Sediment melt and the highest recorded $\delta^{18}O$ in sub-Moho granitoids of the Oman-UAE Ophiolite

SPENCER, C.J.[1], RAUB, T.D.[2], CAVOSIE, A.J.[1], MILLER, J.D.[3], ROLLINSON, H.[4], JEON, H.[5], EIMF[6]

[1]The Institute of Geoscience Research (TIGeR), Dept. of Applied Geology, Curtin University, Bentley, Australia
[2]Dept. of Earth and Envir. Sciences, University of St Andrews, St Andrews, UK
[3]Department of Earth Sciences, University of Stellenbosch, Matieland, South Africa
[4]School of Science, University of Derby, Derby, UK
[5]Centre for Microscopy, Characterisation, and Analysis, University of Western Australia, Perth, Australia
[6]Edinburgh Ion Microprobe Facility, University of Edinburgh, Edinburgh, UK

Sub-Moho granitoid dykes of the Oman-UAE Ophiolite host the highest $\delta^{18}O$ values ever reported for magmatic zircon, exceeding +27‰ (VSMOW), as measured by Cameca 1270 and 1280 ion microprobes. The 2-10 m wide meta- to peraluminous granitoid dykes intrude harzburgite. This massive harzburgite is up to fifteen kilometers thick from the base of the ophiolite to the petrologic Moho. The isotopically enriched granitoid melts require contributions from either molten altered basaltic crust producing zircon with $\delta^{18}O < \sim 12$ ‰ or high-$\delta^{18}O$ seafloor sediments producing zircons with $\delta 18O > \sim 15$ and as high 27 ‰. The zircon $\delta^{18}O$ values, supported by whole rock oxygen isotope, trace element, and petrologic data, indicate the presence of continental crustal material in the asthenospheric wedge. This implies the Oman-UAE ophiolite was formed in a supra-subduction setting. The high values further indicate that the asthenospheric wedge contained substantial compositional heterogeneity. Granitoid dykes produced from pure crustal melts provide insight into the nature of mass transfer in subduction zones. In addition, granitoid dykes derived from the melting of altered basaltic crust (similar to the sheeted dykes and pillow basalts exposed in the Oman-UAE Ophiolite) offer an alternative explanation for mildly $\delta^{18}O$-enriched Hadean and Archaean zircon. We hypothesize that mild $\delta^{18}O$ enrichments in Archaean and Hadean zircon could have been produced by the melting of altered basalt to produce low-volume, high-$\delta^{18}O$ granitoids in the ultramafic mantle lithosphere.