Re-interpretation of the geology of the Cape Breton Highlands using combined remote sensing and geological databases

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The Cape Breton Highlands are underlain by rocks that range in age from more than 1200 Ma to less than 360 Ma, and that display a wide range in composition. Relationships among these varied rocks as revealed by geological mapping are not everywhere clear, in part due to limited exposure, but also due to difficulty of access in some areas. This study was undertaken to try to improve on the geological interpretation of the highlands, especially in those problematic areas, by combining geological and remote sensing databases.

Remotely sensed information used in the study included Radarsat S7, Landsat TM, gravity, magnetic (vertical gradient and total field), radiometric data, and a digital elevation model. The geological, geophysical, and remotely sensed data were integrated into a Geographical Information System, and the resulting datasets were used to evaluate the various geological interpretations of the highlands. The unsupervised classification of the radiometric data (K, eU, eTh, eU/eTh, eU/K, and eTh/K) and the integration of the different image data sets proved to be particularly useful in the interpretation process, especially with the detail of the elevation model that was constructed as part of the project.

The key result of the study is an improved geological interpretation, in particular with respect to geological contacts between known map units in poorly exposed areas, and in the location of major faults and postulated terrane boundaries. Granitoid map units were best detected and distinguished with the radiometric data. For example, the extent of the Bothan Brook Granite was modified and field checked so that the Gold River deposit is now clearly in the contact metamorphic aureole of the granite. The vertical gradient fused with the elevation model and the gravity fused with vertical gradient provided particular insight into separate metamorphic and structural domains within the Highlands. These images clearly show, for example, that the Eastern Highlands Shear Zone is truncated by a major northerly trending structure that appears to merge to the north with the northeasterly trending Aspy Fault.