Al-Rich Pyroxenes in Granulite Xenoliths From Tangier: Implications to Lower Continental Crust, Eastern Meguma Zone, Nova Scotia

A.K. Chatterjee and P.S. Giles
Nova Scotia Department of Mines and Energy, P.O. Box 1087, Halifax, Nova Scotia B3J 2X1

A wide assortment of rounded to angular xenoliths ranging in size from <1 cm to >100 cm occur in a post-Acadian NNW-trending spessartite dyke at Tangier. These xenoliths may be assigned to two groups: (A) graphite- and garnet-bearing and (B) devoid of these minerals. Group A xenoliths containing orthopyroxene (opx) have abundant spinel and aluminosilicates. Those containing clinopyroxene (cpx) have Al-rich sphene, apatite and amphibole. Other minerals common in Group A include quartz, sapphirine, mesoperthite, corundum, plagioclase, rutile, biotite, chlorite and muscovite. Mg values (100 Mg/Mg+Fe^{+2}+Fe^{+3}+Mn) for Group A opx range from 32-74 and total Al in opx ranges from 0.10 to >0.80. Clinopyroxenes from Group A xenoliths are of diopside to salite composition, with total Al ranging from 0.05-0.15.

Xenoliths of Group B include 2-pyroxene granulites and opx-amphibole and cpx-amphibole granulites. Other mineral phases are quartz, K-feldspar, plagioclase, phlogopite, calcite, chlorite and sphene. Mg values for Group B opx range from 84 to 88 and total Al in opx ranges from 0.10-0.20. Clinopyroxenes in Group B xenoliths are exclusively of endiopside composition, with total Al ranging from 0.20-0.40.

Assessment of pyroxene composition in terms of components such as Ca:Mg:Fe+Mn and Al^{iv}-Al^{vi} reveals that Tangier dyke pyroxenes: (1) are atypical of those found in igneous rocks of various affinities, (2) are markedly different from those found in regional granulite terrains ranging in age from Archean to Hercynian and (3) are vastly different from pyroxenes of mantle origin. Furthermore, peak temperature (1030-1166°C) and pressure (14.2-14.8 kb) estimates are unlike those reported from regionally metamorphosed granulite terrains and suggest that the Tangier pyroxenes are indicative of lower crustal origin.

We consider it unlikely that doubly thickened crust could provide a mechanism to explain these P-T conditions and propose, alternatively, that heating of a single crustal plate through mantle magmatism could provide a more appropriate explanation. Links have recently been established between mafic plutonism, of which the Tangier dyke is a local manifestation, and "Acadian" granitoid plutonism with associated diapiric emplacement of high-grade gneissic rocks (e.g., Liscomb Complex). These links in space and time suggest application of this model to a significant portion of the lower crust beneath the Meguma Zone.