

# ARCHAOMETRY AND HERITAGE SCIENCE: CONNECTING AND DIVIDING ELEMENTS

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Archaeometry consists in the application of natural science methods to archaeological findings to assess their provenance, technology, use and dating. First attempts date back to the 18th century, but the discipline mostly developed from the 1960s as a result of the freshly emerged New Archaeology. According to UNESCO, Heritage is all the natural and cultural legacy that “we receive from the past, we live with today, and we pass on to future generations.”

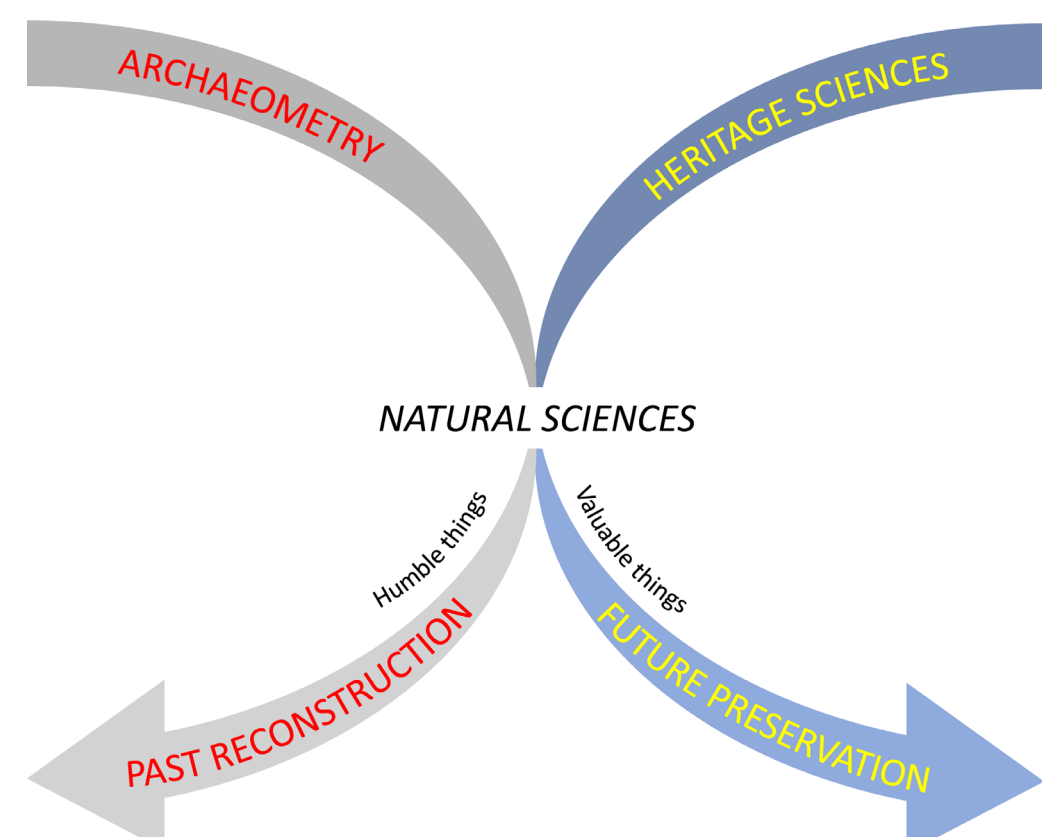


Fig. 1 – Differences and commonalities between Archaeometry and Heritage Sciences. (© ÖAW-ÖAI)

In the archaeometric analysis of mortar recipes, errors in execution may be discovered. If the ideal carbonate-silicate ratio had not been observed, the mortar becomes more susceptible to external sulphate attacks, resulting in the formation of ettringite ( $3\text{CaO}\cdot\text{Al}_2\text{O}_3\cdot3\text{CaSO}_4\cdot32\text{H}_2\text{O}$ ), which is responsible for delamination and detachment (Fig. 2). By identifying the areas of the structure where the ‘wrong’ recipe was used, critical spots requiring immediate intervention can be assessed.

