Sediment melt and the highest recorded δ¹⁸O in sub-Moho granitoids of the Oman-UAE Ophiolite

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Sub-Moho granitoid dykes of the Oman-UAE Ophiolite host the highest δ¹⁸O 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 δ¹⁸O < ~12 ‰ or high-δ¹⁸O seafloor sediments producing zircons with δ¹⁸O > ~15 and as high 27 ‰. The zircon δ¹⁸O 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 δ¹⁸O-enriched Hadean and Archaean zircon. We hypothesize that mild δ¹⁸O enrichments in Archaean and Hadean zircon could have been produced by the melting of altered basalt to produce low-volume, high-δ¹⁸O granitoids in the ultramafic mantle lithosphere.