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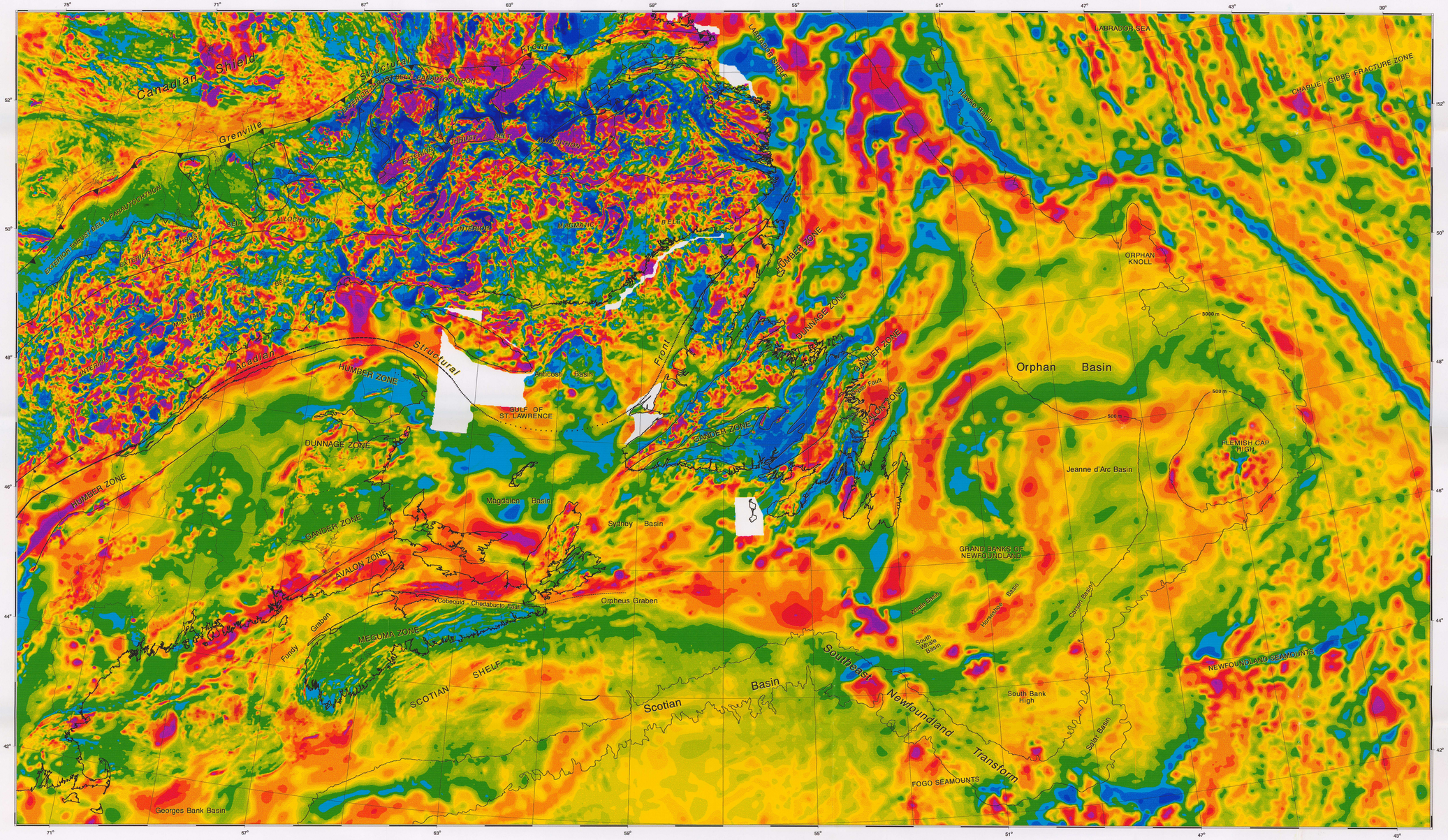

MAGNETIC ANOMALY

The Atlantic region of Canada encompasses the Proterozoic Grenville Orogen, the Paleozoic Appalachian Orogen, and the Mesozoic/Cenozoic Atlantic continental margin. Several upper crustal tectonic zones have been distinguished within each assemblage based on composition, age and ancestry; the boundaries shown follow the divisions of Williams and Grant (1988). The following brief summary of the magnetic signatures of the various tectonic zones and features is based on several recent geophysical reviews (e.g. Woodside and Verhoef, 1989; Miller, 1995; Keen et al., 1990; Williams et al., 1994).

The Grenville Structural Front marks the boundary between the Grenville Orogen and the older provinces of the Canadian Shield. A broad band of relative magnetic quiet south of the front truncates the magnetic anomalies of the shield rocks. The Grenville Orogen is characterised by a complex patchwork of high-amplitude, short-wavelength magnetic anomalies, reflecting both structural complexities and compositional variations. Prominent positive anomalies are related to large gabbroic complexes and negative anomalies tend to overlie anorthosite and related rocks. A gradual increase in depth to Grenville in the northern Gulf of St. Lawrence, due to burial beneath early Paleozoic sedimentary rocks, results in reduced magnetic amplitudes and frequencies. The Grenville may extend for some distance beneath Appalachian rocks, but the magnetic signature of the Appalachians dominates south of the Acadian Structural Front.