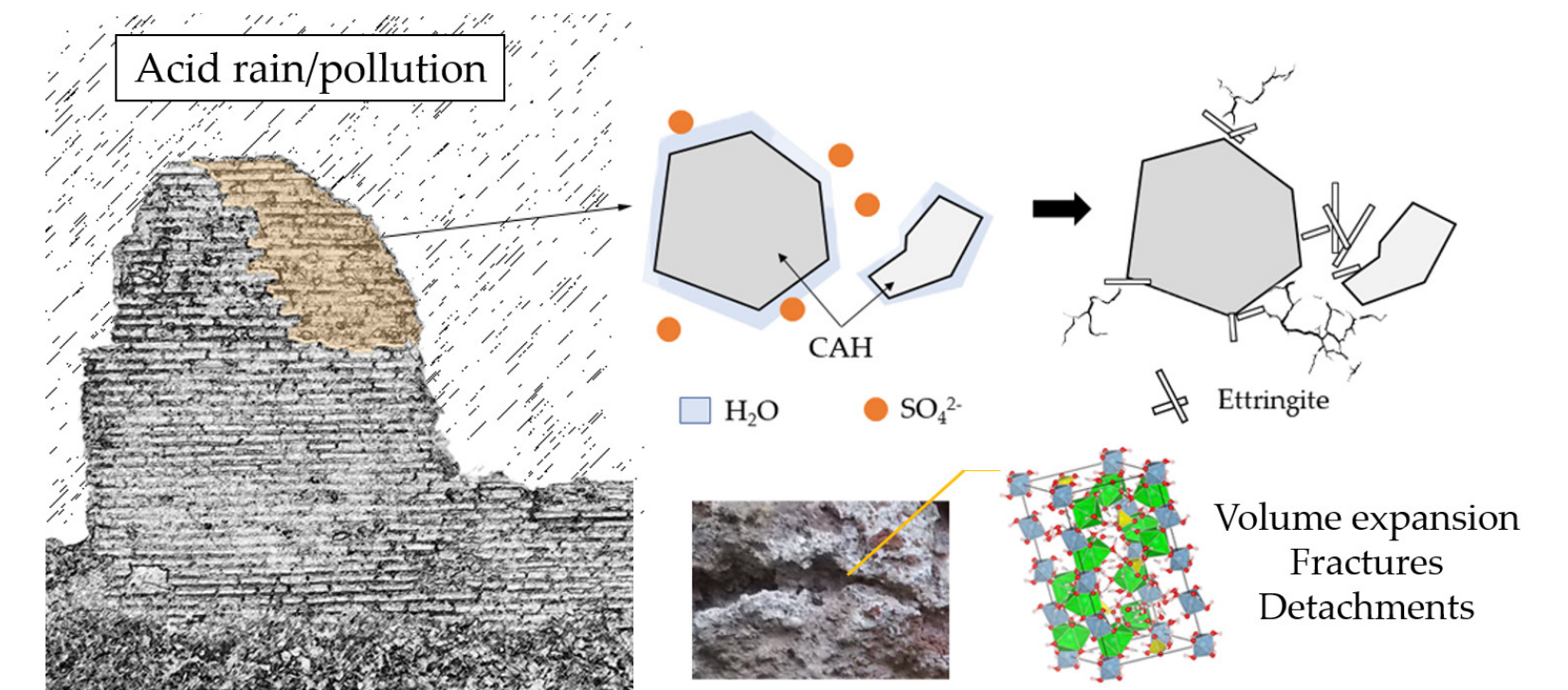


Fig. 2 – Schematic representation of ettringite crystallization on mortar as a result of external sulphate attack (CAH: calcium aluminate hydrates). (© ÖAW-ÖAI)



Fig. 3 – The sampled objects at the Domitian temple are marked with different colors, indicating the different provenance sources (red: Ephesos I, green: Ephesos II, pink: Panayir, blue: Proconnesos quarries). (© ÖAW-ÖAI)

Provenance studies might evidence inappropriate reconstructions, as in the case of the so-called Temple of Domitian in Ephesus (Fig. 3). Indeed, the identification of three different marble sources (Ephesos I, II, and Panayir) demonstrated that marble elements were randomly assembled during the partial rebuilding of the Temple in the 1960s. The assessment of marble properties is also a crucial prerequisite to design suitable preservation measures and products.

Archaeometric analyses enquire not only the choices and technological skills of past potters but also the use of containers through organic residue analyses (Fig. 4). Ceramics are also used in museums and exhibitions to illustrate every day but also special social activities (Fig. 5-6). The UNESCO lists twelve items linked to pottery in the List of Intangible Cultural Heritage to be valorized and preserved. They are traditional knowledge and values attached to ceramic productions (Fig. 7). Traditional technologies are studied by ethnoarchaeologists, too, and this research often results in precious information for archaeologists and archaeometrists.

