The petrography and geochemistry of melt-bearing mantle xenoliths from the Chidliak kimberlite field, Baffin Island, Canada

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We studied the petrography and geochemistry of 25 unaltered mantle xenoliths containing unique melt pockets and veins from the Upper Jurassic CH-6 and Lower Cretaceous CH-7 kimberlite pipes in the Chidliak kimberlite field, Baffin Island, Canada. The xenoliths were entrained from a range of depths and temperatures in the mantle including both the spinel and garnet peridotite stability fields. Thermobarometric calculations indicate the xenoliths last equilibrated in the mantle at temperatures between 646 and 1238 °C at depths from ~ 63 to 213 km. The melts in garnet-bearing xenoliths form both pocket and vein textures. In contrast, spinel peridotites exclusively contain melt veins with textures indicating brittle fracture associated with injection of fluid/melt. The melts crystallised as complex intergrown assemblages of spinel group minerals, apatite, perovskite, ilmenite, and Ni-sulphides with secondary serpentine, brucite, carbonates, and mica. Melt-pockets contain both Cr-rich and Cr-poor spinels with a range of magnesian ülvospinel-magnetite compositions that extend to more oxidized compositions than found in groundmass spinels from CH-6 and CH-7. We suggest that the mineral assemblage in the melt pockets is compatible with kimberlite melt infiltrating these xenoliths shortly prior to, or during mantle transit of CH-6 and CH-7 kimberlite magmas from 68 to 20 kbar.

We also determined the trace element geochemistry of garnets, clinopyroxenes, melt pockets, and kimberlite whole rocks by LA-ICP-MS and HR-ICP-MS. The trace element compositions of the silicate minerals and melt pockets reveal a complex metasomatic history experienced by the peridotites sampled by the Chidliak kimberlites.

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