Preliminary interpretation of gravity and magnetic results from the Epicentral Region of the 1982 Miramichi earthquakes

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The 1982 Miramichi earthquakes occurred in a region in central New Brunswick that is occupied by the North Pole Pluton, an intrusion of Middle Devonian age, that has intruded deformed, Cambro-Ordovician, metamorphic rocks. A 300 station gravity survey of the epicentral region was completed in 1982. In addition, samples were collected for density determinations and *in situ* magnetic susceptibility measurements were made on all major outcrops. The results of this survey, together with previously flown aeromagnetic data, are being used to construct a subsurface model that should provide useful constraints in earthquake mechanism studies.

Density measurements on the samples show that the granitic rock units have the lowest mean densities (2610-2630 Kgs/m^3), whilst the diorite unit has the highest mean density (2780 Kgs/m^3). The metamorphic country rock units have a range of mean densities between 2650 to 2750 Kgs/m^3, with some individual samples of the phyllite unit yielding densities as high as 2850 Kgs/m^3. The *in situ* magnetic susceptibility measurements show that the diorite unit has a magnetic susceptibility that is generally two to three times higher than the granitic units, but the phyllite unit in the country rocks shows a much wider range in susceptibility.

On a regional basis, a large gravity low coincides with the exposed middle portion of the North Pole Pluton and also shows its much greater subsurface extent. However, in the detailed gravity survey results, this large gravity low is also seen to contain smaller positive anomalies that suggest that the higher density diorite unit is more extensive at depth than indicated by surface exposure of this unit. Initial thickness estimates from the gravity anomalies suggest that the metamorphic units are generally thin in the region (0.5-1 km) and that the Miramichi earthquakes and aftershocks are confined to the plutonic body. One explanation for this confinement of the hypocenters is that the brittle rocks of the pluton are weaker than the surrounding tougher metamorphic country rocks when exposed to the same stress system.