Geological setting of Au-Cu-Ni-Pb occurrences in the Second Gold Brook area, southwestern Cape Breton Highlands, Nova Scotia, Canada

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Exploration and mining activity in the Gold Brook area of the southwestern Cape Breton Highlands dates back to the late 1800s, and focused on auriferous quartz veins in metasedimentary and metavolcanic rocks of what was then called the Precambrian George River Group. As a result of mapping in the 1980s, these metamorphic rocks were reassigned to the Silurian Sarach Brook Metamorphic Suite (SBMS). Subsequent work in the southern Cape Breton Highlands did not include the Gold Brook area, in spite of its apparent economic potential. Hence, this study was undertaken to provide enhanced understanding of the geology of the area, and included mapping, sampling, petrographic interpretations, and chemical analyses (wholerock powder and portable XRF methods). Mapping showed that the area is underlain mainly by metavolcanic rocks interlayered with metasedimentary units including quartzite, slate, phyllite, and schist. The abundance of metavolcanic rocks increases from south to north across the area; most are mafic “amphibolite” with minor felsic layers. These rocks are intruded by granite of the Bothan Brook pluton to the east and by the Gillis Brook diorite and associated granite of the Leonard MacLeod Brook suite to the south. In the north, the study area is bounded by an inferred faulted contact with higher-grade metamorphic rocks of the Middle River Metamorphic Suite. Carboniferous sedimentary rocks unconformably overlie the older rocks on the west and southwest.

Chemical characteristics of the mafic metavolcanic rocks indicate that they are tholeiitic and display both MORB and volcanic-arc signatures. Their chemical signatures combined with abundance of interlayered quartz-rich sedimentary rocks suggest that they may have formed in a backarc setting. Chemical similarity suggests that they are related to the Silurian Sarach Brook Formation, although at higher regional metamorphic grade.

No visible gold was observed in quartz, and less abundant calcite, veins in the area and little evidence for gold anomalies was found in whole-rock or portable XRF analyses. Samples of massive sulphides (pyrrhotite, chalcopyrite, pyrite, pentlandite, sphalerite, and galena) were collected from mine waste piles but no sulphides were observed in outcrop. Background levels of Cu, Pb, Zn, and Ni are low in the metavolcanic and metasedimentary rocks. The lack of evidence for economic mineralization in the area suggests that such occurrences may be confined to the areas of historical mining activity in Second Gold Brook.

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