The origin of Cambrian-Ordovician ironstones, Iron Brook Group, Antigonish Highlands, Nova Scotia

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Numerous models exist for the genesis of oolitic ironstone deposits. There is general agreement that in most cases the protoliths to these deposits are porous and permeable clastic rocks laid down in a shallow marine environment. However, the source of the iron and related elements, the association of fossiliferous debris with the reduced iron mineralogy, and the origin of features such as oolitic texture are controversial.

The oolitic ironstone and related carbonate of the Ferrona Formation within the Cambro-Ordovician Iron Brook Group, Antigonish Highlands, N.S., are a local representative of widespread iron deposits found in Avalonia and related terranes. Taken together, lithostratigraphic, paleontological, and paleomagnetic data indicate that Avalonia lay along the northern margin of Gondwana at approximately 60°S during the Cambrian-Ordovician. The protoliths of the ironstones are thought to have been deposited as part of a continental to shallow marine sequence within a pull-apart basin as evidenced in the local stratigraphy consisting of red fluviatile conglomerate, shale, and distinctive pink limestone.

The ironstone was mined at the beginning of the 20th century. In 1961, the Nova Scotia Department of Mines and Energy, as part of an exploratory program, drilled four holes near Doctors Brook, within the Ferrona Formation. Microscopic and μXRD analyses of samples collected from the field and from the core indicate that the ironstones are characterized by quartz grains, siderite spherules, and apatite

clasts set in a hematite matrix. Oolitic textures are common and are characterized by cores of quartz, hematite, and possibly apatite. Concentric growth patterns are identified by variations in colour and texture, presumably reflecting subtle compositional changes. Calcite, siderite, and ankerite have been identified throughout the Ferrona Formation ironstone in veins, spherules, and the matrix, attesting to the importance of carbonate alteration. Minor sulphides are also present and appear to be in association with calcite veining.

Textural features suggest that the ironstone formed by replacement of sandstone, although the age of this replacement is problematic. Compared to the sandstone, geochemical analyses of the ironstone indicate that it contains lower SiO_2 and Zr, and higher Fe_2O_3, CaO, MgO, and V, as well as greater LOI, Al_2O_3, and TiO_2 do not show consistent trends. A further aim of this study is to establish mineralogical and mass balance data in order to better understand the genesis for the oolitic ironstone of the Ferrona Formation.