Ag isotope analysis of galenas from Spain: new insights into silver ore exploitation in Roman times

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Silver played a major role in past societies, first as a luxury commodity, then as metal for coin minting. Silver-bearing galena (PbS) is commonly thought to have been a major source of silver in the Antiquity. Galena was first smelted under reducing conditions to obtain lead bullion which was then used to extract silver by cupellation. Since Phoenician until Roman times, the Iberian Peninsula was intensively exploited for its silver resources [e.g. 1]. Here, we explore the dynamics of silver exploitation in Spain during Roman times using Ag isotopes [2].

We measured the Ag isotope composition of 47 galena samples from several Spanish mining districts previously shown to have been exploited in ancient times. After a two-step purification by ion-exchange chromatography, Ag isotope compositions were measured by multi-collection inductively coupled plasma mass spectrometry (MC-ICP-MS) at ENS Lyon using added Pd to correct for instrumental mass bias. The Ag isotopic compositions of the different Spanish ores were then compared to those of Roman silver coins to identify potential provenance links.

The Ag isotope compositions of silver coins and galenas combined with Ag-Pb isotope correlations exclude most known galena deposits as significant sources of Roman silver. Instead, they suggest that galena was mined mainly for lead, which was used to extract silver from other Pb-depleted ores in only a few specific mining districts. This interpretation is in accordance with the example of Phoenician and Roman silver smelting in Rio-Tinto (Huelva province, SW Spain), where lead was imported from other regions to extract silver from local Ag-rich jarosite [3]. This study constitutes the starting point for the establishment of an extensive database of Ag isotope compositions of ores for future studies of precious metal tracing.

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