Lead Reservoir Interactions at a Multiaccreted Convergent Margin: the Case of Ecuador

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Lead isotopes have been often used to infer interactions among large-scale reservoirs in the Central Andes, but few data are available to date for the Northern Andes. The interest of applying a large-scale lead isotope survey to the Northern Andes stems from a geotectonic evolution characterized by multiaccretionary episodes involving also oceanic crust. In this contribution more than 200 new lead isotope compositions of ores and rocks of Ecuador are discussed.

The consistent overlap between isotopic signatures of ores and magmatic rocks in the Central Andes suggests derivation of most of the lead of ore deposits from a magmatic component (MacFarlane et al., 1999). This is also the case for the pre-Eocene ore deposits of Ecuador which display a close overlap with the compositions of associated magmatic rocks. Nonetheless, pre-Eocene Ecuadorian ore deposits are characterized by isotopic variability according to their emplacement within different geotectonic domains (island arcs, marginal basins) formed from Jurassic to Early Tertiary. In each one of these domains, leads from different reservoirs (e.g., mantle, lower and upper crust, pelagic sediments) were homogenized by distinct geotectonic processes. Of relevance is the presence of up to 95% lead from pelagic sediments in VHMS ore deposits and associated basalts of the Paleocene-Eocene Macuchi island arc, and, possibly, also in basalts and associated VHMS deposit of the Jurassic Alao island arc.

After the assemblage of different geotectonic domains into the multiaccreted crust of Ecuador, which was achieved by the end of Paleocene, Middle-Late Tertiary ore deposits display isotopic signatures that scatter significantly beyond the compositional field of associated magmas. It is suggested that the multiaccreted nature of the Ecuadorian crust caused a fragmentation of mantle-derived melts into small stocks which reached shallow crustal levels through terrane sutures and crustal faults. The small stocks established local hydrothermal systems in which an isotopically homogeneous magmatic lead was mixed with the lead leached from different basement rocks of the accreted terranes resulting in the observed isotopic scatter of Middle-Late Tertiary Ecuadorian ore deposits.