

DETERMINING THE RARE EARTH ELEMENT CHEMISTRY OF APATITE FROM THE EL LACO IRON OXIDE-APATITE DEPOSIT, CHILE

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ABSTRACT

Iron oxide - apatite ore deposits occur globally and are dominated by the minerals magnetite (Fe_3O_4) and apatite [$\text{Ca}_5(\text{PO}_4)_3(\text{F},\text{Cl},\text{OH})$]. In addition to being mined for iron, apatite in many deposits is enriched in rare earth elements (REE) and there is the potential for REE-enriched apatite to become a crucial component of the global REE supply chain, considering that the market currently relies mainly on the Bayan Obo ore deposit in China. Exploration strategies for IOA deposits are limited owing to lack of scientific consensus for a formation model for this deposit type. This proposed project combines fieldwork with quantitative geochemical characterization of apatite and bulk-rock samples collected from the El Laco iron - oxide apatite (IOA) deposit in Chile to test the proposed genetic models for the formation of El Laco, and IOA deposits in general. The field localities consist of previously uncharacterized ore bodies of Vicente Alto, Vicente Bajo, Cristales Grandes, and Rodados Negros. The geochemical investigation of apatite from these localities will combine scanning electron microscopy (SEM), electron probe microanalysis (EPMA), laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). The anticipated data will provide additional geologic and geochemical information that are fundamental to understanding the formation of the iron oxide ore bodies of the El Laco volcanic complex. Ultimately, this dataset will help differentiate among multiple proposed genetic models for IOA deposits, which is crucial to exploration necessary to meet society's consumption of rare earth metals, including alternative energy resources such as wind and solar.

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