
Source(s) of magnetic and gravity anomalies south of
Cape Breton Island, Nova Scotia, and onshore-
offshore geological correlations

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The area offshore southeastern Cape Breton Island is inferred to be part of the Mira terrane, a component of the Avalonia realm of the northern Appalachian orogen. The Scatarie Ridge Magnetic Anomalies (SRMA) are a prominent belt, approximately 100 km long by 25 km wide, of north-east-trending magnetic anomalies that characterize this area. Magnetic values typically range from 300 to 600 nT; however, the centres of the anomalies reach highs of 900 nT to 1400 nT. In addition, positive gravity anomalies correspond approximately to the area of the magnetic anomalies, with gravity values ranging from 10 to 30 mGal. Like other parts of Avalonia, the onshore part of the Mira terrane is characterized by prominent linear total field magnetic anomalies that appear to be related to the linear belts of Neoproterozoic volcanic,

sedimentary, and plutonic rocks that form much of the terrane. The Canso Fault is interpreted to offset the Mira terrane to southern New Brunswick, 100 km to the north, relative to mainland Nova Scotia, suggesting the possibility that the area of the SRMA offshore southeastern Cape Breton Island could correlate with the Antigonish Highlands. The purpose of the study is to investigate the source(s) of the anomalies utilizing magnetic, gravity, and seismic data, and to determine whether the offshore anomalies are 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 marking the suture zone between the two terranes. In the onshore, this boundary is marked by the Cobequid-Chedabucto fault system, 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 evaluate and model the source(s) of the offshore anomalies, based on a compilation of existing magnetic, gravity, and seismic data. The models 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 and offshore exploration wells. Stratigraphic units in the models will be constrained by interpretations of industry and Lithoprobe East seismic lines in the study area. The modelling will ascertain the depth and extent of the anomalies source(s). By providing a better interpretation of the offshore geological units, this study should help to decipher the geology of the area and whether or not the Mira terrane units exposed onshore extend out under the shelf.