Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36352

Multi-stage carbonation of the mantle section of the Semail Ophiolite, Oman

ELLIOT J. CARTER[1], BRIAN O'DRISCOLL[2], RAY BURGESS[3], PATRICA CLAY[2], HÉLÈNE BALCONE-BOISSARD[4] AND PIERRE BÜRCKEL[5]

[1]Keele University
[2]University of Ottawa
[3]University of Manchester
[4]Sorbonne Université
[5]Institut de Physique du Globe de Paris

Subduction of oceanic lithosphere links the surface and depths of the Earth with profound consequences for geochemical cycling of volatiles and surface habitability. The flux of carbon removal to the deep Earth exists as a balance between the inputs (carbon-bearing sediments) and outputs (e.g. arc volcanism) of subduction zones globally. Recent attention has highlighted the potential for hidden outfluxes of CO_2 not sampled by volcanism [1], driven by slab parallel flow of fluids into the shallow forearc mantle. However, unequivocal records of such processes in the geological record have remained elusive. Listvenites – fully-carbonated mantle peridotites – are exposed in the basal sections of many supra-subduction zone ophiolites but even in the best-studied example, the Semail Ophiolite, Oman, geochemistry and geochronology give conflicting information on the tectonic setting for carbonation. By combining detailed petrography with microanalysis of halogen abundances (F, Cl, Br, I) by secondary ionisation mass spectrometry (SIMS) in carbonate and serpentine minerals, we are able to resolve this dichotomy. Our data require at least two carbonation events with different fluid compositions. Fluids from the main carbonation event were derived from both sedimentary pore fluid and deep decarbonation reactions in a subduction zone. The later phase of carbonation was from a Ca- and F-rich fluid and may relate to ophiolite obduction or later magmatic events. Mass balance modelling suggests that CO_2 fluxes into the forearc could represent up to 90% of the global input to subduction zones [2].

[1] Barry, de Moor, Giovannelli, et al. (2019), Forearc carbon sink reduces long-term volatile recycling into the mantle. *Nature* 568, 487-492. doi:10.1038/s41586-019-1131-5

[2] Carter, O'Driscoll, Burgess, et al. (2026), Carbonated mantle peridotites represent a hidden sink for subducted CO2. *Nature Communications*. doi:10.1038/s41467-026-68646-3