Geology of the Stirling Zn-Pb-Cu-Ag-Au VMS deposit, southeast Cape Breton, Nova Scotia: reinterpretation of the quartz-talc-carbonate (QTC) rock with implications for mineral exploration[1]

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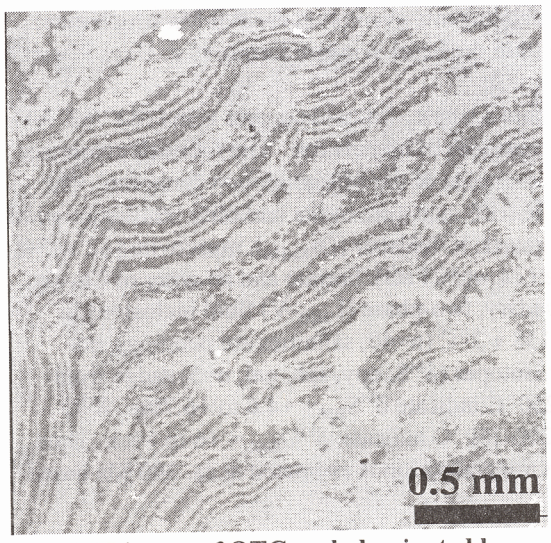
The Stirling VMS deposit is hosted by the Late Hadrynian (680 Ma) Stirling Group, part of the Avalon Terrane of the Canadian Appalachians. Underground mining in the 1930's and 1950's produced 1.06 Mt of 6.3% Zn, 1.5% Pb, 0.8% Cu, 74 g/t Ag and 1.1 g/Au from strongly sheared massive sulphide associated with a quartz-talc-carbonate (QTC) rock. Traditional concepts of a replacement origin for the mineralization were challenged in the 1970's and an exhalative model proposed in which the QTC rock was interpreted as an exhalite. Recent work at Stirling once again suggests that interpretation of the origin and significance of the QTC rock may require modification.



BSE image of QTC rock dominated by magnesite (dark) and dolomite (light).

The Stirling Group, deposited within an intra-arc basin, is dominated by intermediate-felsic volcaniclastics, mafic flows and a sedimentary package of litharenites and siltstone with minor conglomerates, chert and dolostone. The rocks have suffered polyphase, heterogeneous deformation with NE-trending fabrics and structures dominating. At the Stirling deposit, mineralization occurs within a NE-trending, steeply dipping (70-90°S), strongly sheared and altered (carbonate, sericite, epidote, chlorite, silica) felsic volcanic package that is intruded by abundant mafic dykes and the ore is intimately associated with fine-grained, laminated QTC rock. The exposed surface geology indicates that the structural footwall (FW) is a sericite±talc±carbonate±sulphide schist, whereas the structural hanging wall (HW) is a green intermediate tuff with 2 m of laterally discontinuous, well-laminated Sp-Gn-Ccp-Py tectonite intervening. Underground mine plans indicate that: (1) felsic volcanics form the HW and FW; (2) the ore is closely associated with QTC rock; (3) ore horizon intersections are highly variable (≤1 to ≤10 m); (4) multiple lens of ore occur; and (5) the QTC rock increases at depth to 50 m thickness with ≤75% talc. Examination of ddh (1 m intervals) and chip sampling (n=1260) for 6 mine levels indicates no apparent metal zonation with Zn:Pb:Cu of ca. 80:15:5. Detailed study of the QTC rock indicates it: (1) consists of alternating laminae of dolomite-magnesite with magnesite corroding the dolomite (see BSE image) and talc late paragenetically; (2) envelopes clasts of QTC and sulphide; and (3) has multiple episodes of formation. The Stirling deposit is considered to represent a structurally modified VMS deposit with the QTC rock possibly representing a superimposed alteration phenomenon rather than a syngenetic exhalite. However, it is not clear at what time the QTC rock may have formed (i.e. syn- or post-ore). Given this interpretation, a considerable part of the Stirling deposit must have been lost during replacement.

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