Heritage Science

The aim of heritage science is to enhance the understanding, care, and sustainable use of heritage. As a multidisciplinary domain, heritage science interconnects knowledge and methodologies to address key scientific questions in the field.

The tangible memories of our heritage are characterized not only by their stylistic features but also by their materials and physical properties, from which new knowledge of historical significance can be extracted with appropriate interpretation.

The Heritage Science Research Group is embedded in the European heritage science landscape as an access provider to its infrastructure and expertise in material characterization and carbon dating. Large-scale facilities are complemented with various imaging and analytical tools for a thorough investigation of art and archaeological objects.

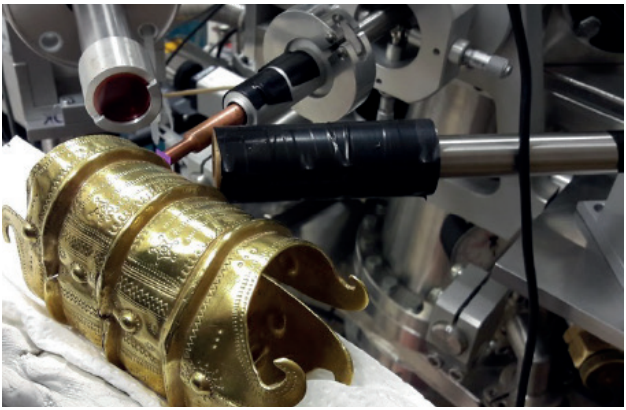
Our laboratories provide information on the structure, material composition, and age of archaeological and museum objects over a wide range of scales using scientific methods, dating, and equipment that allows non-destructive material analysis at the microscopic level.

Micro- and nanoscale imaging, measuring the concentration of elements and isotopes, and identifying chemical compounds and mineral phases can help to reveal the origin, production technology, age, raw materials and state of preservation of objects, as well as the way our ancestors lived.

Raman spectroscopic analysis of a turquoise covered Aztec wooden mask (Museum of Ethnography, Budapest).

Heritage studies is a multidisciplinary field, and our research seeks to answer questions raised by museum professionals and archaeologists. An ion beam analytical setup, installed at the beamlines of the ATOMKI Tandetron accelerator, serves to determine the concentration and distribution of elements both in vacuum and in-air (for larger or sensitive artefacts) with high lateral resolution.

A collection of analytical and imaging tools (3D digital microscope, micro-XRF, Raman microscope, variable pressure electron microscope, etc.) provides complementary information on the structure and composition of the objects. Other ATOMKI infrastructure can also be recruited if need be. The age of objects and jewellery made of organic (e.g. bone, tooth, antler) or inorganic (e.g. shell) carbonaceous materials is determined using the C-14 method, which often also provides the date of the site itself. By measuring carbon, nitrogen and sulphur stable isotopes, we can obtain information on feeding habits or migratory processes. Microfossil analysis of human and animal dental calculus remains can also help us to clarify the history of food and plant cultivation. The hydrogen and oxygen stable isotopes in the inorganic apatite fraction provide evidence of environmental factors, while strontium can be used to trace human migration or, in the case of an object, its place of origin. In addition to joint research with our partners, we carry out methodological research, including optimising measurements and data evaluation for the groups of materials we study, reducing the limit of detection, increasing accuracy, exploring new areas, and, very importantly in this field, defining the safe limits of materials testing methods.



PIXE analysis of a decorated armband, found in the vicinity of Dunavecse (Hungarian National Museum).