µm, which is below the beam resolution. Despite some analytical problems, good results can be achieved with clasts exceeding 10 µm in diameter.

In the Ilişua potshards the clasts include quartz, plagioclase, K-feldspar and micas, rarely amphibole. Plagioclase grains are not zoned, but rather homogeneous or with patchy appearance, and show a wide range of compositions, from oligoclase to bytownite. They cannot be derived from a single rock source. The textural relation with the matrix suggests a firing origin of the more basic plagioclases, whereas the intermediate compositions can be related to the Neogene volcanics cropping out towards north and east of the site. The K-feldspars are partly clastic grains and partly formed upon firing, the latter showing frequently a low K<sub>2</sub>O content. Muscovites occur mainly as form relicts, their composition is only exceptionally preserved. Mostly, they are altered by losing K and Al and gaining Fe.

The majority of the clayish matrix displays low K, low Mg but high Fe contents and is clearly distinguishable from the composition of the micas. Another peculiarity is the variable P content, which can vary within few micrometers distance. The P content is positively correlated with the CaO, suggesting the presence of extremely fine-grained calcium phosphate. However, the P-free matrix has also a high Ca content. The peculiar chemistry of the matrix neither meets the composition of illite nor of montmorillonite or an according mixed layer. The high Fe content could be due to small Fe-oxides particles adsorbed in the clayish matrix, whereas the high Ca content could be related to admixture of extremely fine grained calcite in the raw material.

Summarizing, the EMPA revealed that the matrix is much more complex than is generally thought and consists of a mixture of various clay minerals, newly formed phases and additionally high Fe content. The clasts show partly, e.g. plagioclases, a wide variability and can be interpreted by compositional and textural evidence, either as being derived from some rock sources or having formed during the firing. The latter indicate high temperatures of firing, around 950°C. The precise determination of matrix and clast composition constrains much better the search for raw materials used for producing the pots.

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