
**The Zealand Station beryl (Aquamarine) 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 multiphase Devonian Pokiok Batholith that has been mapped as the Hawkshaw Granite, previously dated at 411 ± 1 Ma by U-Pb titanite. A late-stage, southeast-trending, weakly porphyritic with coarse-grained perthitic feldspar, aplitic to pegmatitic dyke locally contains abundant blue beryl (aquamarine) in the aplitic groundmass. An exposure of the pegmatitic phase, 50 m from the map area, is predominately muscovite, quartz, and orthoclase with granophyric texture containing wolframite. Beryl is also found along quartz-rich veins trending $135^\circ/90^\circ$ and $010^\circ/75^\circ$ W and near altered greisen pockets in the host granite that have no predominant orientation.

The host granite and crosscutting dyke have a slightly potassic granitic composition and the $\text{FeO}^{\text{T}}/(\text{FeO}^{\text{T}}+\text{MgO})$ ratio of the granite indicates that they are predominantly magnesian. Furthermore, the area is approximately calc-alkaline with strong peraluminosity that is enhanced by greisenization. The granite composition partially overlaps those of the aplitic dyke and related phases. Trace-element data have elemental characteristics of S-, fractionated I-, and crustal A-types. In addition, Sm-Nd data indicate that the aplitic dyke is similar to the Pokiok Batholith.

The aplite dyke has been dated at 400.5 ± 1.2 Ma using TIMS U-Pb on magmatic zircon (Memorial University) and at 404 ± 8 Ma using the U-Pb in magmatic monazite by the electron probe microanalysis (EPMA) technique (University of New Brunswick): these ages link the aplitic dyke to the Allandale Granite phase, previously dated at 402 ± 1 Ma by U-Pb monazite, which is the youngest and most evolved phase of the Pokiok Batholith. In addition, two EPMA monazite analyses resulted in an age of 510 ± 20 Ma, indicating a supracrustal xenocrystic origin with an age similar to the Miramichi and St. Croix subzone metasedimentary rocks.

Eight beryl samples were analysed by EPMA from the aplitic dyke, beryl-bearing quartz veins, and greisen pockets. At this deposit, the average H_2O content in the channel site is 1.53 wt.% calculated by $(\text{Na}_2\text{O} + 1.4829)/1.1771$. The beryl's excess silica concentration is well-fitted into the Al-octahedral site, along with other common constituents including iron that is shown to be predominantly ferric and the dominant chromophore. Compositional zonation is evident in all beryl crystals using backscatter electron imaging, with one sample showing oscillatory zoning.