Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.15814

Roman ore sourcing and human exposure to metallurgy in the ancient city of Vienne (Isere, France) using lead and copper isotopes

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Metallurgy was central to the development of ancient societies during Antiquity. Lead, which started as a by-product, quickly became essential and drove sociocultural and economic changes that shaped the urbanization of Ancient Rome [1]. Metal accumulation rates in sediment records have improved our knowledge of the magnitude and intensity of Roman metallurgy [2]. Today, only a few studies use the metal isotope (e.g., Pb, Cu, Fe, or Hg) to identify the specific sources of mined ores and the impact of such activities on the local population's health [3].

Here, we focused on Pb and Cu isotopic composition obtained from several lead artifacts (mainly pipes), ores, sedimentary archives, and human bones from the ancient city of Vienne (France). Lead isotopes allowed us to trace the sources of ores used to meet Vienne's manufacturing demand for lead and its potential incorporation into human bones. Cu isotopes (known for their potential as markers of health deterioration [4]) allowed us to document the exposure and impact of such activity on the local population's health.

Most of the artifacts exhibit a narrow isotopic range which differs from local ore deposits, indicating that the main source for Pb supply was not local. The most probable sources include ores from the Eifel region (Germany) and British Island. The similarity of lead isotopic ratios in bones and pipes suggests that human exposure came mainly from water consumption, but also from ore processing (particle inhalation). The Cu isotopic ratios in human bones exhibit lower values compared to previous studies [5] which can indicate a deterioration of the health status or/and a diagenetic effect on the ∂^{65}Cu of bones related to the burial method.

These results show the reliability of a multi-isotopic approach to improve our understanding of the Roman trade of lead and the impact of ore processing and casting during Antiquity.

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