Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.32229

Radiometric timestamping of ridge flank fluid-rock(-life?) interaction across the South Atlantic Transect

THOMAS M BELGRANO[1], ELMAR ALBERS[2], JENNIFER M LINGTON[3], ROSALIND M. COGGON[3], ALED D. EVANS[3], MICHELLE HARRIS[4], ELLIOT J. CARTER[5], DANIELLE SANTIAGO RAMOS[6], WILLIAM P GILHOOLY III[7], MALLIKA JONNALAGADDA[8], PAMELA D. KEMPTON[9] AND DAMON A. H. TEAGLE[3]

[1]University College Dublin
[2]Alfred Wegener Institute, Centre for Polar and Marine Research
[3]University of Southampton
[4]Plymouth University
[5]Keele University
[6]Department of Marine and Coastal Sciences, Rutgers University
[7]Indiana University Indianapolis
[8]Interdisciplinary School of Science, Savitribai Phule Pune University
[9]Kansas State University

Systematic deficits in heat flow at ocean ridge flanks relative to flows predicted by conductive models suggests that significant hydrothermal circulation continues to operate for ~65 Myr after crustal accretion, on average [1]. The implications of this prolonged circulation for chemical exchange between the oceans and crust and for the persistence of microbial activity are, however, little known. Radiometric age dating of secondary clay and carbonate minerals coupled with trace element and stable isotopic analysis provides a means to unravel time-integrated rock records of these interactions [2,3,4]. This study is developing laser ablation Rb–Sr geochronology by both triple quadrupole (LA–QQQ–ICP–MS/MS) and multiple-collector ICP–MS (LA–MC–ICP–MS/MS) methods for dating the formation of celadonitic and potentially saponitic clays (e.g., Fig. 1), to be employed alongside more established clay Ar–Ar and carbonate U–Pb methods. Here, we review the current state-of-the-art for the method and show preliminary results for altered ridge flank samples recovered along the South Atlantic Transect (SAT) by International Ocean Discovery Program (IODP) Expeditions 390 and 393 [5]. Triple quadrupole dating has timed the formation of petrographically early celadonite at the oldest, 61 Ma SAT sites to within 5–10% age uncertainty, with apparent differences in timing between intact lavas and talus breccias. Development of the LA–MC–ICP–MS/MS method and suitable reference materials is underway, which should improve precision and extend the scope of dating to the younger drill sites and to lower Rb–Sr clay generations. The suite of dated clay samples resulting from this study will be well suited for collaborative geomicrobiological and isotopic work, especially as implemented *in situ* and in conjunction with work on microbiological samples taken aboard the JOIDES Resolution.

[1] Stein, C. A. *et al. Journal of Geophysical Research: Solid Earth* 99, 3081–3095 (1994)

[2] Coogan, L. A. *et al. Geology* 44, 147–150 (2016)

[3] Laureijs, C. T. *et al. Chemical Geology* 579, 120339 (2021)

[4] Suzuki, Y. et al. Comms. Biol. 3, 136 (2020)

[5] Coggon et al. *IODP Proceedings* (2024)