Investigation of Magnetic and Gravity Anomalies on the Scotian Shelf off Southeastern Cape Breton Island, Nova Scotia

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Southeastern Cape Breton Island, known as the Mira terrane, is part of the Avalon terrane of the northern Appalachian orogen. Like other parts of the Avalon terrane, Mira is characterized by prominent linear total field magnetic anomalies that appear to be related to linear belts of Neoproterozoic volcanic, sedimentary, and plutonic rocks that form much of the terrane. A similar northeast-trending magnetic anomaly along the Scotian Shelf, located about 25 km offshore from the coastal belt of the Mira terrane, is the focus of this study. The linear anomaly measures 100 km long by 25 km wide, and has magnetic and gravity values ranging from 300 to 1400 nT and 10 to 30 mGal, respectively. The goal of this study is to determine whether the offshore anomaly is caused by Neoproterozoic Mira terrane units, other Avalonian units such as those of the Antigonish Highlands, or some other as-yet unrecognized sources. The high magnitude of the offshore anomalies is in contrast to lower surrounding signatures caused by widespread Carboniferous sedimentary basins and crustal thinning associated with the Orpheus Graben to the south. Lithoprobe East seismic interpretations suggested that the adjacent Meguma terrane has been thrust over the Avalon terrane, with the Orpheus Graben positioned between the two terranes. The Cobequid-Chedabucto Fault System separates Avalon and Mira terranes in the onshore, but its position in the offshore (north or south of the Orpheus Graben) is somewhat uncertain. The area is further complicated by the recognition of Carboniferous detachment faulting on Isle Madame in the southernmost part of Cape Breton Island, and the possibility that Meguma terrane basement extends into that area.

This study will utilize geophysical software to assess the source(s) of the offshore anomaly. Magnetic, gravity, and seismic data from the area will be compiled and re-interpreted. The interpretations will be constrained by physical property data (i.e. specific gravity, magnetic susceptibility) measured in samples collected from relevant onshore areas in the Mira terrane. These data will assist in the correlation of offshore and onshore units, as well as in the forward modelling of the magnetic and gravity data. The modelling will ascertain the depth and full extent of the anomaly source(s). By providing a better interpretation of the offshore geological units, this study should help to decipher the geologic history of the area and more importantly, demonstrate whether the Mira terrane units exposed onshore extend out under the shelf.

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