Results of mineral deposit studies at the granite-hosted Dunbrack (Zn-Pb-Cu-Ag) and Kinsac (Ba-F) localities, Central Meguma Terrane, Nova Scotia: possible implications for Carboniferous Zn-Pb-Cu-Ag-Ba-F metallogeny in the Meguma Zone

D.J. Kontak[1], R.J. Horne[1] and K. Ansdell[2]
[1]*Nova Scotia Department of Natural Resources, P.O. Box 698, Halifax, Nova Scotia B3J 2T9, Canada*
[2]*Department of Geological Sciences, University of Saskatchewan, 114 Science Place, Saskatoon, Saskatchewan S7N 0W0, Canada*

Two mineralized areas within the ca. 370 Ma Musquodoboit and Kinsac plutons have been examined in order to evaluate the nature and origin of the base-metal (Dunbrack) and barite-fluorite (Kinsac) mineralization, respectively, and determine their implications for regional metallogeny. Although mineralization in both areas is vein-style and of hypogene origin, it is not clear whether the timing of mineralization coincides with emplacement of the host granitic rocks and/or reflects later igneous or hydrothermal events. The setting and nature of the mineralization, as discussed below, indicates that hydrothermal activity might relate to a younger metallogenic event(s) at ca. 300 Ma which may, therefore, have implications for the genesis of Zn-Pb mineralization within the basal Windsor Group (e.g., Gays River).

Base-metal (Zn-Pb-Cu-Ag) mineralization at Dunbrack occurs within a single, 1 m wide quartz vein (100°/62°N) characterized by cockade, comb and crustiform textures with multiple episodes of brecciation. The footwall comprises fine-grained, red felsic dyke (1.2 m), whereas the hanging wall is monzogranite of the Musquodoboit Batholith. The REE profile of a silicified dyke rock sample deviates markedly from the REE signature of the batholith lithologies which possibly suggests a different petrogenesis. Vein mineralogy includes quartz, K-feldspar (Or_{86-100}), muscovite (≤2 wt. % FeO, ≤0.8 wt. % F), kaolinite, Ag-poor galena, chalcopyrite, sphalerite (≤4 wt. % FeO), bornite and an array of Cu, Fe, Pb, Zn sulphides of both hypogene and supergene origin. Pseudosecondary, two-phase (L_{H2O}-V) fluid inclusions in quartz are of equant to negative shape and have uniform T_h values of 138 ± 2°C (n=40; salinities are pending), but trapping conditions are estimated at ≥250°C and ca. 2 kbars. Sulphur isotopes ($\delta^{34}S$; cpy, sph, gal; n=5) range from +2.3 to +6.9‰, except for a single value at -3.1‰, and for T = 200 to 250°C indicate $\delta^{34}S_{H2S}$ = +4.6 to +6.7‰. $\delta^{18}O$ values for vein quartz (n=9) are uniform at +15.3 ± 1.2‰ and for T = 200 to 250°C indicate $\delta^{18}O_{fluid}$ = +6 to 8‰. Thus, both ^{34}S and ^{18}O data are consistent with a magmatic fluid. The age of mineralization is estimated at ca. 300 Ma based on $^{40}Ar/^{39}Ar$ dating of altered dyke rock and vein muscovite.

The Kinsac pluton, an extension of the Musquodoboit Batholith to the east, consists of medium-grained, two mica, cordierite monzogranite that contains abundant joints, dykes (aplites, pegmatites) and quartz-tourmaline veins. The dykes are oriented west-northwest/subvertical, whereas the joints and veins have no preferred trend. Areas of closely spaced shear fractures with horizontal slicken lines define steep northwest oriented shear zones. Veins (125-140°/subvertical), dominated by barite ± fluorite ± quartz and of ≤0.6 m width, are locally abundant throughout the eastern part of the Kinsac pluton in areas where the granite is sheared. The veins are zoned, undeformed and characterized by open-space infilling textures, and are dominated by randomly oriented, bladed barite euhedra (≤6-10 cm) with minor late quartz-fluorite (zoned from clear to purple); fluorite also occurs on joint faces. Barite is Sr poor (n=12; ≤0.35 wt. % Sr) and fluorite (n=5; Sr ≤65 ppm) has slightly concave REE patterns at 10x chondritic abundances with Eu_N/Eu^* = 0.65 and contrasts with the patterns, abundances and Eu_N/Eu^* exhibited by fluorite from the South Mountain Batholith. $\delta^{34}S$ for barite (n=8) is 13.3 ± 2.3‰, which precludes a magmatic source for sulphur assuming equilibrium SO_4^{2-}-H_2S fractionation, whereas $\delta^{18}O$ for vein quartz (n=3) is 22.1‰, which equates to $\delta^{18}O_{fluid}$ = +13‰ for T = 200°C. Quartz from quartz-tourmaline veins in the pluton has a magmatic $\delta^{18}O$ signature (+12.2‰). Thus, both ^{34}S and ^{18}O data suggest a non-magmatic component was involved in formation of the barite veins with the S probably sourced in Windsor Group evaporites.

We suggest that both sulphide and barite mineralization at the above localities are part of a ca. 300 Ma metallogenic event that also includes other centres of mineralization (e.g., Gays River, Walton, Tobeatic Lake, etc.). This metallogenic event coincides with elevated geotherms, magmatic activity (e.g., 312 Ma Wedgeport Granite) and Alleghanian deformation (e.g., southwest Nova Scotia) in the Meguma terrane and suggests that Carboniferous Zn-Pb-Cu-Ag-Ba-F metallogeny is contingent on the conjugation of several geological phenomena.