Petrography and Geochemistry of the Nanuk and Tuwawi Kimberlites, Baffin Island, Nunavut

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Abstract

The Tuwawi and Nanuk kimberlites are located on the Brodeur Peninsula of Baffin Island, approximately 100km northwest of the community of Arctic Bay. The kimberlites were discovered by Kennecott Canada Exploration Inc. in 2003; however the property is now 100% owned by Canterra Minerals Corp. (formerly Diamondex Resources Ltd). New petrographic study of these kimberlites indicates that Nanuk is mainly calcic hypabyssal macrocrystal facies, while Tuwawi is dominated by calcic volcaniclastic facies. Previous work by Cross (2009) identified both volcaniclastic and hypabyssal kimberlite at Tuwawi. Both intrusives are abundant in subhedral to anhedral olivine macrocrysts, and contain rare spinel macrocrysts. Inclusions within olivine macrocrysts are uncommon; however, pentlandite was found in one sample from Nanuk, and a rounded orthopyroxene was found in one sample from Tuwawi. Groundmass phases include: spinel, olivine, serpentine, perovskite, apatite, kinoshitalite, and carbonate. The carbonate consists of three types; magnesite, dolomite and calcite in order of increasing abundance. The groundmass perovskite and spinel exhibit necklace-textures, in which these minerals are concentrated around phenocrystal olivine. As well, groundmass spinel displays atoll-textures, which applies to resorbed and complexly mantled crystals that resemble a core or island surrounded by an unattached outer rim. Kinoshitalite, an unusual barium-rich mica, had not previously been identified in these kimberlites and is typically less than 20 microns in diameter.

Nanuk and Tuwawi are lacking in most minerals indicative of a kimberlitic macrocrystal suite, including garnet, magnesian ilmenite and clinopyroxene. Electron microprobe data shows that the macrocrystal spinel consists of either a chromium-rich type or a titanium-rich type; the titanium-rich type was only observed in Nanuk. Alternatively, the groundmass spinel is either iron-rich or chromium-rich in both kimberlites. The MgO and Cr_2O_3 content of kimberlite-bearing Cr-rich spinels is used to assess the diamond potential of kimberlites; assuming that diamonds are sourced from the disaggregation of chromite harzburgites. Favourable diamond potential is indicated by Cr-rich spinel that have Cr_2O_3 >61% and MgO between 10-19% (Erlich and Hausel, 2002). Preliminary geochemical data from Tuwawi and Nanuk suggest that both macrocrystal and groundmass spinel fit into this diamond-intergrowth and inclusion field. This supports geothermobarometric data from Cross (2009), who found that mantle xenoliths from Tuwawi plot within the diamond stability field. Further work in the present study includes olivine-spinel geothermometry, and a petrogenetic model for Tuwawi and Nanuk. This work has important implications for future diamond exploration on the Brodeur Peninsula.

References

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