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High-temperature contact metamorphism of calc-silicate xenoliths in the Kiglapait Intrusion, Labrador

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ABSTRACT

Calc-silicate xenoliths occur as part of a xenolith and autolith swarm in the Lower Zone of the Kiglapait Intrusion, Labrador. All xenoliths are lighter-colored than the local troctolite host rock, and are surrounded by a 1–2 cm thick reaction zone of clinopyroxenite. The typical mineral assemblage in calc-silicate xenoliths is diopside + forsterite + monticellite + spinel, and one also contains åkermanite. Reaction zones are dominated by diopside and spinel. All clinopyroxene compositions are "fassaitic," with high concentrations of Al_2O_3 (4–12 wt%), TiO_2 (1–4 wt%), and calculated Fe_2O_3 ($Fe^{3+} > Fe^{2+}$). In addition, clinopyroxene grains locally display extreme zoning in Si, Al, Ti, and X_{Mg}. Åkermanite contains up to 1.5 wt% Na_2O.

Textures in the xenoliths are complex, with most containing highly irregular intergrowths of diopside, forsterite, and monticellite. Åkermanite and forsterite are separated locally by a coarse symplectic intergrowth of diopside and monticellite, which resulted from a retrograde reaction. The dominant assemblage probably represents the production of monticellite from calcite + clinopyroxene + forsterite, until calcite was consumed. These reactions require metamorphic temperatures of ~900 °C and pressures ≤ 0.4 kbar, such that the xenoliths were probably derived from the roof of the magma chamber. Whole-rock compositions reflect either substantial chemical exchange with the Kiglapait magma, or a very impure dolomitic protolith. The clinopyroxenite reaction zones were produced primarily by assimilation of carbonate by the Kiglapait magma, in combination with the effects of magma undercooling near the xenoliths.