

Assessment of chemical analyses by means of portable XRF in the Roman mortars of Complutum archaeological site (Spain)

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The chemical characterization of lime mortars used in Roman period has a great significance and plays a key role in the acquisition of knowledge with respect to construction technology, raw materials and, accordingly, in its conservation works. When it comes to cultural heritage studies, sampling is always complicated since the minimum damage is the primary concern. The use of non-destructive techniques and direct measurements with portable devices reduce the amount of samples and time consumed in analyses, consequently it could be stated that such techniques are extremely useful in conservation and restoration works.

In this study, the portable XRF device was used to determine the composition of chemical elements which compose the Roman lime mortars in the archaeological site of Complutum, Alcalá de Henares (Madrid, Spain) which is listed as a World Heritage Site by UNESCO since 1998.

Portable XRF devices have some detection limits below the ones of the laboratory equipment that are immovable and require sampling. In order to correlate the results, sampling and grinding were initially done to prepare the powders for the laboratory XRF analysis with the following elements: Si, Al, Fe, Ca, Mg, K, Ti, Nb, Zr, Sr, Rb, Pb, Zn and Cr. The analyses of the powdered samples were conducted with the laboratory equipment PHILIPS Magix Pro (PW-2440) from the Centre of Scientific Instrumentation CIC in the University of Granada, and the results were compared to the results gathered with X Ray Florescence (EDTRX) THERMO NITON model XL3T from the Petrophysics Laboratory Geosciences Institute IGEO (CSIC-UCM). Analyses were performed on the surfaces of the samples -without any previous preparation-, and on the powdered samples to compare the variations between both traditional XRF analyses and the portable XRF.

A good correlation was found among the results obtained by the laboratory equipment, the portable device as well as the surface measurements. The results of this study enable to differentiate the types of lime mortars used in the site (Caementicium and Signinum) and in different buildings that form the Roman city.

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