Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.17711

In-situ $^{40}Ar/^{39}Ar$ petrochronology: the mechanisms of argon isotope redistribution and loss in white mica.

CLÉMENTINE ANTOINE[1], RICHARD A SPIKINGS[1], ANDRÉ NAVIN PAUL[2] AND PROF. URS SCHALTEGGER, PHD[1]

[1]University of Geneva
[2]Université de Genève
Presenting Author: clementine.antoine@unige.ch

Staircase topologies in $^{40}Ar/^{39}Ar$ degassing spectra of white mica are frequently considered to be controlled by thermally driven volume diffusion in both nature and the laboratory [1]. Other studies, however, have shown that they can also be derived from fluid interaction and chemical breakdown [2]. This study aims to determine the cause of staircase topologies obtained from $^{40}Ar/^{39}Ar$ degassing of muscovite from Triassic rocks in the Northern Andes of Ecuador and Colombia [3]. ^{235}U-^{208}Pb (apatite) and $^{40}Ar/^{39}Ar$ (muscovite) dates of Triassic leucosomes gradually decrease from north to south along the northern Andes, while the $^{40}Ar/^{39}Ar$ (muscovite) yield plateaus in Colombia (~215 Ma; Triassic rifting) and southern Ecuador (~75 Ma; terrane collision) and a staircase topology in northern Ecuador that straddles these end-member events. These trends in muscovite Ar isotopic data are consistent with a thermochronological response to Early Cretaceous extension culminating in terrane collision at 75 Ma (e.g. [3]). However, the previous thermochronological interpretation did not apply petrological tools to seek an alternative explanation for the $^{40}Ar/^{39}Ar$ data. We will seek evidence for fluid flow and retrogression reactions via the acquisition of element maps (EPMA) and in-situ SIMS oxygen isotopic compositions of single muscovite crystals, which will be compared with in-situ $^{40}Ar/^{39}Ar$ measurements (using both traverses and depth profiling).

[1] Harrison, T. M., Célérier, J., Aikman, A. B., Hermann, J. & Heizler, M. T. Diffusion of 40Ar in muscovite. *Geochimica et Cosmochimica Acta* 73, 1039-1051, doi:https://doi.org/10.1016/j.gca.2008.09.038 (2009).

[2] McDonald, C. S. *et al.* Argon redistribution during a metamorphic cycle: Consequences for determining cooling rates. *Chemical Geology* 443, 182-197 (2016).

[3] Paul, A. N., Spikings, R. A., Chew, D. & Daly, J. S. The effect of intra-crystal uranium zonation on apatite U-Pb thermochronology: A combined ID-TIMS and LA-MC-ICP-MS study. *Geochimica et Cosmochimica Acta* 251, 15-35 (2019).