The presence of carbonic-dominant volatiles during the crystallization of sulfide-bearing mafic pegmatites in the North Roby Zone, Lac Des Iles Complex, Ontario

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Mafic pegmatites in the platinum-group element (PGE)-mineralized Roby Zone, Lac Des Iles Complex ("LDIC"), northwestern Ontario, comprise dykes, veins and irregular pods of coarse-grained magnesiohornblende, pyroxene, and labradorite-andesine with minor biotite, apatite, Fe-Ti-oxides and intercumulus quartz that grades into massive quartz or graphic quartz-base metal sulfide-vysotskite [Pd, Ni(S)] intergrowth at their cores. Quartz, apatite and magnesiohornblende host primary and secondary assemblages of one- or two-phase carbonic fluid (CO_2 ± up to ~10% CH_4 ± minor H_2O, N_2) inclusions that contain ore metals (Ni, Cu, Pd, Bi, Te, Fe). Rare trails of late stage, high salinity aqueous fluid inclusions are secondary in origin and therefore unrelated to the crystallization of the pegmatites. Assemblages of primary carbonic fluid inclusions show considerable variation in mode and tem-

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perature of homogenization, reflecting large fluctuations in confining pressure at the time of quartz crystallization of up to ~ 1 kbar (in single quartz crystals) and ~2.8 kbar (all data). Independent thermobarometric methods constrain conditions for two stages of pegmatite formation (and carbonic fluid entrapment): (i) the crystallization of magnesiohornblende-plagioclase intergrowth at T ~ 650-850°C, and P ~ 1-3 kbar, and (ii) the crystallization of quartz at T ~ 535–650°C, and P ~ 0.4-3.2 kbar, setting the maximum depth of emplacement of the LDIC North Roby Zone magma at 10–12 km. The results indicate that aqueous-dominant volatile phases were absent during the crystallization of pegmatitic gabbroic rocks at LDIC, and that water-poor, carbonic fluid entrapment persisted to well below solidus conditions. A role played by carbonic fluid as a potential transport medium for ligands involved in the precipitation and remobilization of the PGE and base metals is strongly suggested and warrants further investigation.