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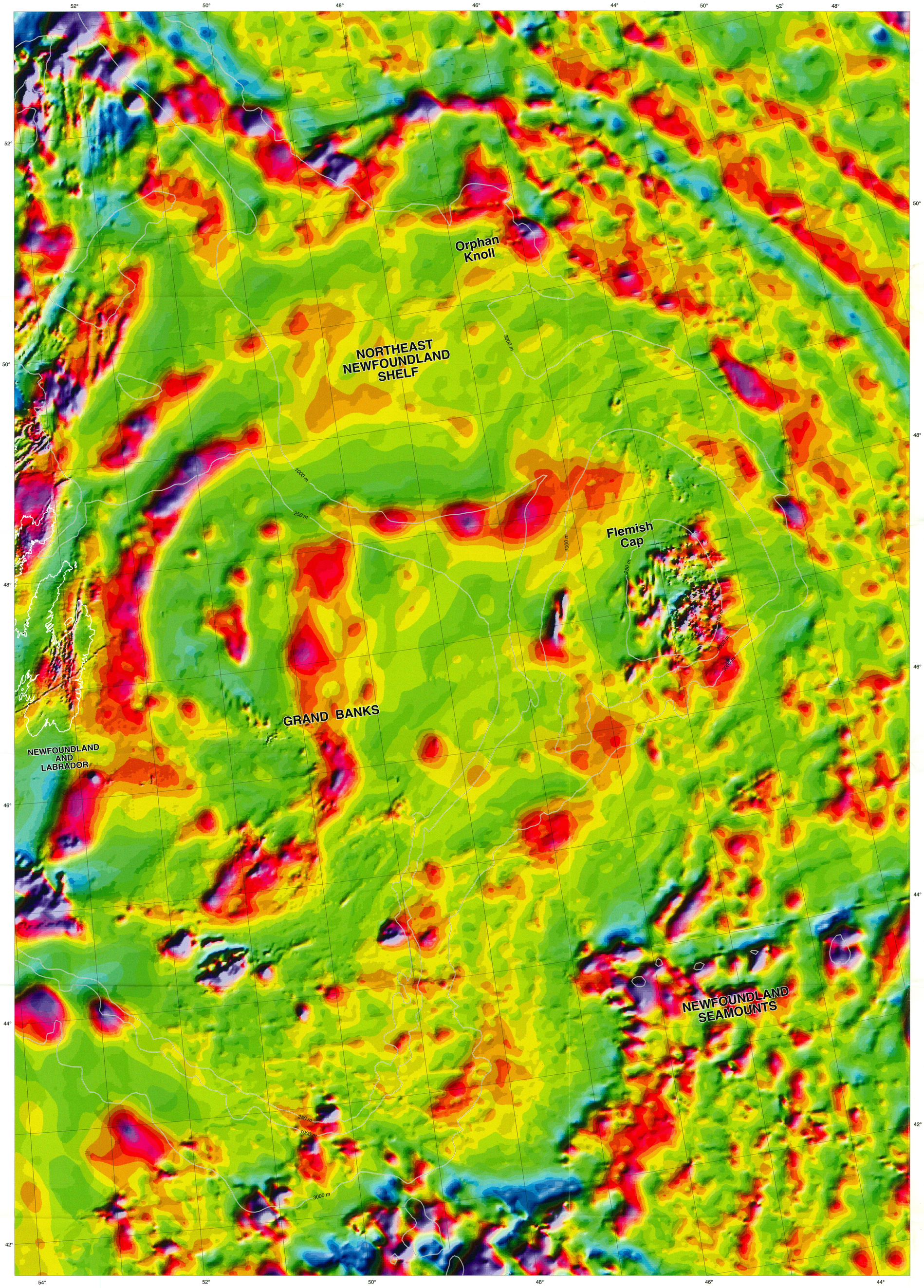
GEOLOGICAL SURVEY OF CANADA / COMMISSION GÉOLOGIQUE DU CANADA



Atlantic Canada Magnetic Map Series

This series of shadow-enhanced magnetic anomaly maps of Atlantic Canada is based on a new 500 m grid assembled from marine track-data, modern digital airborne surveys, digitized profiles from contoured airborne surveys, and gridded data sets. New techniques for micro-levelling individual surveys were employed to image small-amplitude structures and provide offshore continuity of onshore geology. Regional levelling was achieved by adjusting the longer wavelength component (200 to 400 km) with high-elevation survey data. Wavelengths longer than 400 km are invariably due to sub-crustal sources and were removed from this data compilation.

