## The Zealand Station beryl deposit, west-central New Brunswick: mineralogic, geochronologic, and petrogenetic constraints

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The Zealand Station beryl deposit is located 30 km northwest of Fredericton, New Brunswick, along the northeastern cusp of the Devonian Pokiok Batholith that has been mapped as the Hawkshaw Granite, previously dated at 411 ± 1 Ma by U-Pb titanite. The Pokiok Batholith intruded Early Silurian Kingsclear Group metasedimentary rocks. The Hawkshaw Granite in the Zealand Station area is characterized by pink to grey, medium-grained biotite granite that displays local textural variation. Also present, is a late-stage southeast-trending aplite dyke recently dated at 401 ± 2 Ma by U-Pb in zircon, which is likely related to the Allandale Granite, previously dated at 402 ± 1 Ma by U-Pb in monazite.

At the Zealand Station beryl deposit, the host granite is altered to greisen in pockets (<3 m wide) and along veins that have associated molybdenite booklets and beryl. The quartz-rich veins have two predominant orientations: 135°/90°, and 010°/75°W, and <5 cm wide and traceable for up to 30 cm, with rare molybdenite pockets <1.5 cm thick. Located 50 m from the study area is a small exposure of a pegmatite phase of a similar dyke that is predominately quartz and orthoclase with crystals reaching about 30 cm in size, and coarse-grained muscovite booklets. The euhedral beryl is clear, blue to greenish blue and up to 1 cm in diameter. In addition, there is up to 20 vol.% beryl in the aplitic phase. The beryl in the granites and veins vary from 4 ppm Be to >0.72 wt.% BeO with an average concentration of 0.1 wt.% BeO.

The eight beryl samples analyzed by EPMA at UNB come from the aplite phase, the granite phase, and beryl-bearing quartz veins. The common formula of beryl is $Be_3Al_2Si_6O_{18}$, with $Fe^{2+}$, Cr, and V as possible chromophores that substitute into the beryl structure. The Cr and V average concentrations were 0.0006 apfu (atoms per formula unit) and 0.007 apfu, respectably. The dominant chromophore must be the substitution of ferrous iron into the channel sites resulting in the characteristic blue colour. Additional elemental substitution into the beryl structure display expected trends against charge-balancing elements. Beryl from the veins and granitic aplite show contrasting features including the vein-beryl rims having greater octahedral-site substitution and higher Cs in channel sites, reflecting increasing fertility during growth. The rims in the granite-beryl and aplite-beryl show the opposite zoning relationships. The channel site abundances are a function of the Li substitution as controlled by the charge balance in the Be tetrahedral site. One sample from a vein-beryl showed oscillatory zoning with expected charge balance trends, but with most significant alternating peaks of Cs/Li and Na/Li.