Phase Composition and its Spatial Distribution of Antique and Medieval Coins

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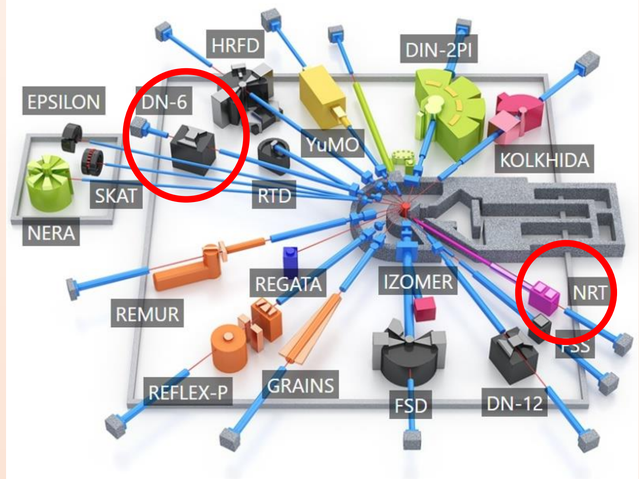
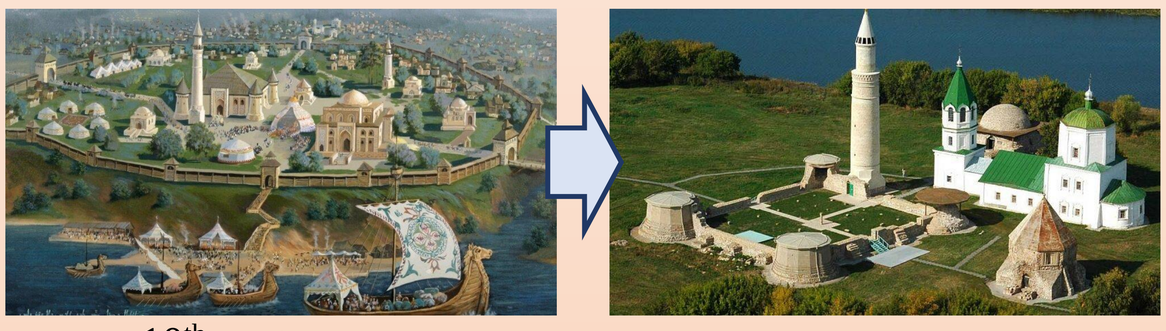
Detailed investigations of the physical and chemical properties of ancient coins are one of the most important directions in the nondestructive testing of objects of cultural heritage. On the one hand, numismatic material contains precious information about the economic and commercial development of ancient civilizations and states; on the other hand, coins are convenient model objects for investigations of corrosion and crack-formation processes that occur in found copper or bronze, silver or gold objects. It should be noted that the experimental data obtained in such investigations are of great importance for the development of a methodology for the restoration and conservation of precious archeological finds and are an invaluable material for identification of the authenticity of the most precious artefacts.



Silver Coins of Medieval Volga Bulgaria

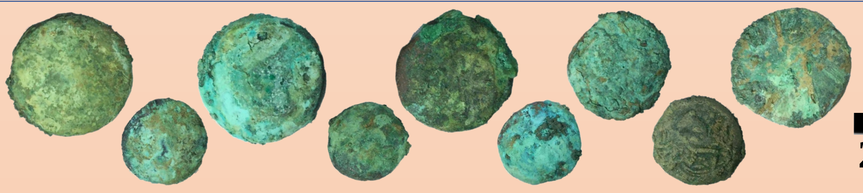


10th century — Now

The convenient position of Volga Bulgaria at one of the central trade routes led to the creation of economic preconditions for the formation of commodity-money relations in the Volga region both within it and with neighboring regions, which resulted in the development of local coining and the wide usage of coins minted in other regions. The study of silver coins of Volga Bulgaria by means of new methods can make it possible to reveal the peculiarities of the chemical composition and the technology of their production to reveal the laws of the Middle Volga region and other regions of that age.