The original data sources include coherent marine and aeromagnetic survey blocks and randomly-oriented marine tracklines. Individual survey blocks were micro-levelled using a Fourier-domain directional filter to remove cross-track Nyquist frequencies (Oakey et al., 1994). This technique involved gridding the raw data using a weighted minimum-curvature algorithm (Smith and Wessel, 1990) to a resolution finer than the track-spacing, applying the directional filter, and producing along-line corrections for the survey lines. For this application, high-amplitude anomalies (outside 2-sigma) were clipped to minimize contamination of correction values for adjacent areas.

In order to assemble the regional grid, the individual micro-levelled survey blocks were gridded at two resolutions (500m and 2km). The 500m grid blocks were high-pass filtered (2km) and a mosaic was assembled by smoothing the seams with a 2.5km weighted-mean filter. The 2km grid blocks were band-pass filtered (20 to 200 km) and a mosaic was assembled by smoothing the seams with a 10km weighted-mean filter. For most of the deep-water marine data, the tracklines of survey blocks were widely spaced (e.g. Scotian Slope) or data existed only as random tracks. In these areas, selected short sections of random lines were carefully merged with levelled survey blocks and merged with the band-passed 2km grid. Where data were very sparse (e.g. north-east of Sable Island) the tracklines are shown without interpolation. The high-elevation data (Haines and Hannaford, 1980) were gridded at a 20 km resolution, downward continued 4.2 km to correct anomaly amplitudes, and band-pass filtered (200 to 400km). This regional component and the band-passed 2 km grid were re-sampled at 500m resolution and added to the high-pass 500m grid to produce the final composite grid.

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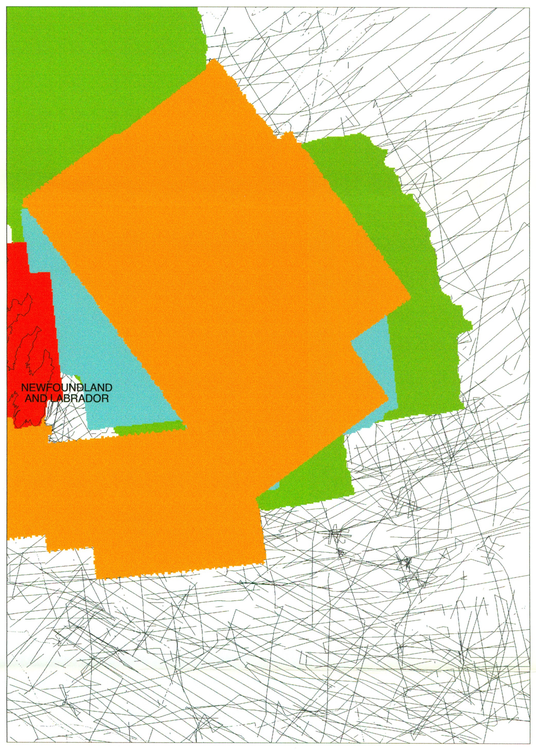
Source Map



1) Modern digital aeromagnetic data
2) Digital profiles from contour maps
3) Hibernia .02°x.02° grid
4) Shipborne survey blocks
5) Regional shipborne tracklines

Data Sources:

1, 2: Geological Survey of Canada, Geophysical Data Centre, Ottawa, ON.
3: Unpublished data compilation by K.G. Shih, GSC (Atlantic) (pers. comm. 1994).
4, 5: Geological Survey of Canada (Atlantic), Dartmouth, NS.

Magnetic Anomaly Map: Grand Banks and Surrounds

This map features the Grand Banks, the Northeast Newfoundland Shelf and surrounding oceanic basins. The basement rocks of the continental shelf are offshore extensions of the Paleozoic Appalachian Orogen, covered by thick Mesozoic/Cenozoic sedimentary fill in basins such as the Whale Basin, Horseshoe Basin, Jeanne d'Arc Basin and Orphan Basin.

