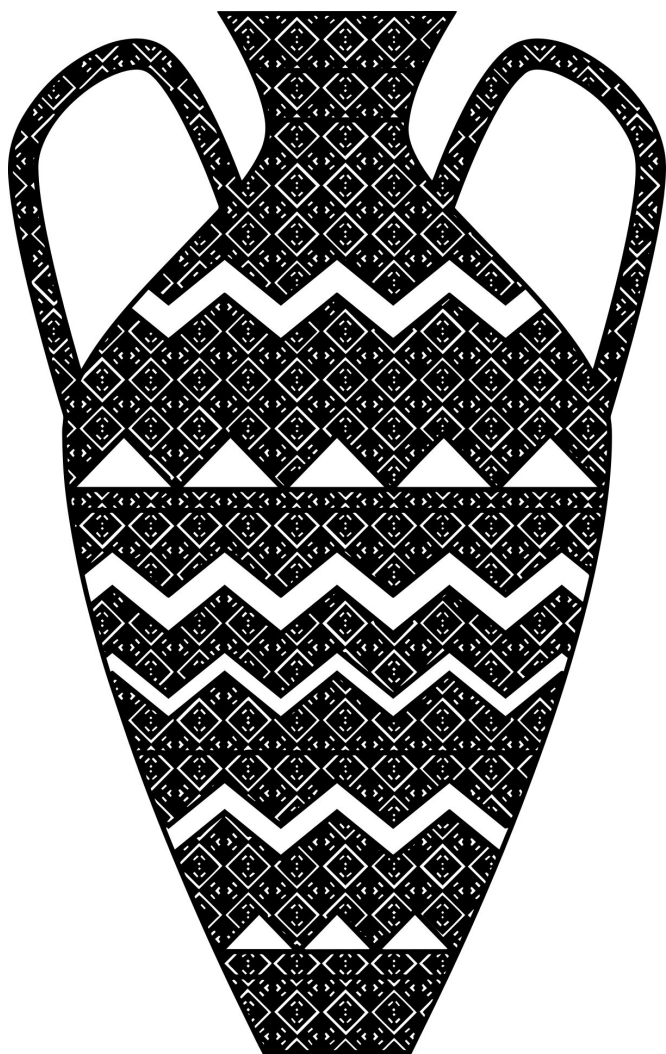


A new methodology with chemical and physical analyses differentiates Ibero-Roman from Punic ceramic fragments

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The recognition of the various types of amphorae from a morphological point of view is usually used as a tool to learn their origin and, consequently, the trade routes of antiquity. However, this methodology does not always make it possible to learn the origin, so it has been completed with

mineralogical and chemical analyses that make it possible to know key aspects like the manufacturing process, workshop and raw materials used in the archaeological objects.

In the analysis of various pieces from Sagunto, a commercial emporium of antiquity in contact with the rest of the Mediterranean 25 centuries ago, UV specialists from the Department of Prehistory, Archaeology and Ancient History; the Department of Analytical Chemistry; and the Institute of Materials Science (ICMUV) have combined various types of chemical and physical analyses to ascribe the fragments.

The team of specialists analyzed the characteristics of 20 pieces of known origin (Iberian-Roman, Punic, Adriatic, Campania, Marseille and Tarragona) to find out about 27 others of difficult ascription. They used a set of analytical techniques that require a total of less than one gram of sample, with which the study has been minimally invasive and has enabled working on fragments of very small size.

Gianni Gallelo, researcher at the Department of Prehistory, Archaeology and Ancient History and coordinator of the multidisciplinary research unit ArchaeChemis, explains that this work establishes the methodological bases to determine the type and origin of ceramic fragments that with classical classification methods are impossible to identify, a fact that constitutes one of the most important obstacles for the study of this type of materials. "These analyses help obtain more exhaustive data in a site or study area on the exchange or trade and the manufacturing of ceramic objects and what they contained," he says.

Clodoaldo Roldán, a researcher at the ICMUV, has combined four different key analytical techniques to

identify the unknown fragments. Thus, [mass spectrometry](#), used for the determination of organic matrices, combined with a portable X-ray equipment, which is a non-destructive technique, has made it easier to identify major chemical elements and traces of others, and determine the origin of the [raw materials](#) used.

On the other hand, near infrared and voltammetry analytical techniques to study oxidation and reduction processes, have provided relevant information on the [manufacturing process](#) of amphorae from the spectroscopic identification of compounds related to cooking temperatures. Here it is worth highlighting the decisive contribution of two specialists from the Department of Analytical Chemistry: Salvador Garrigues for infrared analysis, and Antonio Doménech, for voltammetry.

Agustín Pastor, researcher at the Department of Analytical Chemistry, says that in recent years, the use of rare earths in archaeology is increasing, as they are markers of sources of raw materials. These elements have played a key role in determining the [origin](#) of the fragments.

More information: Mirco Ramacciotti et al. An innovative multi-analytical approach based on spectroscopic and electrochemical techniques to study a complex Roman amphorae collection, *Applied Clay Science* (2020). [DOI: 10.1016/j.clay.2020.105857](#)

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