Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36442

Constraints on volatile fluxes to the forearc mantle during subduction initiation: A case study from the Mont Albert metamorphic sole, Québec

JOHN C. LASSITER[1], JOSHUA MUNRO[1], ALISSA J KOTOWSKI[2], JAIME D. BARNES[1] AND AARON M SATKOSKI[1]

[1]The University of Texas at Austin
[2]Utrecht University

The transfer of surface volatiles to mantle reservoirs at subduction zones helps buffer Earth's climate and maintain planetary habitability. Although numerous studies have examined volatile fluxes to regions of arc magma generation, volatile transfer to the forearc is poorly understood. To constrain fluxes to shallow forearc mantle, we examined elemental and δD and $\delta^{44/40}$Ca variations in the metamorphic sole and peridotite hanging wall of the Mont Albert ophiolite, Québec, Canada.

The Mont Albert ophiolite is a slice of oceanic mantle lithosphere beneath which intra-oceanic subduction initiated in the Ordovician [1]. The underthrust metamorphic sole (mafic amphibolites and minor garnet schists from the subducting plate) records peak temperatures of 750-800°C at 0.8-1.0 GPa [1,2]. Mantle wedge peridotites record ~100% serpentinization at the sole/mantle contact, decreasing to <50% serpentinization within ~60 meters from the contact. Peridotite Al_2O_3 and Yb concentrations are highest at the contact (~3 wt.% Al_2O_3), decreasing to ~1 wt.% Al_2O_3 at ~60 meters from the contact. Similarly, peridotite δD values decrease from -28‰ at the contact to mantle-like values (-70‰) 60 meters from the contact, and $\delta^{44/40}$Ca values decrease from 2‰ to 0.9‰. Combined, these trends are consistent with mantle refertilization by a slab-derived hydrous melt with elevated δD and δ^{44}Ca values relative to normal mantle (~-80‰ and 0.95‰, respectively).

Slab-derived melts typically have elevated δD relative to normal mantle. However, the $\delta^{44/40}$Ca values observed at the slab/mantle contact (2‰) are much higher than in mafic amphibolite from the sole (0.9‰). Elevated δ^{44}Ca values have been reported in some carbonate-bearing altered oceanic crust, in carbonate veins in altered crust, and in carbonate sediments [3,4]. Incorporation of carbonate with elevated δ^{44}Ca into slab-derived melts may explain the elevated $\delta^{44/40}$Ca in the hanging wall. Future isotopic characterization of minor calcite-epidote-albite veins in the metamorphic sole will test this hypothesis. These results suggest significant H_2O and CO_2 transfer to the shallow forearc mantle during subduction initiation.

[1] Dubacq et al. (2019), *Lithos* 334-335, 161-179. [2] Kotowski et al. (2026), *JGR Solid Earth.* 131, 10.1029/2025JB032212. [3] Brown et al. (2014), *Goldschmidt Abstr.* [4] Blättler & Higgins (2017), *Earth. Planet. Sci. Lett.* 479, 241-251.