

Studying ancient ceramics: interplay between mineralogy, physics, chemistry and geology

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The relation between natural sciences (physics, chemistry, geology) and social sciences (archaeology) has a long history. It arises from the need for scientific data which may help to answer to general and particular questions which preoccupied, preoccupies and will ever preoccupy the minds when finding various ceramic artefacts at archaeological sites: From what kind of materials are they made of? How were these objects manufactured? Where are they from?

On the other hand, there is an obvious academic benefit from studying ceramics for mineralogists, not only for the archaeologists. For example, the complex ceramic mixture is an excellent field to study high-T pyrometamorphism. The initial inhomogeneous mixture of mudstone and tempering material transforms upon firing into a mosaic of micro-domains which are not in equilibrium but yet “coexist”, due to the short time of firing and rapid cooling.

The ceramic objects study needs an integrated approach, combining archaeological, mineralogical, petrographic, chemical and physical data. A wide range of analytical methods can be involved: polarized light optical microscopy (OM), X-Ray diffraction (XRD), electron microprobe (EMP), scanning electron microscopy (SEM), as well as Fourier transform infrared spectroscopy (FTIR), thermal analyses (TA), Raman spectroscopy and electron paramagnetic resonance (EPR). Each method provides a part of a final image.

For a provenance study, the knowledge of the geological and petrographic background of the area around the archaeological site combined with the mineralogy and petrography of the ceramics is mandatory. However, the geochemical data on major, minor, trace and RE elements may shed light not only on the geological sources but also on treatment procedures applied to raw materials, e.g., levigation, selection or mixing. Case studies on pottery sherds found at various prehistoric and historic sites illustrate the state of the art in archaeometric studies in Romania.

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