

Eclogites of the North Atlantic Craton: Insights from the Chidliak eclogite xenoliths (S. Baffin Island, Canada)

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The 156–138 Ma Chidliak kimberlites on the Eastern Hall Peninsula (EHP) of Baffin Island entrained mantle xenoliths interpreted to have been a part of the Archean North Atlantic Craton (NAC) mantle.

Eclogites account for 11% of all mantle xenoliths in Chidliak. We studied 19 Chidliak eclogite xenoliths that comprise 10 biminerals, 5 rutile-bearing, 3 orthopyroxene-bearing and one kyanite-bearing eclogites. The eclogites are classified into HREE-enriched, depleted and metasomatized based on their reconstructed whole rock REE patterns. All Chidliak eclogites are equilibrated in the diamond P-T field and cluster in two groups, low-temperature (840–990 °C at 4.1–5.0 GPa) and high-temperature (T >1320 °C at P >7.0 GPa). The eclogites resided in the peridotitic mantle affected by several metasomatic events, including an early pervasive silicate-carbonate metasomatism and a more recent Ti metasomatism at 180–215 km. The silicate-carbonate metasomatism is reflected in higher Ce/Yb, Sr/Y, TiO₂ or MgO of the metasomatized group of eclogites. Only two samples may have formed after metamorphosed gabbro based on the presence of kyanite, high Sr content of garnet and positive Eu anomalies. Depleted Chidliak eclogites can be residues after 5–35% partial melting of Archean basalt after extraction of TTG from the EHP, as suggested by major and rare earth element modelling. The average contents of MgO, FeO and CaO in NAC eclogites are statistically distinct from those in Slave craton eclogites with a probability of > 95%. The former are more magnesian, less ferrous and calcic, contain more magnesian and less calcic garnets, and lower proportions of Group C eclogites partly because of more intense metasomatism. The Mg metasomatism is further evidenced by common development of secondary diopside-rich clinopyroxene and consistently more magnesian minerals in the eclogite xenoliths compared to Chidliak eclogitic diamond inclusions. Beneath Chidliak, the deepest xenolith sampling in the very base of the thermal lithosphere (220 to 250 km) is restricted only to eclogites.