

NEUTRON DIFFRACTION AS A METHOD OF ANALYSIS OF SAMANID SILVER DIRCHAMS FROM THE ANCIENT MUROMA BURIAL GROUND PODBOLOT'IE

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Series of silver Samanid dirhams from excavated in 2012 burial ground Podbolot'ie (dated by 8 – middle of 11 cc.), left by the ancient Muroma tribe, were studied by several methods: XRF, neutron diffraction and isotope analyses by Pb-Pb method.

The silver fineness of Arab coins was very high up only to the middle of 10th century. Most of the coins we studied dated by the end of 9th c. – the middle of 10th century. Studied sample of coins from the Podbolot'ie burial ground were manufactured from fine silver, or from silver-copper alloys; the lead was detected in coins as impurity with content up to 1% (XRF; M1 Mistral, Bruker). It is very interesting that all studied coins had a peculiar surface with 'craquelure', which characterizes the presence of a larger amount of lead, which causes 'brittleness' of the alloy.

The neutron diffraction method performed at the DN-12 neutron diffractometer at the IBR-2 high-flux pulsed reactor (Frank Laboratory for Neutron Physics, JINR, Dubna, Russia) turned out to be more informative in this case for obtaining the necessary data on the content of both copper and lead. Almost of coins were manufactured from the fine silver and some coins – from the "yellow multicomponent" silver (content of silver ranged from 900 to 985⁰). But the content of lead in coins, according to the neutron diffraction, was reached up to 4%, in contrast to the data recorded by the XRF-method. Such a high lead content correlates with the marked presence of "craquelures" on the surface of coins. This behavior of lead (lack of liquation on the surface, higher content in the thickness of the coin) may indirectly indicate a special methods of processing the coins during minting.

In most cases the content of the lead in silver ranging from 0,5 to 2,5% indicates its hit from the ore sources (the natural impurity). The neutron diffraction data about content of the lead allowed to study the isotope composition of Pb in silver of coins for determination of the most probable ore source of metal.