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Deep sourced fluids for peridotite carbonation in the shallow mantle wedge

JUAN CARLOS DE OBESO[1], PETER KELEMEN[2], JAMES ANDREW LEONG[2], MANUEL D. MENZEL[3], CRAIG MANNING[4], MARGUERITE GODARD[5], YUE CAI[6,7] AND LOUISE BOLGE[6]

[1]University of Calgary

[2]LDEO, Columbia University

[3]RWTH Aachen University

[4]University of California, Los Angeles

[5]Géosciences Montpellier, CNRS, Univ. Montpellier

[6]Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY 10964, USA

[7]State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology and Center for Excellence in Life and Paleoenvironment, Chinese Academy of Sciences

Presenting Author: juancarlos.deobeso@ucalgary.ca

Completely carbonated peridotites (listvenites) represent a window to study reactions of carbon-rich fluids with mantle rocks. We present details on the carbonation history of listvenites close to the basal thrust of the Samail ophiolite in the Sultanate of Oman. We use samples from Oman Drilling Project Hole BT1B, which provides a continuous record of lithologic transitions varying from serpentinite to listvenites in the ultramafic section crossing the ophiolite mega-thrust to metamorphic rocks as well as outcrop samples from listvenites and metamafics below the basal thrust of the ophiolite. $^{87}Sr/^{86}Sr$ of listvenites and serpentinites, ranging from 0.7090 to 0.7145, are significantly more radiogenic than mantle values, Cretaceous seawater, and other peridotite hosted carbonates in Oman. We show that the radiogenic Sr isotope component was transported via carbon-rich aqueous fluid that reacted with the peridotite to form the listvenites and serpentinites. Based on these results, we propose that during subduction at temperatures above >400°C, carbon-rich fluids derived from decarbonation of underlying sediments similar to those of the Hawasina formation migrated updip and generated the radiogenic $^{87}Sr/^{86}Sr$ signature and the fractionated d^{13}C values of the serpentinites and listvenites in core BT1B in processes akin to what might operate in modern subduction zones[1].

[1] de Obeso et al. (2022), Journal of Geophysical Research: Solid Earth, 127, e2021JB022704