
**Mineralization at Brookfield barite deposit:
structurally controlled mineralization formed
from 250°C, COHN basinal brines in the
Carboniferous Maritimes Basin**

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Barite mineralization at Brookfield occurs in highly-deformed, dominantly terrestrial clastic sedimentary rocks forming part of the Carboniferous Maritimes Basin. This mineralization has been considered as part of the Carboniferous MVT metallogenic domain (Zn-Pb-Ba-F) of Nova Scotia (e.g., Walton barite; Jubilee and Gays River Zn-Pb deposits), but is anomalous in that the mineralization is within terrestrial rather than marine sedimentary rocks. The Horton Group sedimentary strata distal to mineralization are greyish sandstones (Horton Bluff Formation), whereas proximal mineralization they change to red-brown siltstones (Cheverie Formation) The mineralization, filling a ca. 25 m wide fault zone, occurs as coarse, white, crystalline barite in steeply-dipping, fault breccia veins cutting a thrust-thickened package of sedimentary rocks. Recrystallized, aphanitic barite is cut by undeformed, coarse barite veins and indicates that mineralization occurred in an active fault zone environment. Adjacent the mineralized veins the red-brown host rocks are intensely bleached, as manifested by their olive-green colour, and replacement of muscovite/illite to quartz+kaolinite and destruction of hematite, both confirmed by Rietveld analysis. The veins are dominated by barite, but siderite (10–20%) generally occurs at vein-wallrock contact and trace quartz-calcite (trace) occlude open space.

Fluid inclusion studies of the veins indicate that saline brines (20–30 wt. % equiv. NaCl+CaCl₂) coexisted with an immiscible N₂-CO₂-CH₄ gas. Laser Raman analysis and thermometric measurements of the most common gas-rich inclusions indicates a uniform fluid chemistry of X(N₂) = 0.66, X(CO₂) = 0.34. Homogenization temperatures for primary, L-V and L-V-Halite inclusions in quartz intergrown with barite provide minimum trapping conditions of 210°C. Conditions at the time of entrap-

ment, based on intersection of aqueous and gaseous isochores, are estimated at ca. 750 bars and 250°C.

Stable isotopic data for vein minerals (barite, siderite, quartz) are uniform and indicate $\delta^{18}\text{O}_{\text{fluid}} \approx +12\text{‰}$ at 250°C for siderites and +9.8‰ for quartz; and $\delta^{13}\text{C}_{\text{fluid}} = -4$ to -6‰ from siderites and $\delta^{34}\text{S}_{\text{fluid}} = +12\text{‰}$ from barite; fluid inclusion extracts indicate D values of -47 to -71‰ . Collectively, these fluid compositions are consistent with a basinal-type fluid derived from modified meteoric water with sulfur derived from Carboniferous evaporites and carbon of mainly marine limestone origin (i.e., Carboniferous Windsor Group) with a minor biogenic component from the Horton Group.

Mineralization at Brookfield resulted from fluid focusing of over-pressured fluids of modified basinal origin into an active fault zone environment. The association of the barite mineralization with intensely altered wall rocks represents a rare example of such alteration in this metallogenic domain. However, similar alteration associated with Ba-Fe-Mn mineralization along the Cobiquid-Chedabucto Fault Zone does raise the possibility that the Brookfield deposit may, instead, be part of another mineralizing environment and is not, *sensu stricto*, part of the 300 Ma MVT Zn-Pb-Ba metallogenic event.