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# Analysis of Gold Distribution and Form in Antimony Mineralized Systems in the Northern Appalachians with preliminary results from the Bald Hill Sb deposit in southern New Brunswick, Canada

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The locally auriferous Bald Hill antimony deposit in south-central New Brunswick is a NW-trending, fault-controlled system located within the Late Cambrian–Early Ordovician Annidale Belt near the southeastern margin of the Gander–Dunnage Zone. Mineralization also occurs along major NE-trending thrust faults and associated shear zones that commonly host gold, antimony, and base-metal sulfides within carbonate-bearing quartz vein and alteration systems. The deposit is mainly hosted by the Bald Hill rhyolite dome complex of the Late Cambrian Carpenter Brook Formation, composed of sandstone-siltstone and shale facies interlayered with felsic volcanic rocks. The rhyolite complex includes ash tuff, pyroclastic breccia, rhyolitic flows, and intrusive microgranite aligned with regional northeast-trending structures. Identifying pathfinder elements, indicator minerals, and alteration associated with antimony mineralization remains challenging. Selected drill core intervals from the Bald Hill antimony system, characterized by abundant stibnite and associated sulfide minerals including pyrite, chalcopyrite, and arsenopyrite, were investigated using a portable X-ray fluorescence (pXRF; Olympus Vanta™) spectrometer, and followed up with selected sample micro-X-ray fluorescence (μXRF) energy-dispersive spectrometry (EDS) elemental mapping. Samples were chosen from auriferous antimony mineralized zones identified through drill-hole assay data to evaluate geochemical variations related to mineralization. Elemental associations and mineral distributions were further examined using μXRF-EDS elemental mapping of polished thin sections, which complemented petrographic observations conducted using reflected light microscopy. This integrated approach enabled detailed characterization of mineral textures, variable styles of vein development and brecciation, paragenetic relationships, and alteration features. The results indicate that gold mineralization is primarily associated with early-stage sulfide assemblages dominated by arsenopyrite and pyrite, whereas antimony mineralization occurs mainly as later stibnite-bearing phases. These observations suggest that gold preceded antimony mineralization representing distinct mineralizing events within the Bald Hill system, reflecting evolving hydrothermal conditions during deposit formation, i.e. hydrothermal continuum. In addition to the above, our mineralogical studies further indicate that sericitic and chloritic alteration with various sulfides are associated with antimony mineralization. The mineralization represents a locally auriferous epithermal system to either an orogenic or intrusion-related hydrothermal system. Many other locally auriferous Sb-rich systems in the region have similar characteristics to this deposit, which will demonstrate an intrusion-related association.