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Investigating the Early Stages of Magmatism in the Muskox Intrusion and Mackenzie Large Igneous Province from the Geochemistry of Ultramafic-Mafic Rocks Beneath the Layered Series

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The ca. 1.27 Ga Mackenzie large igneous province (LIP) covers a vast area of northern Canada and includes the 3-4 km-thick Coppermine River Group flood basalts, the sub-volcanic Muskox layered ultramafic-mafic intrusion, and the giant radiating Mackenzie dike swarm. The Muskox intrusion, one of the largest layered intrusions in the world, is the product of open-system magmatic processes and was emplaced early in the magmatic history of the Mackenzie LIP. The funnel-shaped intrusion consists of a 1.8 km-thick layered series (dunites, olivine clinopyroxenites, websterites, gabbronorites), marginal zones (100-250 m-thick) of feldspathic peridotites to olivine gabbronorites, and a granophyric roof zone; the vertical, 150-500 m-wide, gabbronoritic keel dike extends beneath the intrusion. We present the initial results of a chemostratigraphic study of ultramafic-mafic cumulates intersected by a sub-vertical, 427 m-deep drill hole in the southernmost part of the intrusion to evaluate the products of early magmatism in the Muskox intrusion. The dataset includes major element oxides and trace element concentrations of 81 whole rock samples from drill core. Based primarily on geochemistry (+mineralogy/petrology), four distinct units are recognized: (1) pervasively serpentinized dunites (MgO ~39 wt%, Mg# = 0.80-0.82) from 0-92 m depth representing the base of the layered series, (2) feldspathic peridotites to olivine-rich gabbronorites (MgO = 23-28 wt%, Mg# = 0.78-0.79) from 92-193 m depth with distinctive orthopyroxene phenocrysts containing abundant plagioclase inclusions, (3) a thick unit from 193-421 m depth varying progressively (MgO = 15-31 wt%, Mg# = 0.75-0.80) from olivine gabbronorites with orthopyroxene phenocrysts in the upper part to feldspathic peridotites and peridotites in the lower part, and (4) gabbronorites-peridotites (MgO = 18-21 wt%, Mg# = 0.70-0.74) from 421-427 m depth. The geochemical relations of the cumulates intersected below the layered series dunites indicate that they are not marginal zone rocks, which transition progressively from dunite through peridotite to olivine gabbronorite at the margin of the intrusion. The geochemistry of these ultramafic-mafic rocks is compared with existing datasets from other components of the Muskox intrusion to provide insight into the early filling history of this layered intrusion and the onset of magmatism in the Mackenzie LIP.