LEAD ISOTOPE SIGNATURES OF ORES, VOLCANIC, AND BATHOLITHIC ROCKS OF THE CANDELARIA- PUNTA DEL COBRE AREA, CHILE

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Pb isotope ratios of ores of the Candelaria-Punta del Cobre iron oxide Cu-Au deposits, Chile, and associated volcanic and batholithic rocks have been determined. Pb isotope ratios of sulfides and least altered batholithic rocks define a single narrow field in the uranogenic diagram. Their signatures indicate a homogeneous mixture of mantle and upper crust leads. Altered volcanic and intrusive rocks, and magnetite-dominated ores plot along a trend line that passes through the Pb isotope signatures of sulfides and least altered intrusive rocks. We interpret this trend line as the volcanic rock isochron thus implying that the original Pb signature of these rocks was similar to that of the sulfides and least altered intrusive rocks. The radiogenic Pb enrichment of the volcanic rocks is thought to be caused by leaching of lead due to regional scale hydrothermal alteration. The result of our Pb isotope study is in agreement with field observations that indicate large scale fluid flow and alteration along the eastern margin of the Copiapó Batholith near the ore deposits. The Pb isotope data of volcanic rocks suggest that this regional fluid had a homogeneous Pb isotope composition and a relatively high Th/U ratio. Genetic models in which magmatic fluids or evaporitic brines cause alteration and mineralization in iron oxide Cu-Au deposits have been proposed. The high Th/U ratio of the regional fluid inferred herein would be consistent with a magmatic fluid that exsolved from the crystallizing batholith causing the large scale alteration, but does not exclude an evaporitic brine which has been further modified, e.g., by passing through the volcanic-volcaniclastic rocks which floor the Lower Cretaceous basin in the Candelaria-Punta del Cobre area.