The Mira – Bras d'Or terrane boundary in Cape Breton Island, Nova Scotia: potential field and petrophysical investigations applied to tectonic analysis in the northern Appalachian orogen

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The regional geology of south-central Cape Breton Island is interpreted to consist of two terranes or tectonostratigraphic zones correlative throughout the northern Appalachians. The Mira and Bras d'Or terranes have been locally defined based on stratigraphy, age, metamorphic grade, plutonism, and lithogeochemistry. However, the spatial continuity of the Mira and Bras d'Or terranes, in particular the boundary location and geometry, is for the most part equivocal. This is due in large part to the presence of water cover and/or extensive Devonian and Carboniferous sedimentary sequences.

Previous tectonic studies have utilized various geophysical methods (e.g., seismic and/or potential fields) to identify subsurface features associated with terranes or tectonostratigraphic boundaries. The present study has compiled qualitative, semi-quantitative, and quantitative potential field and petrophysical data for the Avalon and Gander terranes in Newfoundland in addition to generating an extensive corresponding data set for southern Cape Breton Island. This information is used to assess the internal character of the Avalonian Mira and Ganderian Bras d'Or terranes and evaluate the nature of the boundary between these two terranes through south-central Cape Breton Island.

Magnetic and gravity data have been processed to extract long wavelength features associated with shallow (<5 km) crustal sources, and petrophysical data is correlated to mapped geological units in the study area. The results confirm the presence of significant geophysical breaks related to an interpreted terrane contact and other geophysical phenomena interpreted to reflect the structural complexity of the Mira – Bras d'Or terrane boundary. In several areas, the mapped units associated with the terrane boundary appear to have limited depth extent interpreted from 2-D potential field modelling. Preliminary interpretations suggest that these phenomena could be locally explained by positive flower structures whereby the terrane boundary lies beneath a wedge of strata comprised of both Mira and Bras d'Or terrane rocks.