Thermal evolution and formation of supergene mineralization in the El Salvador District, Chile: evidence from geo-thermochronology.

Paula Montiel*[1,2], Stéphanie Brichau[3,4], Marcelo Farías[5], Cristopher López[6], Rodrigo Riquelme[6], Caroline Sanchez[6,7], Marc Poujol[8], Stéphanie Duchêne[9], Eduardo Campos[10], Sandrine Choy[11], Jorge Morales-Leal[12], and Mathieu Leisen[11]

[1]Universidad de Chile – Chili
[2]Université Toulouse III Paul Sabatier – Université Toulouse III - Paul Sabatier – France
[3]Institut de Recherche pour le Développement (IRD) – Institut de Recherche pour le Développement – Adresse du siège - Le Sextant 44, bd de Dunkerque, CS 90009 13572 Marseille cedex 02, France
[4]Universidad de Chile – Chili
[5]Department of Geology, FCFM, University of Chile – Chili
[6]Universidad Catolica del Norte – Chili
[7]Géosciences Environnement Toulouse (GET) – Observatoire Midi-Pyrénées, Institut de recherche pour le développement [IRD] : UR234, Université Paul Sabatier (UPS) - Toulouse III, CNRS : UMR5563, Université Paul Sabatier [UPS] - Toulouse III, Institut de recherche pour le développement [IRD] : UMR239 – Observatoire Midi-Pyrénées 14 Avenue Edouard Belin 31400 Toulouse, France
[8]Géosciences Rennes – Univ Rennes - CNRS, UMR 6118 – France
[9]Géosciences Environnement Toulouse (GET) – Observatoire Midi-Pyrénées, Institut de recherche pour le développement [IRD] : UMR239, Université Paul Sabatier [UPS] - Toulouse III, CNRS : UMR5563, Université Paul Sabatier (UPS) - Toulouse III – France
[10]Universidad Católica del Norte – Av. Angamos 0610, Antofagasta, Chili
[11]Géosciences Environnement Toulouse – Observatoire Midi-Pyrénées, Institut de recherche pour le développement [IRD] : UMR239, Université Paul Sabatier [UPS] - Toulouse III, CNRS : UMR5563, Université Paul Sabatier (UPS) - Toulouse III – France
[12]Universidad Santo Tomas – Chili

Résumé

Chile is one of the world's leading copper producers. The deposits are mainly derived from the alteration of copper porphyries located in varied morphotectonic and climatic contexts. Indeed, above subduction systems, these porphyries feature hypogene mineralization formed by hydrothermal fluids related to the emplacement of these intrusives, subsequently altered in supergene mineralization by surface water interaction. Previous studies (i.e.,Clark et al.,1990) have demonstrated that the equilibrium between tectonic,climatic,and erosional processes allows supergene cooper mineralization(SCM) formation and preservation.
This study aims to characterize the morphotectonic and climatic conditions associated with the development of supergene mineralization in the El Salvador-Potrerillos Mining District,

*Intervenant

located at the margin between the Central Depression and the Andean range, using low-temperature thermochronology and geochronology.

We present new ages obtained in Permian to Oligocene intrusives in the El Salvador and Potrerillos districts, using AFT, AHe, and U-Pb zircon dating methods. Preliminary results indicate U-Pb ages ranging between 290.7± 1.7Ma and 32.99±0.32Ma, and AHe ages ranging from 64.41±9.0Ma to 13.80±6.1Ma. These results show that the magmatic activity occurred from the late stages of the Gondwanic cycle to the Andean cycle while its exhumation history lasted until the Miocene in this region.

In El Salvador, previous studies have demonstrated that supergene processes was active between late Oligocene to early Miocene. Some authors attribute the cessation of supergene formation to aridification during the middle Miocene(Mote et al.,2001) also enabling its preservation.

We expect to report new U-Pb ages obtained on unconventional supergene copper minerals (silicates, carbonates, and phosphates), completed with previously published data for the local supergene profile (e.g., Mote et al.,2001; Bissig and Riquelme,2010; Morales-Leal et al.,2022).

These results will allow us to constrain the chronology of supergene formation to compare it with 1)the exhumation history of the porphyries; 2)the case study of the Centinela District (Sánchez et al.,2018) located further north in the Atacama Region.
With this study, we look forward to assess the factors controlling the development and preservation of supergene copper mineralization from districts experiencing similar tectonic conditions but with very different water inputs, even though both are located in an arid climatic region.

Mots-Clés: Minéralisation supergene, datation, tectonique, relief, climat, Chili