An occurrence of subsilicic orthopyroxene and Opx-Sp-Ru-Qtz assemblage in xenoliths of the Tangier Dike, southern Nova Scotia

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Sapphirine-bearing granulite xenoliths of metasedimentary parentage from Tangier contain abundant subsilicic orthopyroxenes (Si^{+4} < 1.75 per formula unit) in domains made up of unexsolved ternary feldspars, sapphirine, garnet, spinel, rutile and quartz. Subsilicic orthopyroxenes and the assemblage Opx-Sp-Ru-Qtz have been predicted through experimental and petrogenetic consideration to occur in rocks of appropriate bulk composition subjected to temperatures exceeding 1000°C and pressures approaching 10 Kb. The Tangier granulites provide a rare opportunity to compare theoretically predicted mineral

assemblages and petrogenetic relationships with naturally occurring assemblages, in turn permitting a rigorous assessment of P-T history of these rocks normally unattainable due to their rarity at the earth's surface.

Petrogenetic considerations at 1100°C and 11.7 Kb predict a decreasing Xmg for Fe-Mg minerals in the assemblage from sapphirine through orthopyroxene, spinel and finally garnet. The Tangier data closely match theoretical predictions (Xmg Sa 0.80, Xmg Opx 0.71, Xmg Sp 0.57; and Xmg Gt 0.56). The Xmg value for garnet should theoretically approximate the Xmg of the bulk rock. In the Tangier assemblages, this relationship is confirmed. With an equilibrium temperature of 1000°C independently provided by ternary feldspars, the Tangier data strongly corroborate the experimental predictions.

The uniqueness of these sapphirine-bearing xenoliths with their unusual mineral assemblages lies mainly in their preservation at surface, possible only through very rapid rise to high crustal levels. Equally important is the recognition that these represent sedimentary rocks deposited in a presumably normal range of sedimentary environments, and subsequently transported to lower crustal depth within the stability field of pyrope. They are therefore very much "natural rocks" that have experienced crustal conditions far more extreme than most rocks exposed at surface.