Investigating volcanogenic massive sulphide and vein mineralization and its host rocks in drill core from the Jumping Brook Metamorphic Suite, Faribault Brook area, Cape Breton Highlands, Nova Scotia, Canada

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The Jumping Brook Metamorphic Suite (JBMS) underlies a large part of the western Cape Breton Highlands east of Cheticamp. Although previously interpreted to consist of mafic metavolcanic rocks (Faribault Brook Formation) overlain by metasedimentary rocks (Dauphinee Brook Formation), based on field observations and detailed studies of drill core, the metavolcanic and metasedimentary rocks are interlayered, and the relative abundance of metasedimentary rocks increases with depth. The JBMS contains many occurrences of gold, silver, and sulphide minerals including chalcopyrite, arsenopyrite, galena, and sphalerite. The rocks are strongly deformed and stratigraphic relationships and the nature of the mineral occurrences that they contain are poorly understood. The purpose of this study is to further investigate these relationships by examining core from two drill holes, GM-08-08 drilled at 45 degrees to a depth of 52 m by Globex Mining Enterprises Limited in 2008, and FB-01-86/08 drilled vertically to 128 m by Selco BP Resources Canada Ltd. in 1986 and deepened to 278 m by Globex Mining in 2008.

Core logging by visual inspection combined with magnetic susceptibility measurements, petrographic study, 5 assay analyses, 18 whole-rock chemical analyses, and 132 portable X-ray fluorescence (pXRF) analyses enabled documentation of units of greenschist facies basalt, tuff, gabbro, wacke, and rhyolite, intruded by thin sills of unmetamorphosed amygdaloidal basalt. The mafic units are difficult to distinguish based on petrography as all are dominated by actinolitic amphibole, chlorite, epidote, plagioclase, and quartz, and have similar low magnetic susceptibilities. Hence, protolith variations were distinguished geochemically using immobile elements and elemental ratios, including Zr/TiO_2, Zr/Y, and Nb/Y. As in other studies of metabasic rocks in the Faribault Brook Formation, the mafic samples display depletion in Nb and light rare earth elements, and the overall chemical characteristics are those of mid-ocean ridge basalt erupted or intruded in association with turbiditic wacke in a back-arc basin. More mineralization was found in hole FB-01-86/08 than reported in previous studies, especially in the upper part. In addition to elevated Cu, Pb, Zn, and As in pXRF analyses in zones of disseminated and vein-hosted sulphides, whole-rock analyses from Bureau Veritas Commodities Limited showed elevated background Au mineralization of 139 and 83 ppb in two samples. The observations support the hypothesis that most of the mineralization is of syngenetic polymetallic volcanogenic massive sulphide (VHMS) type, overprinted by epigenetic vein-related mineralization related to the intrusion of Ordovician and/or Devonian plutons that contact the metamorphosed Cambrian host rocks of the Jumping Brook Metamorphic Suite.

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