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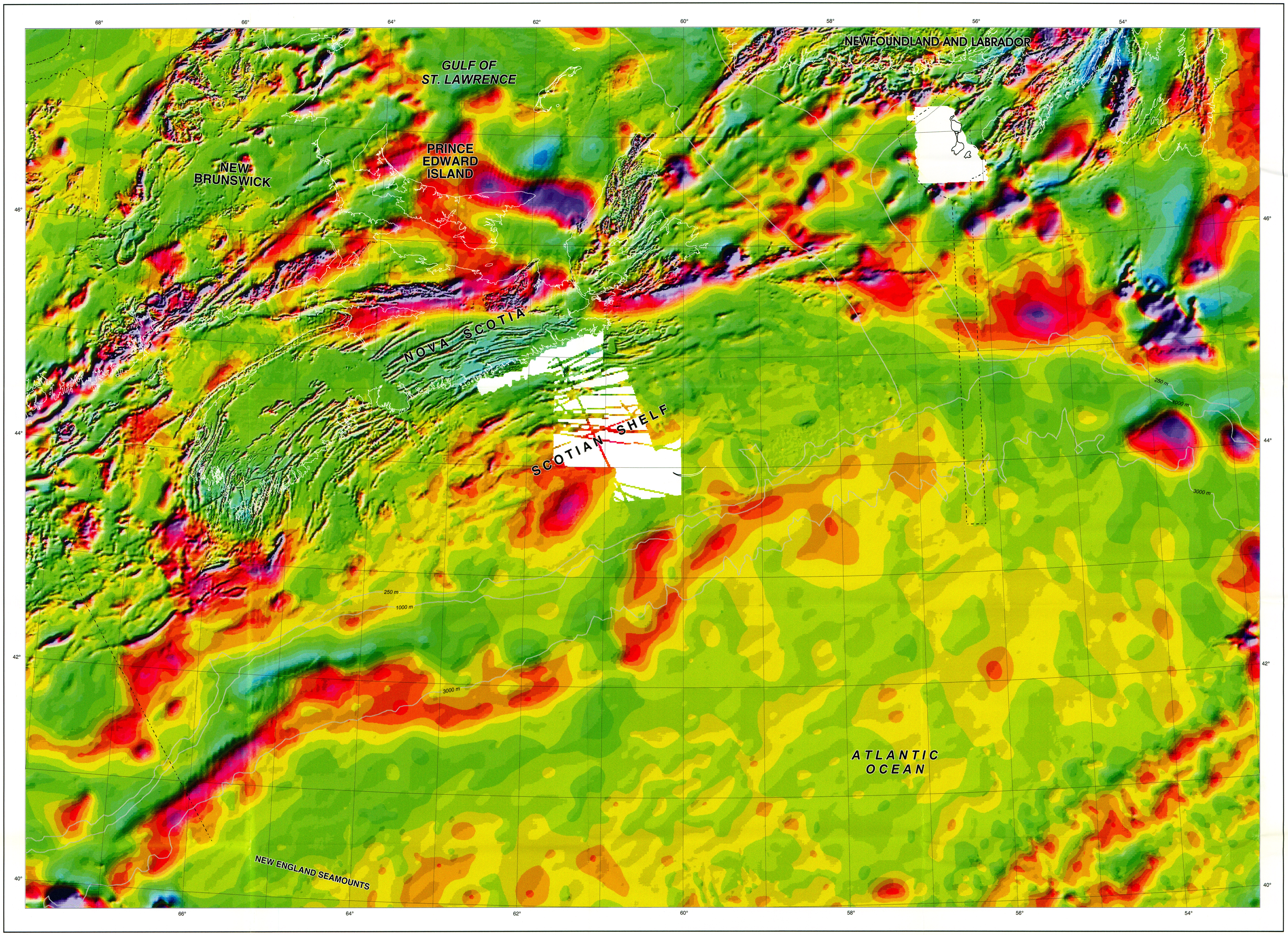
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA



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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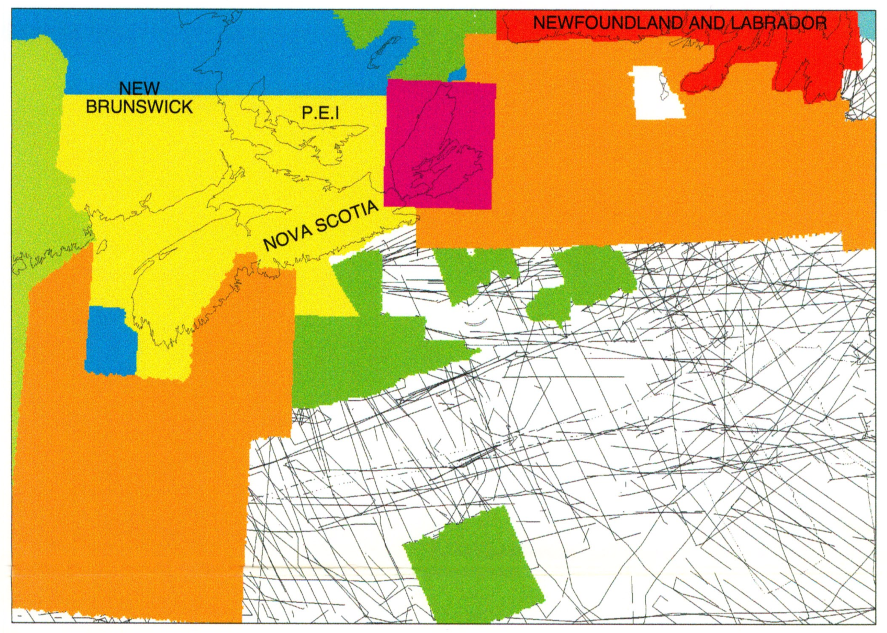
Source Map



