Early Ordovician island arc formation, arc-continent collision, and syn- to post-accretionary sedimentation, volcanism and mineralization, Baie Verte, Newfoundland Appalachians

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On the Baie Verte Peninsula, Early Ordovician ophiolites and their volcano-sedimentary cover are host to a number of important ore deposits. New geological and geophysical data help constrain the tectonic and metallogenic setting of the various volcanic packages. In the east, the Betts Cove ophiolite complex comprises ultramafic cumulates, layered and massive ca. 489 Ma gabbro and cogenetic, sheeted boninite dykes and overlying pillowed lavas. Overlying island-arc tholeiitic pillow basalts are interbedded with intermediate TiO_2 boninites and represent the final stage in the development of a juvenile, submarine volcanic arc. Stringer-type copper and gold mineralization occurs in the Betts Cove Mine at the transition between boninitic sheeted dykes and pillow lavas. Copper-rich ore is associated with island-arc tholeiitic basalt pillow breccias at Tilt Cove. In south-central Baie Verte, pillowed boninites and thin, felsic tuffs and flows are overlain by the ca. 487 Ma Rambler rhyolite and associated volcanogenic massive sulphide (VMS) mineralization. To the north, the Point Rousse ophiolite comprises mantle peridotite, layered ultramafic and mafic boninitic cumulates, ca. 488 Ma trondhjemite, and overlying sheeted boninitic and island-arc tholeiitic dykes and lavas. A small showing of VMS mineralization is associated with boninitic intermediate volcanic rocks at Mud Pond. The Advocate Complex to the west is separated from the continental margin by the Baie Verte Line (BVL), and comprises a tectonically-thinned and eroded sequence of mantle harzburgite overlain by layered cumulates, boninitic dykes, and erosional remnants of boninitic and island arc tholeiitic lavas. The latter are host to VMS mineralization at the Terra Nova Mine and at small showings along the Baie Verte highway. In summary, the development of island arc crust was accompanied by VMS mineralization as epigenetic ore in underlying boninites, associated with arc basalts, and locally at ca. 487 Ma within submarine felsic volcanic rocks. The overlying ophiolite cover

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was deposited between ca. 476 and 467 Ma. In the west, it comprises a proximal ophiolite- and platform-derived conglomerate (younger than ca. 479 Ma) overlain by ca. 476 Ma rhyolite, iron formation, and tholeiitic, pillowed basalts and tuffs. In the east, the conglomerate thins and gives way to basinal-facies iron-formation, mafic tuffs, pillowed tholeiitic basalts, calc-alkaline basalt and ca. 470 Ma felsic tuff, volcanic turbidites, and ca. 467 Ma rhyolite and tholeiitic basalts. Ophiolite obduction was accompanied by erosion, deposition of conglomerates (ca. 479–476 Ma), followed by trench migration, episodic arc volcanism (ca. 470 Ma) and arc-rift-related tholeiitic volcanism. Iron formation near the base of the cover sequence was host to later epigentic gold + pyrite mineralization associated with quartz-albite-carbonate alteration at both Nugget Pond and in the Goldenville horizon. Orogenic gold mineralization is associated with polydeformed, hydrothermally-altered ophiolite and cover rocks near the BVL. The host rocks to gold mineralization include serpentinized ultramafic rocks along the Baie Verte Highway, thrust-repeated panels of island arc tholeiitic basalts at Deer Cove, and hydrothermally-altered tholeiitic gabbro and basalt at Stoger Tight and Pine Cove.