

Graphitisation in the shallow mantle wedge of a fossil subduction zone

MENZIES, C. D.^{1*}, MUIRHEAD, D.¹, CRAW, D.², BOYCE, A. J.³, ROBERTS, S.⁴, KELEMEN, P. B.⁵

¹Department of Geology and Petroleum Geology, University of Aberdeen, Aberdeen, UK

*(correspondence: catriona.menzies@abdn.ac.uk)

(dmuirhead@abdn.ac.uk)

²University of Otago, Dunedin, New Zealand

(dave.craw@otago.ac.nz)

³SUERC, Rankine Avenue, Scottish Enterprise Technology Park, East Kilbride, G75 0QF

(adrian.boyce@glasgow.ac.uk)

⁴Ocean and Earth Science, University of Southampton,

European Way, Southampton, SO14 3ZH

(steve.roberts@noc.soton.ac.uk)

⁵Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY 10964

(peterk@ldeo.columbia.edu)

Fully carbonated peridotites composed of magnesite + quartz (+ dolomite) + chromite, termed listvenites formed at ~100 °C during the thrusting of the Samail ophiolite on top of metasediments of the Arabian margin [1]. The structure and mineralogy of these listvenites illustrate the complexity of fluid flow and subsequent carbonation of the shallow mantle wedge the subduction zones. Graphite has been identified throughout the these rocks and the reduction of carbonate to graphite is possible under reducing conditions. This reaction may be important as it requires that the destabilisation of carbonate may not always lead to decarbonation during subduction, stabilising carbon in the subducting slab [2] or forearc mantle, but its volumetric importance has yet to be quantified.

In this study we interrogate OmanDP listvenite cores using a combination of FT-IR and Raman Spectroscopy, and carbon isotope analyses to characterise different generations of graphite. We model the geochemical thermodynamic conditions that would facilitate the formation of these mineral assemblages. As this work assesses the conditions under which mantle wedge carbonation is facilitated, it is a crucial first step in upscaling the interrogation of the prevalence of these reactions in shallow mantle wedges globally.

[1] Falk, E. S. and P. B. Kelemen 2015. Geochim et Cosmochim Acta **160**: 70-90.

[2] Galvez, M. E., et al. 2013. Nat. Geosci **6**: 473-477.