1) Modern digital aeromagnetic data
2) Digital profiles from contour maps
3) Atlantic Canada 200m grid
4) Canada 1km grid
5) Maine 1km grid
6) Cape Breton 250m grid
7) Shipborne survey blocks
8) Regional shipborne tracklines

Data Sources:

1, 2, 4: Geological Survey of Canada, Geophysical Data Centre, Ottawa, ON.
3: Unpublished data compilation by Paterson, Grant and Watson Limited, for B.D.L. Loncarevic, GSC, 1993.
5: Data compilation provided by D.L. Daniels, U.S. Geological Survey (pers. comm. 2002).
6: Dehler, S.A., and J. Verhoef (comp.) Magnetic Anomaly Map, Cape Breton Island, Nova Scotia, with Geology Overlay. Scale 1:250 000. Geological Survey of Canada, Open File 3378, 1996.
7, 8: Geological Survey of Canada (Atlantic), Dartmouth, NS.

Magnetic Anomaly Map: Scotian Shelf and Surrounds

long the southern Bay of Fundy shoreline, a linear magnetic anomaly extending into the Gulf of Maine correlates with exposures of Jurassic basalts extruded during a phase of extension prior to opening of the Atlantic Ocean (Wade et al., 1996). This extension was accommodated along the Chedabucto-Cobequid Fault, the boundary between the Avalon Zone and Meguma Zone. North of the Chedabucto-Cobequid Fault are the Cobequid and Antigonish Highlands, where medium amplitude magnetic features associated with a low amplitude long wavelength regional field, correspond with a complex distribution of intrusive and extrusive volcanic rocks within the Avalon Zone (Piper et al., 1993).

The Appalachian tectonic zones extend from Newfoundland, across the Sydney Basin, to Nova Scotia. The frequency content of the magnetic anomalies is decreased offshore due to an increase in source depth beneath thicker late Paleozoic sedimentary rocks. In Cape Breton, exposures of Avalon and other terranes have been identified; however, direct correlation of terranes across the Sydney Basin is still debated (eg. Williams et al., 1999, Barr and Raeside, 1989). In northern and central Cape Breton, high-amplitude magnetic anomalies are generally related to ultramafic intrusions, while along the southern coast and offshore, high amplitude anomalies correspond with volcanic extrusive rocks. These volcanic rocks are exposed in northern mainland Nova Scotia, southern New Brunswick, and Maine, and are considered part of the Avalon zone. Over northern and central New Brunswick, magnetic anomalies are associated with plutonic ultramafic rocks within the Gander and Dunnage terranes. A thick cover of late Paleozoic sedimentary rocks subdues much of the magnetic signature over central New Brunswick.

Along the Scotian Shelf, thick sequences of Mesozoic/Cenozoic sedimentary rocks limit the ability to map basement structures. Although the Continent-Ocean transition is not clearly defined by the magnetic anomalies, a linear positive anomaly (the East Coast Magnetic Anomaly or ECMA), near the 3000m bathymetric contour, correlates with seaward dipping reflectors associated with volcanic material extruded during initial rifting (Keen and Potter, 1995). This feature is continuous along the US Atlantic margin but absent along much of the Canadian Atlantic margin. Seaward of the ECMA, the characteristic pattern of seafloor stripes is subdued, as the oceanic crust was formed during the Jurassic Quiet Zone (Barrett and Keen, 1976), a period of rapid polarity changes of the earth's magnetic field.

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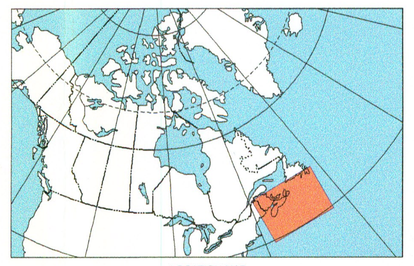

LOCATION MAP

OPEN FILE 1814

MAGNETIC ANOMALY MAP

SCOTIAN SHELF AND SURROUNDS

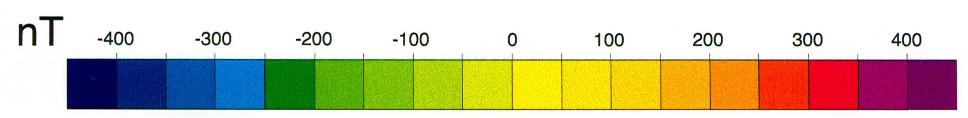
ATLANTIC CANADA

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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2004

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2004: Magnetic anomaly map, Scotian Shelf and surrounds, Atlantic Canada. Geological Survey of Canada, Open File 1814, 1:1 500 000.

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