THE RESOLUTION OF A MAGNETIC ANOMALY MAP EXPECTED FROM GRM DATA

D.W. Strangway and J. Arkani-Hamed
Department of Geology
University of Toronto
Toronto, Ontario
M55 1A1

and

D.J. Teskey and P.J. Hood
Geological Survey of Canada
Energy, Mines and Resources Canada
Ottawa, Ontario
K1A 0E4

Data from the MAGSAT mission have been used to derive a global scalar magnetic anomaly map at an average altitude of about 400 km. It was possible to work with 2 data sets corresponding to dawn and dusk. This enabled us to identify those anomalies which were repeatable at dawn and at dusk, and also to estimate the error limits of these anomalies. The repeatable anomalies were downward continued to about 10 km altitude. The anomalies over Canada were correlated quantitatively with band-pass filtered magnetic anomalies derived from aeromagnetic surveys. The close correlation indicates that the repeatable anomalies detected from orbit are due to geological causes. This correlation lends support to the geological significance of the global anomaly map.

The downward continued anomalies were typically limited to a scale size of 500 km or greater. The limitation was imposed by a) the high altitude (a range of 280 to 560 km) of the satellite. Any short wavelength (shorter than about 500 km) magnetic anomalies of lithospheric origin were attenuated at this altitude and were reduced below the error limit of the original data, and b) the variations of the satellite's altitude, which created elongated anomalies along satellite passes, analogous to the flight-line leveling noise of conventional aeromagnetic surveys. The noise level was about ± 2 nT. The filter employed in order to suppress the noise also suppressed anomalies with wavelengths of about 900 km or less.

The geopotential research mission (GRM) will orbit the earth at an altitude of about 160 km, with relatively minor altitude variations, largely due to the shape of the earth. The magnetic anomalies of lithospheric origin will be enhanced by a factor of about 4 because of the lower altitude of GRM compared to that of MAGSAT. The flight-line leveling noise will probably be reduced to below ± 1 nT, allowing us to retain relatively shorter wavelengths in the derivation of a magnetic anomaly map. This will increase the magnitude of the anomalies and also

significantly enhance the resolution of the map. We can expect an overall improvement of about an order of magnitude in the magnetic anomalies derived from GRM data compared to those deduced from MAGSAT data.

A possible resolution of a magnetic anomaly map expected from GRM data is estimated from the upward continuation to 160 km of a high-pass filtered magnetic anomalies of the Canadian shield derived from low-level aeromagnetic surveys. The filter reduces the long wavelengths which overlap with the main geomagnetic field, since they may have been dominantly contaminated by the field. The upward continued anomalies have high resolution and delineate major geological features. It is concluded that a magnetic anomaly map derived from GRM data will have the ability to detect geological features as small as about 100 km in scale.