

STUDY OF CULTURAL HERITAGE OBJECTS FROM THE ANCIENT TURKIC CULT-MEMORIAL COMPLEX OF EAST KAZAKHSTAN WITH NON – DESTRUCTIVE NEUTRON METHODS

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The peculiarities of studying historical artifacts due to their existence in a single copy require non-destructive research methods. Modern methods of non-destructive testing allow us to obtain unique scientific information about the elementary, chemical and phase composition of the object under study, allow us to identify hidden defects in various types of structures, study and visualize internal (volumetric) properties, as well as determine the internal structure of the object under study. Of particular note are such methods of structural non-destructive diagnostics as neutron diffraction and tomography. The nature of the interaction of neutrons with matter determines the high penetrating power of these methods and sensitivity to hydrogen-containing phases or components of the object under study.

This work reports on the results of the study of metal and ceramic objects of cultural heritage (weapons and household items) found in the cult-memorial complex of Eleke Sazy, located on the territory of Tarbagatay district of East Kazakhstan region. The Eleke Sazy cult-memorial complex appeared on the site of the burning of the body of one of the khagans of the Western Turkic Khaganate. The emergence of the cult-memorial complex on Tarbagatay reflects the cultural processes in the center of Asia associated with the entry into the historical arena of the ancient Turks, their spiritual, ideological, religious and philosophical orientations.

To determine the mineral phase composition of the studied ceramics, the neutron diffraction method was used on the DN-6 [1] neutron diffractometer of the IBR-2 pulse reactor (JINR, Dubna, Russia). The features and spatial distribution of phases and the internal structure of metal objects were studied by neutron radiography and tomography [2] at the experimental station TITAN on the 1st channel of the stationary research reactor WWR-K. The obtained data on the mineral composition of the studied ceramic fragments indicate the production of tableware mainly from clay with a natural admixture of feldspar, quartz and mica. The structural features and spatial distribution of various components within the volume of ceramics are also investigated. Neutron tomography made it possible to obtain three-dimensional data on the spatial distribution of chemical elements in the bronze alloy of the samples under study, as well as on internal voids and features of the casting process.

[1] D.P. Kozlenko (2018). The DN-6 Neutron Diffractometer for High-Pressure Research at Half a Megabar Scale Crystals 8, 331.

[2] K.M. Nazarov (2021). Non-destructive analysis of materials by neutron imaging at the TITAN facility. Eurasian Journal of Physics and Functional Materials. 5(1), 6-14.