**D12**

## Petro-Geochemical Characterization Of Supergene Copper Mineralization In Atacama Desert (Northern Chile): U-Pb Chronometric Potential And Formation Conditions

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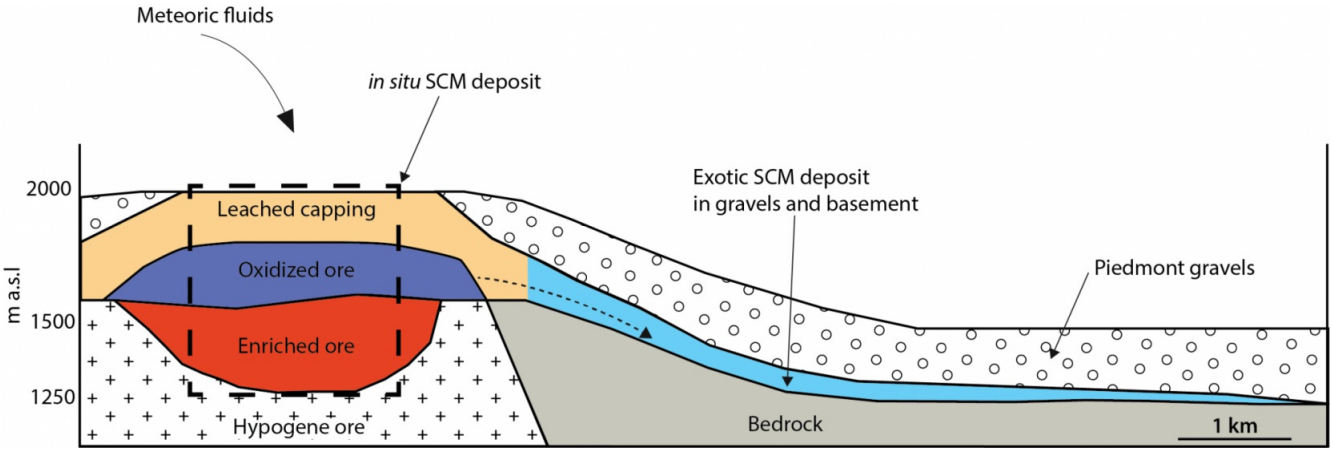
Supergene copper mineralizations (SCM) are nowadays the economic viability of many porphyry copper deposits worldwide. These mineralizations are derived from supergene processes, defined as sulfide oxidation and leaching of ore deposits in the weathering environment, and any attendant secondary sulfide enrichment. For supergene copper mineralization to form, favorable tectonics, climate, and geomorphologic conditions are required. Tectonics control the uplift needed to induce groundwater lowering and leaching of sulphides from a porphyry copper deposit. Climate controls copper leaching in the supergene environment and groundwater circulation toward the locus where supergene copper-bearing minerals precipitate. In the Atacama Desert of northern Chile, SCM seem to take place during specific Tertiary climatic periods and relief formation. But many uncertainties remain regarding the genesis and the exact timing for SCM formation.

We present mineralogical and chemical data on supergene copper-bearing minerals sampled from in situ and exotic SCM from the Atacama Desert of northern Chile. Although northern and southern areas of the Atacama Desert have experienced different geological evolution, they both underwent similar geological and climatic controls to form and preserve SCM.

Chrysocolla and pseudomalachite are the most common copper-bearing minerals found in SCM from the Atacama Desert of northern Chile. This led us to test the potential of both minerals as dating materials to place the SCM formation in a geochronological context. However, variation of U content from one mineral to another, common Pb contribution, and the absence of matrix-matched-standard for both minerals made U-Pb LA-ICP-MS dating of chrysocolla and pseudomalachite challenging. A mixed approach combining texturally-controlled in situ LA-ICP-MS U-Pb dating and multi-elements mapping, together with SIMS oxygen isotope analyses, was applied to the Mina Sur, Damiana, and El Cobre exotic copper deposits from the Atacama Desert.
Regardless of location, the results obtained demonstrate the important role played by the local geological parameters on the control of the U-Pb chronometer in supergene copper minerals. Initial high U content of the porphyry source can promote U-rich supergene copper minerals as is the case at Mina Sur. Additionally, a long-term supergene alteration will favor long-term water circulation in the depositional environment, which can leach U from the porphyry source and allow the formation of U-low supergene copper minerals during recent times.

The promising results obtained represent a new tool to understand the physicochemical, climatic, and geological conditions that prevailed during the formation of supergene copper deposits, as well as a proxy for their prospection around the world.


Meteoric fluids
*in situ* SCM deposit
Exotic SCM deposit
in gravels and basement
Piedmont gravels
2000
1500
1250
m a.s.l
Leached capping
Oxidized ore
Enriched ore
Hypogene ore
Bedrock
1 km