Ultramafic alkaline magmas (meymechites) from the mid-Archean Ivisartoq greenstone belt, Southwest Greeenland

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A magnetite-rich, grey-green schistose layer, 10 to 50 m thick, in the composite Ivisartoq greenstone belt is interpreted as an ultramafic volcanic unit. This rock is exposed over a strike length of 8 km and is located between amphibolites with pillow lava structures in the northern part of the belt and intensely deformed banded amphibolites to the south. U-Pb zircon ages by laser ablation-ICPMS suggest that the unit and associated amphibolites are 3.1 Ga or older.

We mapped and sampled two detailed transects through the ultramafic unit. The mineralogy of the schists is composed of magnetite, chlorite, tremolite, phlogopite, talc and serpentine, overprinted by pyroxene and less abundant olivine porphyroblasts. The samples have very unusual but, despite the schistose nature of the rocks, remarkably consistent geochemical characteristics: high MgO (18-24.wt %), $Fe_2O_{3\ (total)}$ (17-22 wt %), Ni (450-1500 ppm), Cr (620-1560 ppm) and TiO_2 (1.1-3.4 wt %), and very low SiO_2 (mostly 41-45 wt %), Al_2O_3 (3.7-6.5 wt %) and Al_2O_3/TiO_2 (1.9-4.3). Incompatible trace element concentrations are highly enriched (Nb, La ~ 20 to 150 times primitive mantle values) and strongly fractionated ($[La/Sm]_{pm}$=1.8-4.5; $[Gd/Yb]_{pm}$=2.6-7.9). Primitive mantle normalized spider diagrams for the rocks do not have negative Nb-Ta anomalies, precluding significant crustal contamination of their parent magmas or subduction zone enrichment of their source regions. Initial epsilon-Nd values (3.1Ga) range from -0.6 to +2.3, indicating both enriched and depleted mantle sources.

We interpret the protolith of the unit as the first reported occurrence of meymechitic volcanic rocks in the Archean. They formed by very small-degree melting (<5%) of the deep Archean mantle, either in the lower part of thick (200 km) subcontinental mantle lithosphere or in the asthenosphere below. The iron-rich nature of the Archean meymechites is strong evidence for the proposal that the Archean mantle was more iron-rich (chondritic) than the pyrolite composition of the present-day upper mantle [1]. The Ivisartoq discovery also demonstrates that both enriched and depleted components occurred at great depths in the mid-Archean mantle, and could be tapped during the same melting event.

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[1] Francis D. (2003) *Lithos* **71,** 135-152.