

The isotopic composition of silver and its variation in silver-bearing ore deposits

Antonio Arribas*, Ryan Mathur, Arribas Isabel, Peter Megaw, Marc Wilson, Steven Stroup,
Meyer-Arrivillaga Danilo

*Akita University, Akita, Japan, Email: arribasa@yahoo.com

Silver isotope geochemistry is a relatively new field with applications to understanding and measuring a variety of natural and technological processes. Recently, the isotopic composition of silver has been used in combination with copper and lead isotopes to fingerprint archeological artifacts and clarify historical events. However, such provenance studies require an understanding of the silver isotopic geochemistry of natural ores, which to date is missing. In this study we collected silver isotope data of over 150 samples from more than 60 deposits or districts representative of the main types of silver deposit and Ag-bearing copper, gold and lead-zinc deposits in 20 countries. The data indicate preliminary conclusions on several issues relevant to the silver isotope systematics of natural ore systems. There is evidence to support isotopic fractionation: a) among Ag-bearing mineral phases, such as native silver and silver sulfides/sulfosalts versus galena, enargite, tetrahedrite, and other minerals, and b) during low-temperature remobilization of silver due to supergene alteration. By contrast, we do not see evidence of fractionation or isotopic variation related to a) ore deposit type or (hypogene) genetic environment, or b) the geographic (protolith or geologic terrane) setting of an ore deposit. The variation in silver isotopic composition observed within some mineral districts can be as large as that for the respective ore deposit type. Thus, direct association of silver isotope data from archaeological or historical artifacts with ore deposit data appears to be subject to major limitations. On-going work is focusing on: a) better understanding the mechanisms of isotopic fractionation during low-temperature (supergene) processes, b) the nature and origin of the variations within individual deposits and systems, c) isotopic fractionation among mineral phases, and d) isotopic changes caused by metallurgical processing of natural ores