

Electron microscopy methods in studies of archaeological objects.

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The usage of traditional and new material science methods for Cultural Heritage objects investigations resulted in a number of breakthroughs. The comprehensive composition and structural analysis plays highly important role in the scientific base for the development of the history, conservation and restoration of artifacts. One of the key methods used for these goals is the Electron Microscopy (EM) together with Microanalysis (MA). These methods provide relatively quick qualitative and quantitative data on the artifacts. The morphology of the samples in the range of 5 nm-500 μm is usually studied by Scanning EM (SEM) and energy dispersive X-ray spectroscopy (EDXS) [1]. Nowadays these methods are accompanied with focus ion beam (FIB), which enable to produce tiny cross sections and analyze not only the specimen surface but also the bulk. That technique is important for the study of coatings, thin films and multilayer systems, especially when the regular section cannot be prepared in the sake of preservation of the sample. Moreover, FIB together with SEM is used for 3D reconstruction of bulk samples. Recently, low voltage and environmental SEMs were used for the study of non conductive (like ceramic) and organic (wooden or parchment) in the "low vacuum" SEM specimen chamber. The crystal structure of the samples is analyzed by the means of the Transmission EM (TEM). A number of thoughtful studies of a number of cultural heritage objects have been conducted lately in the National Research Center "Kurchatov Institute". These are inlaid metal alloys, ceramic and parchment found in different areas. In our presentation some of these studies like the ancient Cross-Encolpion found near Chernizh-2 (Russia), which were initially dated to the 12th century. They are interesting not only as the historical and iconographic pieces, but as inlaid unknown alloys. The research helped to enlarge the scientific scope of knowledge on Mediaeval materials and manufacturing techniques, while the conservation efforts gave back the proper artistic value to the artifacts. The second is the Italian Terracotta "Madonna Friedrichstein" (XV AC). A study of the origin and manufacturing process (moulding, baking, touching up and painting) of these terracotta pieces has been made on the basis of the data obtained. Insight may then be gained into the technological knowledge and skill of ancient potters. The unique detailed results of these studies will be given in the present contribution.

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