Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35300

Mix-design reconstruction and provenance of coarse-grained pottery from Cales (South Italy) through Sr-Nd-Pb isotopic fingerprints

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Isotope geochemistry has become a powerful tool in archaeological sciences, widely used to date objects, define their provenance and reconstruct ancient dietary practices. In recent years, it has also been applied to archaeological ceramics, showing that trace metals isotopic composition in pottery reflects that of the raw materials used in its manufacture. This development opens new perspectives for investigating production technologies and supply strategies.

This work is aimed at employing a combined approach involving three isotopic systematics - Sr, Nd, and Pb - to track origin and mix-design of coarse-grained pottery. This method enriches our understanding of the interplay between raw materials and final products. The materials chosen for analysis derived from a meticulously documented dataset and were selected based on mineralogical-petrographic and chemical assessments. Specifically, thirteen representative ceramic fragments of coarse-grained pottery were analyzed.

To serve as reference points for our investigation, we also selected well-documented Ca-rich and Ca-poor clay raw materials found in the nearby of the Cales archaeological site in South Italy. By comparing the ceramic samples with these clay raw materials, we discovered a significant resemblance to the alluvial clays of the Volturnum river plain. The correlation is further supported by the Sr-Nd and Pb isotopic fingerprints observed in the ceramic samples, as well as production indicators and raw materials. These findings validate the reliability of our method and align with previous experimental studies.

Overall, our multi-isotopic approach has yielded promising results, offering further confirmation of the technique's accuracy. This research refines a method previously applied on fine-grained pottery from the same archaeological and geological context [1]. Since we are dealing with coarse-grained pottery in this case, the work aims to address a new challenge, taking us one step closer to reconstructing the precise temper-clay ratio employed by ancient craftsmen, thereby enhancing our understanding of their manufacturing practices.

Reference

[1] Verde, M., De Bonis, A., D'Antonio, M., Renson, V., Czujko, S., Tomeo, A., & Morra, V. (2025). Unveiling the distinctive geochemical signature of fine ware through Sr–Nd–Pb isotopes: A site-specific perspective from the site of Cales (South Italy). *Geoarchaeology* 40(1), e22021.