Highly depleted peridotites within Mesoarchaean orthogneiss at the Seqi Olivine Mine, SW Greenland - Potential implications for the formation of cratonic keels

KRISTOFFER SZILAS[1], VINCENT J. VAN HINSBERG [2], IAIN MCDONALD[3], TOMOAKI MORISHITA[4], D. GRAHAM PEARSON[5]

[1] Stanford University, USA (szilas@stanford.edu)
[2] McGill University, Canada
[3] Cardiff University, United Kingdom
[4] Kanazawa University, Japan
[5] University of Alberta, Canada

Field observations, petrography and geochemistry is presented for dunite and chromitite from the Seqi Olivine Mine of SW Greenland. This ultramafic complex comprises a ca. 500 x 1000 meter enclave within Mesoarchaean orthogneiss. Field and geochemical data indicates a cumulate origin and preliminary Re-depletion ages suggest a magmatic age of ca. 3.3 Ga for these rocks. This age marks a hiatus in the supracrustal rock record in this region, but may correspond to a magmatic event involving the lithospheric mantle, which resulted in the emplacement of noritic Ameralik dykes within the Eoarchaean Itsaq gneiss complex. The Seqi dunites are characterised by highly fosteritic olivine with cores consistently having Mg# of around 93. Spinel compositions are variable with Mg# and Cr# mostly below 60 and above 40, respectively, and Fe^{3+}# below 20. Chromitite bands at Seqi have interstitial orthopyroxene with Mg# of ca. 91. Amphibole is common in veins and joints within the Seqi complex and their enriched trace element compositions point to formation by metasomatism associated with the intrusion of the hosting granitoids. The refractory major element compositions of the Seqi dunites are essentially indistinguishable from those of the highly depleted subcontinental lithospheric mantle (SCLM) xenoliths that have previously been reported from alkaline dykes and kimberlites in SW Greenland. Although their incompatible and highly siderophile trace element compositions are distinct, the Seqi dunites would likely have behaved in a similar buoyant manner as SCLM during the formation of the North Atlantic craton. We therefore propose that at least parts of the shallow SCLM in this region may in fact represent peridotites with a cumulate origin, rather than being entirely made up of mantle residues.