

Petrography and geochemistry of the Tuvssap Ultramafic Complex, southern West Greenland

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The Itsaq Gneiss Complex of southern West Greenland formed in several events starting at ~3.87 Ga, and hosts numerous ultramafic enclaves that pre-date the gneiss protolith¹. Some of these enclaves have been interpreted as residual upper mantle and others as older mafic-ultramafic crust¹, as such, they provide a unique opportunity to examine pre-3.87Ga crustal and mantle processes. The Tuvssap Ultramafic Complex (TUC) is a ~2km long and ~300m wide metamorphosed ultramafic enclave hosted in the Itsaq Gneiss Complex. This study examines the major, trace, and platinum group element (PGE) geochemistry, mineral chemistry, and petrography of the TUC in an attempt to resolve the petrogenetic processes responsible for the formation of previously unstudied ultramafic enclaves south of the Tuvssap Supracrustal Belt.

Within the TUC there are 4 lithological domains consisting of dunite, Ol-clinopyroxenite, amphibolite, and hornblende gabbro. The bulk rock major element data of the dunites and olivine clinopyroxenites largely reflects that of their mineral constituents and between all lithologies displays decreasing MgO, FeO, NiO, and Cr₂O₃ and increasing SiO₂, TiO₂, Al₂O₃, MnO, and CaO from the dunite to hornblende gabbro lithologies. Primitive mantle normalized trace element patterns for all rock types are light rare earth element (REE) enriched relative to heavy REEs and have high field strength element (Nb, Ti, Zr, Hf) depletion relative to other trace elements. In addition, heavy REE concentrations are lowest in the dunite samples and increase through the lithologic units to the amphibolite samples without a corresponding increase in light REEs. Hornblende gabbro samples have a marked enrichment in both heavy and light REEs relative to the other lithologies. Primitive mantle normalized PGE patterns for dunite, olivine clinopyroxenite, and amphibolite samples are iridium group PGE (Os and Ir) enriched relative to palladium group PGE (Pd and Pt) and hornblende gabbro samples are iridium group PGE depleted relative to palladium group PGE. Iridium group PGE concentrations decrease and Pd/Ir ratios increase from the dunite lithology to the hornblende gabbro lithology.

These bulk rock data are not in agreement with a residual mantle, komatiitic, or picritic origin for the TUC rocks. Dunite, olivine clinopyroxenite, and amphibolite lithologies can best be interpreted as having cumulate origins, and solidification of a basaltic melt to form the hornblende gabbro lithology. Later amphibolite facies metamorphism is responsible for alteration minerals.

1. Nutman, A.P., McGregor, V.R., Friend, C.R., Bennett, V.C., and Kinny P.D. (1996). The Itsaq Gneiss Complex of southern West Greenland; the world's most extensive record of early crustal evolution (3900-3600Ma). *Precambrian Research*, 78, p. 1-39.

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