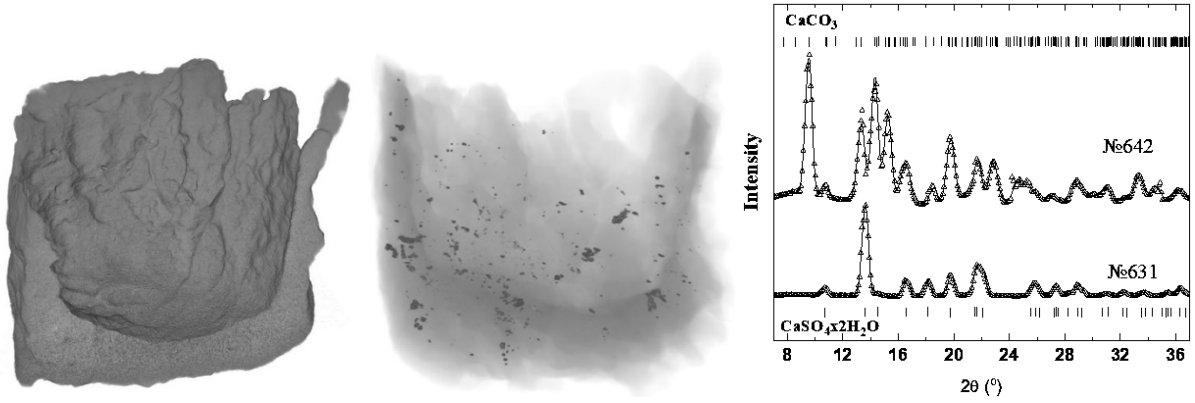
Structural Studies of Greek Alabaster Vases: Data from X-Ray Tomography and Diffraction, Raman Spectroscopy

Smirnova V.S.[1], Kichanov S.E.[1], Bakirov B.A.[1], Saprykina I.A.[1,2], Egorova T.V.[2]

[1]*Joint Institute for Nuclear Research, IIO, Dubna*
[2]*Institute of Archeology of the Russian Academy of Sciences, Moscow, Russian Federation*

There is still no reliable petrographic indicator of the geographical origin of homogeneous gypsum and limestone rocks [1]. Usually, assumptions are made about the origin of raw materials based on the stylistic indications of artifacts or on the geographical proximity of quarries. Currently, a search is underway for structural prerequisites for a comparative analysis of archaeological finds, and on the basis of this, identifying sources of raw materials or locations of ancient workshops [2]. Since the supposed alabaster material of the vases contains mainly light atoms of calcium, sulfur, carbon and oxygen, this makes X-ray imaging methods preferable and effective.

In our work, we present structural studies of alabaster vases from archaeological excavations of the Volna 1 soil burial ground of the 4th-6th centuries, located on the Taman Peninsula. The vases under study are fragments of white and grayish vessels, the differences in their mineral composition and internal volumetric features were studied using X-ray tomography, X-ray diffraction and Raman spectroscopy. Two phases of the vases' material were discovered – a phase of gypsum and calcite with anhydrite inclusions.



(a) (b) (c)

Fig.1. A section of a fragment of a gypsum vase reconstructed from tomographic data (a) and its representation with segmented grains of inclusions (b), X-ray diffraction data on the phase analysis of the material of two vases (c). Experimental points, the profile calculated using the Rietveld method, and the positions of the Bragg peaks for the gypsum and calcite phases are presented.

1. Amin, A.T.A., Elkholy, D.M., Khamis, H.A. et al. Structural and geochemical processes controlling the formation of Egyptian Alabaster at Wadi Mawathil area, Eastern Desert, Egypt. Arab J Geosci 15, 1190 (2022).
2. Bakirov, B.; Smirnova, V.; Kichanov, S.; Shaykhutdinova, E.; Murashev, M.; Kozlenko, D.; Sitdikov, A. Structural Features of the Fragments from Cast Iron Cauldrons of the Medieval Golden Horde: Neutron Tomography Data. J. Imaging 2023, 9, 97.