

EVOLUTION OF BASE METAL PORPHYRY MINERALIZATION IN CHILE BASED ON RE-OS ISOTOPES

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Re-Os isotope studies of molybdenite and other more common sulfides have yielded new geochronological and tracer information on the origin of the ore-forming metals for base metal porphyry mineralization in Chile. The Re-Os data reinforce previous geochronological work that shows that mineralization occurred about 35-40 Ma ago in northern Chile and about 3-5 Ma ago in central Chile. The Re-Os data, however places the mineralization in the later stages of the magmatic history of the deposits studied here. Pyrite, chalcopyrite and bornite from the base metal porphyry deposits have Re concentrations between 0.01 ppt and 4500 ppt; Os concentrations range between 0.01 and 200 ppt. There is no obvious correlation between geographical setting, or age, and the concentration of Re and Os.

The $^{187}\text{Os}/^{188}\text{Os}$ ratios of the deposits are between 0.2 to values greater than 1. All the measured Os isotopic ratios of sulfides from the base metal porphyry deposits are more radiogenic than those of the mantle in continental arcs. However, there is a correlation between the size of the deposit (total tonnage of copper) and Os isotopic signature. The most radiogenic Os is found in the smaller deposits and the least radiogenic Os occurs in the larger deposits. These data indicate that all the base metal deposits have a crustal contribution of copper but that the copper of the larger deposits is mostly derived from the mantle.