

The Brazil Lake Pegmatite, Southwestern Nova Scotia: Role of Sodium Metasomatism in an LCT-type Pegmatite of Magmatic Parentage¹

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The Brazil Lake Pegmatite (BLP) occurs in metasedimentary and metavolcanic rocks of the Silurian White Rock Formation, southwestern Nova Scotia, and crystallized at 378 ± 1 Ma (concordant U/Pb tantalite age). The BLP occurs ca. 10 km west of the termination of the chemically evolved, peraluminous, F- and Li- rich Davis Lake Pluton (DLP), part of the 380 Ma South Mountain Batholith. The pegmatites form a NE-trending, steeply-dipping, en echelon dyke swarm ca. 700 m long with individual pegmatites <10-20 m width. Detailed mapping of the southern dykes revealed the following assemblages: (1) heterogeneous nucleation of coarse (1-2 m) Kfs and Spd crystals oriented perpendicular to the contact; (2) intergranular Qtz-Kfs-Ab-Ms-Spd between the coarse Kfs and Spd with mineral proportions varying considerably; and (3) a locally developed wall zone of fine-grained pegmatite with quartz enrichment. Secondary mineral growth is recorded by: (1) abundant exomorphic tourmaline in the wallrock quartzite and mafic volcanics, and replacing inclusions of volcanic rock near contacts; (2) silicification of the wall rock; (3) abundant, fine-grained sacchroidal-textured albite and euhedral cleavelandite replacing primary pegmatitic Kfs ($Or_{75}Ab_{25}$; $K/Rb=20$, $K/Cs=450-1000$); and (4) abundant muscovite ($Rb < 5000$ ppm, $Li=330-1500$ ppm) after Kfs. In addition to the major phases, accessory minerals, many of which are secondary and occur in albite-rich rock, include apatite (Mn- and F-rich types), Mn-rich garnet, triplite, beryl, topaz, Ta-Nb oxides, cassiterite, biotite, titanite, lithiophilite, fillowite, and amblygonite/montebbrasite. Whole-rock analyses of pegmatite samples indicate positive correlations for P, Ca, Ta versus Na, which reflects metasomatic mobility of the elements. Our observations indicate that a primary assemblage of Kfs-Qtz-Spd-Ms was modified by interaction with a Na-rich, magmatic fluid that formed albite/cleavelandite - rich zones after primary Kfs with enrichment in Nb-Ta oxides and associated secondary Li-P phases. Liberation of K during Kfs destructive alteration was sequestered in secondary muscovite. Preliminary fluid inclusions measurements ($T_h=200-300^\circ C$, 5-25 wt. % eq. NaCl) combined with the absence of petalite in the BLP constrains initial formation conditions to ca. $550^\circ C$ and 3-3.5 Kbars with subsequent PT evolution similar to that at the Tanco pegmatite. Initial ^{18}O isotopic analysis indicate: Qtz=8.4-10‰, Ms=7-7.8‰, Spd=6.2-7.1‰, Ab=8.5-8.8‰, Tur=6.8-8.0‰, Grt=9-11.1‰. These data indicate an initial magmatic system was contaminated by the country rock via fluid interaction as the system cooled. The BLP melt is considered to represent an evolved fractionate of the DLP found at depth or laterally from this site.

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