

Laser ablation: a moderate micro-sampling of cultural heritage objects for ICP-MS detailed elemental analysis

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Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) is one of modern instrumental methods, which use in elemental analysis of cultural heritage objects has recently noticeably increased. The method requires almost no sample preparation and permits direct analysis of solid samples, availing only minute amount of the material. The micro-destructiveness of ablation processes remains usually within the scale acceptable for art historians, conservators, archaeologists and art curators, therefore the capability to perform multi-elemental, ultra-trace and isotopic analysis can be fully used during studies of cultural heritage objects.

Different scenarios of using laser ablation will be discussed with highlighting their influence on the state of entire objects depending on the analytical protocol developed individually for each case:

- (1) ablation from the mechanically taken fragments of analyzed objects;
- (2) ablation executed directly from a surface of an object, which fits to a closed ablation cell;
- (3) ablation executed in an open cell attached to a surface of an object;
- (4) direct laser ablation executed in ambient air;
- (5) ablation with use of a portable laser device.

Some constrains are reported on using of LA-ICP-MS for quantification, however apart from just a few limitations it is a method that can be flexibly tuned to collect the desired elemental/isotopic information about various cultural heritage objects. The application potential of LA-ICP-MS will be presented in comparison to other instrumental methods and illustrated by examples of a comprehensive use of this method with (i) SEM-EDS; (ii) XRF; (iii) LIBS and (iv) Raman spectroscopy in analysis of diverse historical objects (pottery, red stoneware, glass beads, coins, wall paintings) towards their provenance and identification of used materials.