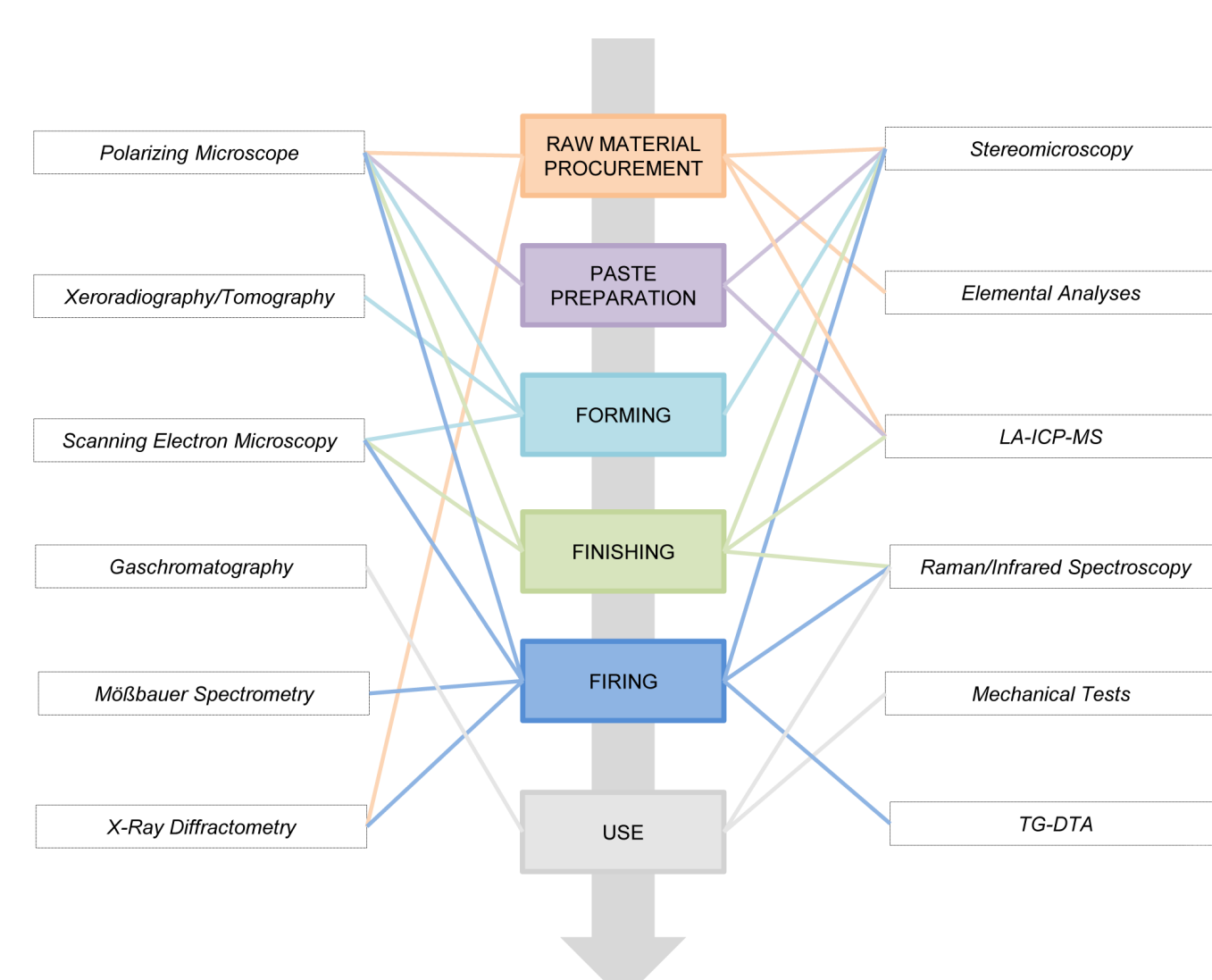


Fig. 4 – Archeometric analyses to explore the life-cycle of ceramic vessels. (© ÖAW-ÖAI)



Fig. 5 – From the field to the museum (© Archive MAIAO, Sapienza Università Roma).



Fig. 6 – Restoration of ceramic vessels: consolidating, reassembling and integrating missing parts (Photo R. Ceccacci; © Archive MAIAO, Sapienza Università Roma).



Fig. 7 – Pottery-related values knowledge and practices of the Awajún people-Peru (© Ministry of Culture Peru, 2014).

A particularly fascinating aspect of the processes during the corrosion of metals is the migration of metal ions into adhering organic residues. The biocidal properties of e.g. copper help prevent the degradation of organic material such as residues from textiles, wood, feathers, etc. In positive substitution, the metal ions migrate into the matrix, the corrosion products thus replace the fibres in their degradation and form a positive, mainly consisting of chlorides and carbonates (Fig. 8).



Fig. 8 – Wood remains of the species „Prunus sp transverse“ (determination A. Heiss) in the shaft of an arrowhead. This comes from Smyrna, excavation “Keil”, city gate and room 35b.

Interdisciplinarity has to be present as forma mentis since the idealization of any research. Equally crucial is the knowledge of the single disciplines to avoid analytical redundancies and identify fruitful areas of integration. When well-designed, interdisciplinarity has the potential of generating new research questions and knowledge. The lesson HS can learn from Archaeometry is that solutions adopted in the past might be more durable and sustainable than those on hand in the present. Vice versa, archaeometrists can gain profit from the HS to increase the impact of their research on present-day society.

