

In-situ O isotope analyses in lawsonite by SIMS: application to Port Macquarie HP rocks

LAURE A.J. MARTIN¹ & ALYSSA GALTIER²

¹ Centre for Microscopy, Characterisation and Analysis,
University of Western Australia, Perth, WA 6009,
Australia

laure.martin@uwa.edu.au

² alyssa.galtier@gmail.com

Lawsonite occurs in altered oceanic crust and sediments metamorphosed at high pressures (HP), very low temperature conditions in subduction zones. Its importance for understanding fluid generation in subduction zones is demonstrated by its experimental stability up to mantle depths and its very high content of H₂O (12 wt.%) and key trace elements (REE, Sr, Pb and Th) [1].

In this study we present a new lawsonite standard for in-situ, O isotope measurements by Secondary Ion Mass Spectrometer (SIMS). Six lawsonite samples were investigated in term of isotopic homogeneity for O isotopes according to their chemical homogeneity in minor elements and porosity conditions. For each tested lawsonite sample, ~50 grains of >100µm size were analysed in situ, yielding reproducibilities ranging from 1.0 to 0.5 per mil (2SD, n>70). LW-UWA, which returned the best reproducibility (0.5 per mil, n=82) was analysed by conventional method and returned a bulk $\delta^{18}\text{O}$ of 13.4 ± 0.2 per mil (2SD, n=3).

O isotopes were analysed in-situ in lawsonite crystals from four HP rocks from the Port Macquarie (Australia) mélange zone. All the lawsonite crystals showed complex growth zoning in minor elements such as Fe, Ti or Cr. Nevertheless, core-rim analyses within single crystals did not return isotopic heterogeneity. Except in one blueschist, in which lawsonite returned a lower average $\delta^{18}\text{O}$ (7.7 ± 0.3 per mil, n=14), lawsonite crystals from the other samples show similar $\delta^{18}\text{O}$ of ~10 per mil. These results will be discussed in term of metamorphic conditions, nature of the protolith and fluid source.

[1] Martin *et al.* (2014) *Journal of Metamorphic Geology* **32**, 455-478