

The ^{129}I isotopic composition of supergene iodine minerals in Chile and Australia

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Because of its large ionic radius, iodine (I) is rarely incorporated into minerals and remains in the aqueous phase much longer than other halogens. Naturally-formed I minerals are very rare, but are found in the nitrate ore fields of the Atacama Desert in Chile and the supergene zones of base and precious ore deposits in extremely arid environments (Chile, Australia). The presence of I in Cu deposits in northern Chile has not been investigated previously, but provides the opportunity to apply the ^{129}I system for the study of the tectonic history of the area and of climatic changes, particularly the desiccation of the Atacama region.

Here, we report the first ^{129}I data of iodide minerals from supergene zones of Cu and Ag deposits from the hyperarid Atacama Desert. Two marshite (CuI) samples from the supergene zone of the Chuquicamata Cu deposit show $^{129}\text{I}/\text{I}$ ratios of 218 ± 72 and 562 ± 77 ($\times 10^{-15}$ at-at⁻¹), similar to the ^{129}I isotopic signature of a geochemically anomalous, iodine-rich soil sampled above the Spence porphyry Cu deposit (473 ± 75). Therefore, mineral and soil samples range between typical volcanic arc fluids ($^{129}\text{I}/\text{I} \sim 700\text{-}1000$) and forearc fluids ($^{129}\text{I}/\text{I} \sim 100\text{-}250$). In contrast, marshites and iodargyrites (AgI) from the Broken Hill Pb-Zn-Ag deposit in Australia and the Chañarcillo Ag deposit in Chile show a wider dispersion of $^{129}\text{I}/\text{I}$ ratios, ranging from ~ 100 to 2000, indicating a significant meteoric influence.

We suggest that I-rich fluids were involved in supergene enrichment and recycling of Cu in the Atacama region, revealing a complex link between multiple sources of fluids, active tectonics and climate change.

Melting conditions associated with the Colorado Plateau, USA

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Continental foundering occurs by lithospheric detachments associated with gravitational instabilities as well as by shear-related thinning. Volcanic activity is progressively encroaching on the otherwise tectonically stable Colorado Plateau in the southwestern U.S. We show that decompression melting of local ambient enriched mantle lithosphere - rather than compression melting of lithospheric mantle drips or delaminations, or decompression melting of the asthenospheric mantle return flow - is likely responsible for this volcanism. New Hf and Nd isotope data (>120 analyses) significantly expand evidence for heterogeneous enriched mantle sources beneath the Colorado Plateau. $^{206}\text{Pb}/^{204}\text{Pb}$ values <18.5 and as low as 17, characterize those samples with Hf-Nd isotope signatures that are evocative of mantle enrichment by mixing with pelagic \pm terrigenous sediments: values >18.5 would be expected if Cordilleran and other sediments had been incorporated into their sources during Laramide-aged (80–40 Ma) shallow subduction. Relative abundances of minor and trace elements further show that the more volumetrically significant melts are sourced dominantly in peridotite rather than in pyroxenite or eclogite. Silica- and MgO-based thermobarometry supports evidence from trace element fractionation that melting locally transcends the garnet-spinel transition (~ 75 km), with shallower melts characterized by higher degrees of partial melting. Low P- and S-wave velocity domains, pronounced thinning of the lithosphere beneath the margins of the Colorado Plateau, and possible evidence for lithospheric delamination [1] may be further evidence that localized mantle upwelling is responsible for Colorado Plateau volcanism.

[1] Levander *et al.* (in press) *Nature*.