Carbonic fluid inclusions in the Lac Des Iles (Ontario) and Greendale (Nova Scotia) complexes: constraints on mafic pegmatite crystallization and platinum-group element (PGE) mineralization

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[Poster]

The study aims to constrain the conditions of mafic pegmatite formation in the Lac Des Iles (LDI) and Greendale (GC) complexes in order to understand better the processes responsible for the precipitation and redistribution of associated platinum-group elements (PGE). The main ore zone at LDI, the Roby Zone, is hosted within heterolithic gabbro breccia or varitextured gabbro, with high grade PGE mineralization occurring in gabbro pegmatite dikes (up to 37 ppm Pt + Pd + Au). Mafic pegmatites in the Roby Zone consist of primary magnesiohornblende, pyroxene, plagioclase (labradorite-bytownite), and secondary chlorite and actinolite. Disseminated sulfides and oxides, and interstitial quartz are also present. PGE minerals documented at LDI include: braggite, kotulskite, isomertieite, merenskyite, sperrylite, moncheite, stillwaterite, palladoarsenide, and vysotskite. The GC in Nova Scotia consists of porphyritic hornblende gabbro and diorite, with minor gabbroic pegmatite composed of actinolite, plagioclase (oligoclase-andesine), and quartz. PGE mineralization in the GC is sub-economic and contains grains of Pt-Sb (genkinite) hosted in pyrite and pyrrhotite within the pegmatite.

Intercumulus quartz at LDI hosts primary and pseudosecondary assemblages of pure CO_2 inclusions (two phase L + V at room T) and secondary, late aqueous fluid inclusions. The GC quartz hosts primary, pure CH_4 inclusions (two phase L + V at room T) and secondary, late aqueous inclusions. Microthermometric measurements show that the carbonic fluid inclusions in the coarse-grained LDI pegmatitic quartz homogenize one of three ways: (i) to L between 28.5 and 31.1 °C (n = 31); (ii) to V between 27.6 and 30.9 °C (n = 9); or (iii) by supercritical behaviour between 30.9 and 31.2 °C (n = 14). Carbonic fluid inclusions from fine-grained LDI pegmatitic quartz homogenize only to L between 9.9 and 26.4 °C (n = 37). Methane fluid inclusions from the Greendale complex homogenize either to L between -88.2 and -84.9 °C (n = 25), or rarely by supercritical homogenization at -83.9 °C (n = 4). A variety of thermobarometers were used in conjunction with microthermometrically-derived carbonic fluid isochores to obtain P-T conditions of pegmatite formation. Quartz hosting the inclusions at LDI crystallized between ~550 and 630 °C, with P varying between 460 and 1660 bars. Quartz hosting the inclusions at GC crystallized at very similar T between ~510 °C and 550 °C, with P varying between 470 and 1930 bars.

The results indicate that (i) the primary fluid involved in pegmatite formation in both locations was not aqueous but anhydrous carbonic in composition; (ii) CO_2 or CH_4 entrap-

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ment at both LDI and GC occurred over a very similar and relatively large range in P consistent with the transition from lithostatic to nearly hydrostatic conditions.