The magnetic anomalies of the Appalachian Orogen, exposed on the island of Newfoundland, are generally discrete medium amplitude features with a low amplitude long wavelength background (Williams et al., 1999). Over northernmost Northeast Newfoundland Shelf, the Humber, Dunnage and Gander zones have been identified, while the Avalon zone constitutes the predominant basement rock beneath the Grand Banks (Hall et al., 1998). The southern tip of the Grand Banks has been interpreted as Meguma Zone (Schenk, 1981); however very few wells encounter basement rock, and the affinity of the crust is still unknown.

On the Grand Banks, the Avalon zone has quite distinctive arcuate positive and negative magnetic anomalies. The positive anomalies correlate with onshore exposures of Precambrian mafic volcanics, and the banded appearance is attributed to basement faulting and offsets. The high frequency component of the anomalies associated with onshore exposures is not apparent in the offshore anomalies due to deep burial beneath sedimentary rocks. In some offshore areas, high-frequency anomalies indicate the presence of basement rocks near the seafloor.

The Flemish Cap is a large block of the Avalon zone that has shallow basement with virtually no sedimentary cover. Smaller basement highs on the Grand Banks are identified in several locations by high frequency anomalies: 47r. The Flemish Cap is a large block of the Avalon zone that has shallow basement with virtually no sedimentary cover. Smaller basement highs on the Grand Banks are identified in several locations by high frequency anomalies: 47°N, 46.5°W and 46.5°N, 50.5°W (The Eastern Shoals).

North of Newfoundland, several linear N-NE trending anomalies are associated with dike intrusions that cut strata as young as Cretaceous-Tertiary (Haworth et al., 1976) and may be offshore extensions of lamprophyre dikes mapped onshore Newfoundland (Strong and Harris, 1974). The Avalon Dike, exposed on the Avalon Peninsula, eastern Newfoundland (Hodych and Hayatsu, 1980), has a well defined magnetic anomaly and can be mapped offshore for 40 km, beyond which the feature disappears.

Magnetic anomalies over the oceanic crust feature the characteristic pattern of magnetic stripes that identify crust formed during normal and reverse periods of the Earth's magnetic field. In the Labrador Sea, the oldest magnetic lineation has been identified as C-34 (middle Cretaceous), however an adjacent magnetic lineation has been attributed to older volcanic extrusions coincident with the continent-ocean boundary (Srivastava et al., 1988). This pattern is offset at the Charlie-Gibbs Fracture Zone, where oceanic crust of different ages is juxtaposed. In the Newfoundland Basin the oldest magnetic lineation has been identified as M-20 (Late Jurassic) (Srivastava et al., 2000).

The volcanic edifices of the Newfoundland and Fogo Seamounts are also identified by positive magnetic anomalies. The Fogo seamounts, associated with the transform margin along the southern Grand Banks, are considered middle Cretaceous, coeval with Aptian (117 Ma) volcanic rocks sampled from wells within the South Whale sub-basin (Jansa and Pe-Piper, 1988). The Newfoundland Seamounts are slightly younger than the Fogo seamounts and are dated as Cenomanian (97 Ma) (Jansa and Pe-Piper, 1988).

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Cartographic production by Gary M. Grant, Electronic Publishing, Geological Survey of Canada (Atlantic)

OPEN FILE 1816

MAGNETIC ANOMALY MAP

THE GRAND BANKS OF NEWFOUNDLAND AND SURROUNDS

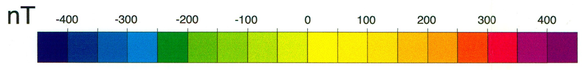
ATLANTIC CANADA

Scale 1:1 500 000/Échelle 1/1 500 000

kilometres 50 0 50 100 150 kilomètres

Transverse Mercator Projection
Central Meridian 60° West
North American Datum 1927

Projection de Mercator transverse
Meridien central 60° O
Système de référence géodésique nord-américain, 1927



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1816
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
2004

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Recommended citation:
Oakey, G.N., and Dehler, S.A.
2004: Magnetic anomaly map, The Grand Banks of Newfoundland and surrounds, Atlantic Canada. Geological Survey of Canada, Open File 1816, 1:1 500 000.

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