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Neutron Tomography in the Study of the Cultural Heritage of Antiquity and the Middle Ages

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The study of cultural heritage by modern scientific methods is an important interdisciplinary field. Of particular interest are archaeological finds made of metal. They store valuable information about the technological, economic and social level of ancient states. Corrosion processes occurring in metals also require careful study. This allows the development of restoration and conservation methodologies. However, research methods traditional in archeology are often unacceptable or incorrect due to the destructive nature of the impact or low penetration depth. In such cases, neutron tomography can be used.

In this work, metal artifacts of various ancient states located on the territory of modern Russia were studied. Research experiments were carried out at the facilities of the IBR-2 high-flux pulsed reactor: neutron radiography and tomography (NRT) and a DN-12 diffractometer. Using neutron tomography, spatial variations in the phase composition were visualized, the degree of degradation and the spread of corrosion were determined, and the original appearance of some artifacts was reconstructed. The phase composition was measured by neutron diffraction and Raman spectroscopy. The data obtained made it possible to shed light on aspects of the craft, to identify archaeological objects.

Additionally, we faced a number of problems, the solution of which requires the use of new algorithms for tomographic reconstruction. This is an improvement in the quality of the resulting models, a decrease in the time spent on routine actions, a decrease in the time for the experiment. Therefore, modern approaches have been proposed and applied.

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