

## **Characterization of concrete from Roman theatre and amphitheater in Emerita Augusta (Mérida, Spain)**

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The restoration of historical buildings is very important for the history and culture of the cities and their population. It requires an advanced knowledge of the building materials used for the construction of these structures. Previously to any intervention in historical buildings, it is necessary a historic-scientific study of the original material. Historic mortars or concretes can reveal us different composition and the dependence on the geographical location and the time period of its construction.

Historical concretes are complex systems that contain aerial or hydraulic binders or a blend of them, with aggregates, not always crystalline, and others elements that interact with the binder. The use of different techniques for microstructural characterization of materials, like optical microscopy, X-ray diffractometry or petrophysical analysis, allows the determination of the composition and some properties of these concretes. However, each technique has its own limits and, in many cases, several characterization techniques must be used to obtain coherent and reliable results.

The present study focuses on the compositional characterization of Roman concrete from Roman buildings for public spectacles of Emerita Augusta, Mérida, Spain. An advanced knowledge of the Roman concrete composition is required to get a reliable restoration and preservation of these ancient monuments. Various samples of concrete were extracted from different zones from this archaeological site. The concrete was studied through mineralogical analysis (petrographic microscope and XRD) and petrophysical properties determination (bulk and real density, open porosity, mercury porosimetry intrusion, compressive strength and Ultrasound propagation velocity). The results obtained allow us to know the original composition of the concrete and the provenance of the aggregates used in it.

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