Sediment-hosted Manganese in Newfoundland: settings and significance

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Sediment-hosted manganese occurs in three principal settings in Newfoundland: (1) an earliest Midle Cambrian shallow marine sequence within the Avalon zone, (2) allochthonous Lower Ordovician slope sequences within the Humber zone, and (3) Ordovician oceanic sequences within the Dunnage zone in central Newfoundland. The Avalon occurrences appear at the disconformable base of the Middle Cambrian, and consist of nodules and thin beds of Mn-carbonate within shale. In the deep-water slope sequences of western Newfoundland, Mn precipitation was localized in a late Tremadoc to Arenig interval along portions of the margin. Here Mn-carbonate was precipitated as discrete horizons within shale during shallow-burial diagenesis. Central Newfoundland examples also appear in the Lower Ordovician, but are most common in deep-ocean chert/shale sequences of Caradocian age, where Mn-carbonate and silicate occurs in intervals up to 50 m thick.

The sedimentary concentration of manganese is a redox-driven process which requires an Eh gradient to facilitate mobilization and subsequent precipitation. In the Cambrian, levels of dissolved oxygen sufficient to facilitate Mn precipitation were only widespread in the shallow marine environment. The later, deep water occurrences are consistent with an episode of "oceanic ventilation" in the Early Ordovician. This resulted in an Eh gradient at the seafloor which promoted precipitation during early diagenesis. Metamorphosed manganiferous beds (coticules) within the Appalachian-Caledonian orogen have been correlated with the enrichment of other metals and are commonly of inferred Early and Middle Ordovician age. While these may relate, in part, to an overall increase in hydrothermal activity they may also reflect early, redox-related redistribution of metals in oceanic sedimentary sequences.