

Recycled volatiles determine fertility of porphyry deposits in collisional settings

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ABSTRACT

An intensive study of the geochemical characteristics (including the volatile elements Cl and S) of apatite associated with porphyry deposits was undertaken to address the debate about the crust- or mantle-derivation of their copper and gold and to better understand the controls on the transport of metals in magmatic fluids in post-subduction settings. New geochemical data on apatite reveal parameters to discriminate mineralized porphyry systems across Iran and western China (Tibet and Yunnan), from coeval barren localities across this post-subduction metallogenic belt. Apatites in *fertile* porphyries have higher Cl and S concentrations (reflecting water-rich crystallization conditions) than those from coeval *barren* ones. Our new isotopic data also indicate these volatiles are likely derived from pre-enriched sub-continental lithospheric mantle, metasomatized by previous oceanic subduction. This study demonstrates that refertilization of suprasubduction lithospheric mantle during previous collision events is a prerequisite for forming post-subduction fertile porphyries, providing an evidence-based alternative to current ore-enrichment models.

Keywords: Collisional settings, in situ isotope, deposits, Tibet