Petrogenesis of the Weekend dykes, a suite of Late Devonian spessartite lamprophyres in the Meguma Zone of Nova Scotia

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Post–tectonic, Late Devonian (ca. 370 Ma) peraluminous granitoid plutons, and a suite of contemporaneous calc–alkaline mafic intrusions, intrude the southern and eastern Meguma Zone. Ten spessartite (amphibole and plagioclase dominant) lamprophyre dykes, known informally as the Weekend dykes, constitute a subset of this mafic intrusive activity. All dykes exhibit characteristic panidiomorphic textures, with seriate phenocrysts of amphibole, rare biotite, and clinopyroxene. Plagioclase, K–feldspar, quartz, and primary calcite and epidote occur only in the groundmass. Restricted major element variations (SiO_2 54–56 wt. %, MgO 6–13 wt. %, Al_2O_3 13–17 wt. %, and total alkalies 2.3–5.8 wt. %) reflect changes in mafic phenocryst abundance, and high Mg–numbers (0.6–0.8), Cr (278–1500 ppm), Ni (75–349 ppm), and LOI (1.7–4.3 wt. %) indicate the primitive and volatile–rich nature of these rocks. Enrichments of LILE (e.g., Sr, Rb, Ba – 270–835 ppm) relative to HFSE (e.g., Nb, Ta, Y – 4–30 ppm), and of LREEs relative to HREEs (La/Lu - 41–82) are typical of calc–alkaline lamprophyres. The textural and compositional consistency among dyke members suggests that they are cogenetic.

Models for the origin of such primitive, incompatible element enriched, hydrous magmas involve metasomatized lithospheric or asthenospheric mantle sources, with or without crustal contamination. HREE fractionation suggests derivation from a garnet–bearing asthenospheric source. Negative Ta–Nb–Ti anomalies, and geochemical similarities with modern subduction–related basalts, imply that fluids derived from subducted oceanic lithosphere promoted mantle metasomatism, generating lamprophyric parental melts. Combined low pressure fractionation, assimilation of crustal lithologies, and/or parent magma heterogeneity can account for geochemical differences between individual dykes.