Systematic assessment of the analytical performances of handheld and benchtop XRF instruments

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X-ray Fluorescence Analysis (XRF) is a fast, multi-element analytical method that is widely used to examine objects of our cultural and natural heritage. The method is non-destructive, non-contact; however, its information depth is limited, so it primarily provides information about the surface of the sample. The analytical performance depends on the physical processes, the parameters of the instrument, the evaluation methods, and the sample properties.

XRF research on museum objects used to be carried out at the Institute for Nuclear Research for many years, however, the technique based on homemade set-ups was abandoned at one point. As a result of the continuous technological development and spread of commercially available devices, it has become timely to make XRF available in addition to particle-induced X-ray emission (PIXE) spectroscopy in the Laboratory for Heritage Science of the Institute. Our laboratory has a benchtop micro-XRF (M4 TORNADO, Bruker Nano GmbH, Berlin, Germany) and a handheld XRF (S1 TITAN 600, Bruker Nano GmbH, Berlin, Germany) device.

The advantages of the benchtop micro-XRF in comparison with the handheld instrument are the higher intensity, the more controlled measurement geometry, and the fact that the irradiated X-ray beam can be focused, allowing measurements with 20 μm lateral resolution. Furthermore, its vacuum chamber facilitates the detection of light elements. On the other hand, the advantage of the handheld XRF is that it can be used during field measurements due to its small size, simple and fast operation. In this presentation we compare the two devices in terms of their analytical performance. Complex glass standards (Corning A, B, D, NIST 610, 611, 612, and 614), as well as obsidian samples were used for the assessment.

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