Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35117

Pseudomorphing after lawsonite: Open or Closed System?

ALAINA A HELM, ANNE A HAWS, MARK J CADDICK AND ROBERT J. BODNAR

Virginia Tech

Pseudomorphing reactions commonly preserve evidence of lawsonite breakdown during subduction. Here, we examine pseudomorphs in blueschist from the Cycladic Blueschist Unit on the island of Syros, Greece. Although these reactions are commonly thought of as isochemical, observed pseudomorphs can contain major-element components not explained by lawsonite breakdown alone [1]. For example, pseudomorphs in our sample contain paragonite, albite, and chlorite and likely formed during the breakdown of lawsonite + glaucophane. However, mass-balance calculations show that there is ~50% more Na and Fe (by molar amount) and ~80% more K in pseudomorphs than expected from this reaction. K is almost entirely absent from the matrix mineralogy and is concentrated on the inside borders of pseudomorphs. Additionally, the pseudomorphs contain less than 1% quartz by volume, which is a common product of lawsonite breakdown [1]. Given this, we propose that these samples experienced metasomatic fluid influx at near-peak metamorphic conditions. Garnet-epidote oxybarometry [2] indicates a change in oxidation state between garnet core and rim growth, which could reflect the influence of these fluids. Preliminary reactive transport modeling indicates that an influx of fluid containing Fe, K, Na, Si, and Mg could result in lawsonite pseudomorphs enriched in Fe, K, and Na at the relevant *P-T* conditions. Furthermore, these results suggest that Si input from the infiltrating fluid is not captured by the pseudomorph, from pseudomorph minerals. Together, these results support fluid influx during or after lawsonite pseudomorphing, providing evidence for major element transport during metamorphism that may be widespread but is most readily inferred from the stoichiometries of ‘simple’ reactions such as lawsonite breakdown.

[1] Hamelin, Brady, Cheney, Schumacher, Able, and Sperry (2018), Pseudomorphs after Lawsonite from Syros, Greece. Journal of Petrology 59, 2353-2384.

[2] Donohue and Essene (2000), An oxygen barometer with the assemblage garnet–epidote. Earth and Planetary Science Letters 181, 459-472.