Antique Copper Coins from the Necropolis Volna-1 in Krasnodar Region

A great number of archaeological materials and unique finds, including a numismatic collection, was obtained by archeological excavations of the necropolis “Volna-1”, which is located in the south-west of the Taman Peninsula, Krasnodar region. The necropolis burials date from the second quarter of the VI century BC to the beginning of the III century BC. Numerous finds of Bosporan coins and Greek import items like tableware from Attica and Asia Minor, beads from North Africa, amphoras from the islands of the Aegean Sea and southern Pontus with wine and olive oil remains were indications of the well-being and life of the inhabitants of this ancient settlement.

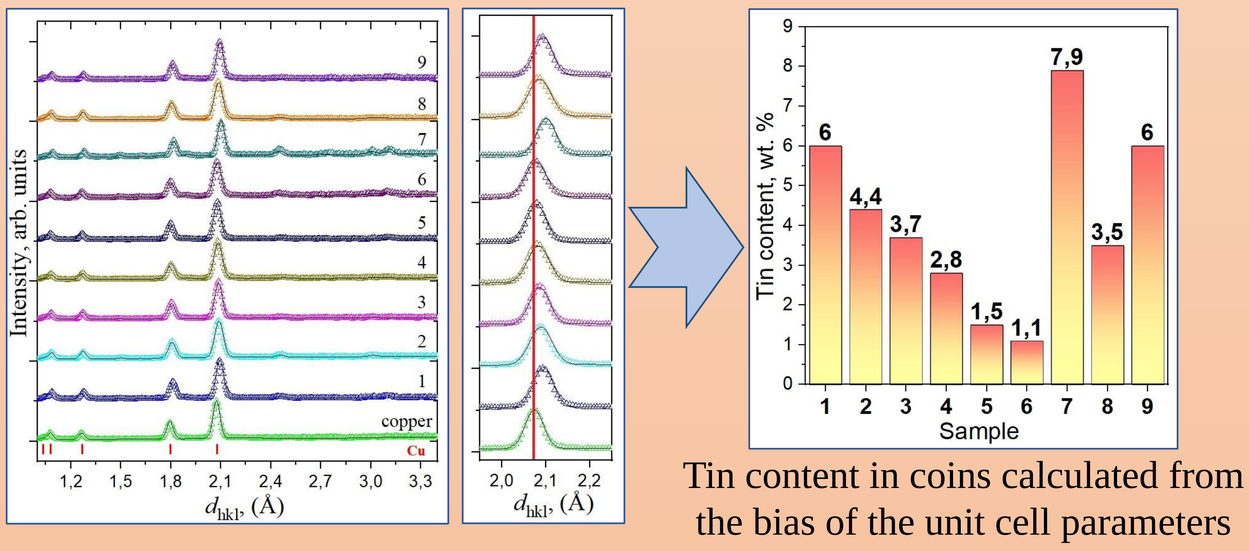


Neutron Diffraction Studies

Expected Result
Copper content in the alloy < 10%

Abnormal result!
Copper content in the alloy ~ 50%

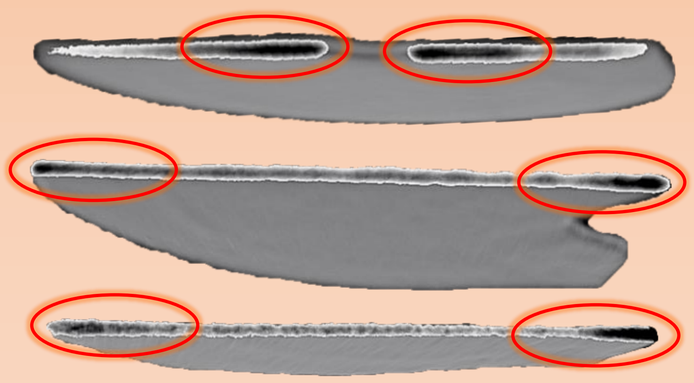
Studying the Composition of the Alloy



Tin content in coins calculated from the bias of the unit cell parameters

Neutron Tomographic Studies

Copper phase localization



The surface was silvering!

Surface Reconstruction

Charon’s Obol

- The neutron diffraction method was used to determine the phase composition of coin alloys and corrosive materials.
- The internal structure of the coins was studied using the neutron tomography method.
- The combination of these methods made it possible to obtain additional information on the technology of minting coins and to carry out identification.