Nature and Origin of Cornwall-type Clay Mineralization in Southwest Nova Scotia, Canada: The Black Bull Resources Inc. Yarmouth Silica-Kaolinite Deposit

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The southwestern part of the Meguma Terrane of Nova Scotia, underlain by ca. 370 Ma peraluminous granites and Cambro-Ordovician metaturbidites of the Meguma Group (MG), is well known for its granophylic mineralization (e.g., East Kemptville Sn-Zn-Cu-Ag). However, recent exploration has delineated extensive reserves of silica-clay mineralization within the same granite batholith, some 10 km from the East Kemptville deposit. Initial reserves of ca. 15 Mt silica (≥98-99% SiO₂) and ca. 4.6 Mt kaolinite (80-85% brightness) are indicated for part of the 6 km strike length of the deposit (100 m depth), with exploration drilling and geophysical surveys indicating considerably larger reserves. The deposit occurs at the southern contact of the SMB with MG metasedimentary rocks and is confined to a northeast-trending brittle-ductile shear zone of 1.5 km width, with the mineralized zone ≤200-300 m wide. The intensely deformed (i.e., mylonitic) wall-rock biotite leucogranite is progressively replaced by silica-clay rock, culminating in zones of ≥98% SiO₂ and ≥60% kaolinite; there is a border zone of quartz-kaolinite breccia and a core of quartz breccia. Paragenetically, early silicification and feldspar-destructive clay alteration is succeeded by repeated brecciation and quartz formation with concomitant increase in wt. % SiO₂. Fluid inclusion studies indicate minimum entrapment temperatures of 141° to 218°C and salinities of ≥0.8 wt. % eq. NaCl; decrepitate analysis indicate a mixed Na-K fluid chemistry. Imaging of opened fluid inclusions indicates the presence of barite euhedra and kaolinite. δ¹⁸O analysis are +10 to +15‰ for quartz and +15 to +17‰ for kaolinite, whereas δD for kaolinite is -60‰ and -65 to -80‰ for quartz-hosted fluid inclusions. Interpretation of these data favours a two fluid mixing model involving magmatic and meteoric fluids with mineralization occurring at ≤300°C. Comparison with additional geological and geochemical information for strike-parallel mineralization in the area (e.g., Tobeatic Lake, Pb-Ag-Ba-Au) suggests that the mineralized zone is laterally extensive (i.e., 10’s km), representing part of an extensive silica-clay-base and precious metal environment in southwestern Nova Scotia. The structurally-controlled mineralization probably occurred shortly after SMB emplacement with incursion of meteoric water along a vertically extensive and active fault structure.