The magnetic anomalies of the Appalachian Orogen are generally discrete medium-amplitude features with a low-amplitude long-wavelength background. The boundaries between zones are often identified by marked contrasts in magnetic signatures. The Humber zone is characterised by generally low-amplitude anomalies, with pronounced high-amplitude anomalies over the Grenville inliers. Magnetic anomalies over the Dunnage zone are variable but generally positive; highest values are attributed to plutons, where as low values, associated with sedimentary rocks, dominate over the southeastern region of the Exploits subzone. A thick cover of Paleozoic sedimentary rocks subdues much of the magnetic signature associated with the Dunnage zone in New Brunswick. The Gander zone has predominantly negative magnetic anomalies, but broad areas of positive values are also present in both Newfoundland and New Brunswick. The Avalon zone is quite distinctive on the magnetic anomaly map because of the broad arcs of positive and negative anomalies that sweep across Newfoundland and the Grand Banks. The positive anomalies correlate on land with Precambrian mafic volcanics, and the banded appearance is attributed to basement faulting and offsets. The Meguma zone has a negative anomaly associated with it, punctuated by thin bands of less negative or positive anomalies that reflect the structural trend of the folded sedimentary rocks.The boundary between the Avalon and Meguma zones is quite prominent because of the sharp gradient from positive to negative anomalies. The boundary coincides with the Cobequid-Chedabucto Fault across Nova Scotia and with the Orpheus graben offshore. The eastward projection of this fault boundary appears to mark a terminus of the arcuate anomalies of the Avalon zone south of Newfoundland.

Many of the magnetic anomalies on the continental shelf are offshore extensions of the anomalies mapped on land. The increased source depths, overlying sediments, and generally coarser survey intervals combine to produce a more subdued, longer-wavelength anomaly pattern in the offshore areas than on land. The transition from continental to oceanic crust is not readily apparent in the magnetic anomaly field. A linear positive anomaly near the 3000m bathymetric contour off Nova Scotia correlates with the East Coast Magnetic Anomaly that is continuous along the US Atlantic margin but absent along much of the Canadian Atlantic margin. Magnetic anomalies over the oceanic crust feature the characteristic magnetic striping pattern that identifies crust formed during normal and reverse periods of the Earth's magnetic field. This pattern is offset at the Charlie-Gibbs Fracture Zone, where oceanic crust of different ages is juxtaposed. The volcanic edifices of the Newfoundland and Fogo Seamounts are also identified by positive magnetic anomalies.

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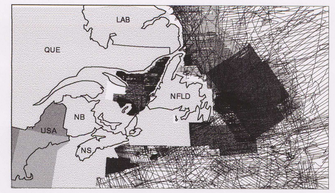
Woodside, J.M. and Verhoef, J. Geological and tectonic framework of eastern Canada as interpreted from potential field imagery. Geological Survey of Canada, Paper 88-26, 1989.

MAGNETIC DATA DISTRIBUTION



DNAG 5km grid
Gulf of Maine 1km grid

GSC (Ottawa) 1km grid
GSC (Atlantic) marine database

This map represents a compilation of IGRF-reduced marine survey data and aeromagnetic gridded data. A 1 km grid of aeromagnetic data, provided by the Geophysical Data Centre (GSC, Ottawa), was used for coverage over the Canadian landmass. The 5 km DNAG grid (OSA, 1987) was used for the US landmass, and a 1 km grid (Macnab et al., 1990) was used for the Gulf of Maine. Data for the remaining offshore areas of the map were derived from marine survey data that had been previously adjusted (Verhoef et al., 1996) to account for secular variations in the magnetic field and crossover errors, and filtered to remove acquisition and gridding artifacts. Wavelengths longer than 400 km were removed from the resulting marine data grid. The final 1 km grid shown in the map was assembled by merging the various grids along a 4 km overlap zone. Blank areas on the map represent regions of no magnetic data coverage.

Committee for the Magnetic Anomaly Map of North America. Magnetic Anomaly Map of North America, 4 sheets, scale 1:5,000,000; Geological Society of America, Boulder CO., 1987.

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Macnab R., Shih, K.G., Bothner, W.A., Brooks, J., Delorey, C., and Klitgord, K. Magnetic Data over the Gulf of Maine and Adjacent Land Areas: Preparation of a Data Base for construction of a 1:500,000 Magnetic Anomaly Map. Geological Survey of Canada Open File 2295, 1990.

Verhoef, J., Roest, W.R., Macnab, R., Arkani-Hamed, J., and Members of the Project Team. Magnetic Anomalies of the Arctic and North Atlantic Oceans and Adjacent Land Areas. Geological Survey of Canada Open File 3125. 225 pp., 300 figures. 1996.

ATLANTIC CANADA MAP SERIES
GEOPHYSICS, GEOLOGY AND PHYSIOGRAPHY

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DEDICATED TO OUR LATE COLLEAGUE AND FRIEND, ALLEN STARK

KEY TO STRUCTURAL LINES

- Grenville Structural Front
- Front of Labradorian allochthons
- Tectonic Zone Boundaries (assumed, speculative)
- Acadian Structural Front : onland, marine, sub-Carboniferous, presumed
- Normal Faults
- 500m, 3000m bathymetric contours

LOCATION MAP - LOCALISATION DE LA CARTE

MAGNETIC ANOMALY MAP
ATLANTIC REGION
CANADA

Scale 1:3 000 000 - Échelle 1:3 000 000

Kilometres 50 0 50 100 150 200 250 Kilomètres

Lambert Conformal Projection
Standard Parallels 45°N and 66°N CM=61°W

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-800 -500 -300 -200 -100 -75 -50 -25 0 25 50 75 100 200 300 500 800 nT

Special thanks to J. Tod and W. Miles of the Geophysical Data Centre (GSC, Ottawa) for providing gridded magnetic data for the Canadian land mass. Digital cartography was provided by David Vardy. The basemap was created using the World Vector Coastline high resolution data.

Copies of this map can be obtained from the Geological Survey of Canada (Atlantic) PO Box 1006, Dartmouth, Nova Scotia, Canada, B2Y 4A2
email: agc@agc.bio.ns.ca
web: http://agcwww.bio.ns.ca

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