Chemostratigraphy and depositional environment of an Ordovician sedimentary section across the Miramichi Group - Tetagouche Group contact, northeastern New Brunswick

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A thick section of Ordovician sedimentary rocks underlies and overlies felsic to mafic volcanic rocks of the Tetagouche Group, Bathurst Mining Camp. The dark grey quartzose slates and siltstones of the Patrick Brook Formation (Miramichi Group) occur below the volcanic rocks, whereas the dark grey to black slates and siltstones of the Boucher Brook Formation (Tetagouche Group) are intercalated with the volcanic rocks and overlie the sequence. The Miramichi-Tetagouche contact represents the interpreted Gander-Dunnage boundary in northeastern New Brunswick. Distinguishing between these two similar formations is important for stratigraphic and geotectonic interpretations of the Bathurst Mining Camp and for exploration in these sequences. The geochemical composition of a semi-conformable section of rocks from the Boucher Brook (Middle to Late? Ordovician) and Patrick Brook (Early to Middle Ordovician) formations was determined to identify geochemical chemostratigraphic discriminants, as well as to determine the palaeodepositional environment in which these were deposited.

The high Al_2O_3 and distinctly higher high-field-strength elements (LREE, Th, HREE, and Y) in the Patrick Brook rocks are mature sedimentary rocks indicating intense chemical weathering (tropical environment) in the source regions, which is consistent with their compositional similarity to Avalon-derived shales analogous to Gander Zone sedimentary rocks. The Boucher Brook slates and siltstones are immature sedimentary rocks based on the preservation of albite and less coherency of trace-element systematics to phyllosilicate indices (Al_2O_3 and K_2O). They are probably derived from the associated volcanic rocks.

The higher Mn and Fe and positive Ce/Ce* anomalies in some Boucher Brook rocks compared to the Patrick Brook rocks indicate that the Boucher Brook rocks in this section were deposited in a transitional anoxic/oxic environment. The Patrick Brook rocks that immediately precede felsic volcanism and formation of massive sulphide deposits are highly reduced based on C and S contents, which is consistent with the sulphur isotope data. Moderately heavy $\delta^{34}S$ values are indicative of SO_4^{2-} reduction to H_2S under anoxic conditions, which is significant in the formation and preservation of massive sulphides in the basal Tetagouche sequence.