

Paleomagnetism of the Devonian McAras Brook Formation, Avalonia, Canada: revisited

HIRUNI GUNAWARDANA¹, PHIL J.A. MCC AUSLAND¹, AND J. BRENDAN MURPHY²

1. *Department of Earth Sciences, Western University, London, Ontario N6A 5B7, Canada <hgunawa@uwo.ca>*

2. *Department of Earth Sciences, St. Francis Xavier University, Antigonish, Nova Scotia B2G 2W5, Canada*

This paleomagnetic study conducted on the McAras Brook Formation (MBF) of the Antigonish Highlands in Nova Scotia attempts to find paleolatitudinal constraints for the Laurentian margin and to assess structural rotations of the Antigonish Highlands in the aftermath of the amalgamation of Avalonia.

The MBF lies unconformably on the Knoydart and Stonehouse formations of late Silurian–early Devonian age and is overlain by sedimentary rock units of Windsor Group. U-Pb age dating of rhyolites from an adjacent rift basin at Ballantynes Cove, which has been correlated with the MBF type section, further suggests a late Devonian age of 370 Ma. In total, 276 samples obtained from the MBF consists of coastal and stream bed exposures represented by ten intercalated paleomagnetic sites of six basalt flows, six hematitic sedimentary sites and two conglomerate field test sites.

Demagnetization data of MBF samples give three Characteristic Remanent Magnetization (ChRM) directions, consistent with the previously published results. The dual-polarity direction of two separate flows with significant stratigraphic separation reveals a direction at (D/I = 027/-6.3°, tilt corrected) with a corresponding paleopole at 35.5° S, 263.5 E. Two other flows with little to no stratigraphic separation yield a direction of (D/I = 340/9.1°, tilt corrected) with a paleopole at 45.2° S, 326.7 E. Hematitic beds underlying the flows provide evidence of potential baked contacts, supporting primary ages for both these directions. A third direction obtained from two basaltic flows with no stratigraphic separation provides a direction at 251/-59° with a paleopole at 41° S, 186 E. All redbed units indicate similar results to their overlying basaltic counterparts indicating little to no overprinting of secondary magnetizations.

The intraformational conglomerate sites pass statistical conglomerate tests, indicating the retention of primary remanence since their deposition, suggesting large secular variations of the earth's magnetic field during the time of formation as at least two of the three ChRM directions appear to be primary. The calculated paleolatitude of 3.2° S is therefore considered to be from an instantaneous reading of the earth's magnetic field and is not a conclusive latitudinal constraint for the Laurentian margin. Preliminary paleomagnetic analysis of several overlying sites from the Visean-aged Windsor Group indicates northwesterly shallow directions expected from early Carboniferous paleopole positions for North America. Therefore major structural rotations and displacements of the Antigonish Highlands portion of the Avalon terrane can be ruled out for this time period onwards.