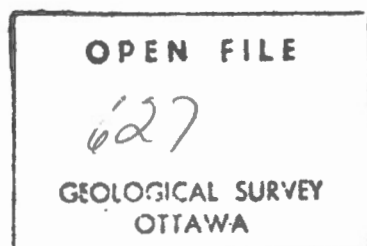


O.F. MARINE GRAVITY AND MAGNETIC ANOMALY MAPS OF THE LABRADOR SEA  
BY S.P. SRIVASTAVA

Gravity and magnetic data collected by the Canadian Hydrographic Service and the Atlantic Geoscience Centre together with published data from other Institutions made available to us have been compiled in the form of Free Air, Bouguer and Magnetic Anomaly Maps. The maps are on Lambert Conformal projection at a scale of 1:2 million. The gravity values were calculated using the 1967 Gravity Reference Field and base values connected to the new International Gravity Standardization Network (I.G.S.N. 71). The magnetic anomalies were calculated using the 1965 International Geomagnetic Reference Field (I.G.R.F. 1965) as the reference field.

The Open File is available for viewing at all GSC Libraries. Copies may be obtained at the user's expense from Precision Microfilming Services Ltd., 6061 Young Street, Halifax, N.S. B3K 2Y3.



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## LEGENDS

### LABRADOR SEA MAGNETIC ANOMALY

(Based on the International Geomagnetic Reference Field 1965).  
Compiled by S.P. Srivastava, Atlantic Geoscience Centre, Geological Survey of  
Canada, Bedford Institute of Oceanography, Dartmouth, N.S.  
Cartography by the Geoscience Mapping Section of the Canadian Hydrographic  
Service

MAGNETIC CONTOURS IN NANOTESLA  
BATHYMETRIC CONTOURS IN METERS  
CONTOUR INTERVAL - 100 NANOTESLA  
Lambert Conformal Projection (Standard Parallel 45°N and 66°N)  
Scale 1:2,000,000

The data presented on this map were compiled from the absolute magnitude of the earth's total magnetic field measured using a marine proton precession magnetometer along ship's track at the locations shown. The anomalies were derived by calculating, at each point of observation, the difference between the observed total field and the International Geomagnetic Reference Field (IGRF) 1965.0\*.

The majority of the data used in the compilation was collected by the Bedford Institute of Oceanography (BIO) during the combined Hydrographic Geophysical cruises operated by the Canadian Hydrographic Service. Also included is a substantial amount of data supplied by the U.S. Naval Oceanographic Office from their detailed 1966 magnetic survey of the Labrador Sea (Vogt and Levy, 1974), data collected on other BIO cruises through this region, published and unpublished data of other institutions as well as aeromagnetic data on Labrador (courtesy of Dr. P. Hood, GSC Map 1255A, 1977) and on the Greenland shelf (shown by dashed dot lines. Geological Survey of Greenland Report 78-1). Published and unpublished Natural Resource Charts based on high density magnetic measurements made by the Bedford Institute of Oceanography on the Labrador shelf and margin have been incorporated in the map.

The map includes data which were collected over a twelve year period. Extremely large differences (in excess of 200 nT) in the amplitudes of well lineated anomalies were observed between cruises which made the contouring difficult. These differences arose because secular variation terms used in IGRF '65 expression do not accurately represent the secular variations for the region\*\*. In order to conform with the lineated pattern of the anomalies as observed from the magnetic profiles plotted along tracks, the data from various cruises were adjusted for minimum crossover errors. The resulting data were then hand contoured on 1:500,000 scale and later reduced photographically to this 1:2 million scale.

No diurnal corrections were applied to the data but temporal variation recordings from magnetic observations closest to the survey area were examined for periods of magnetic storms. Marine magnetic data collected during periods of magnetic storms were rejected. The primary navigation system used during the collection of the majority of the data on BIO cruises since 1972 consisted of a combination of Rho-Rho Loran-C and Satellite Navigation giving a continuous positional accuracy of 100 m or better. Data collected prior to 1972 used mainly linear interpolation between satellite and celestial navigation fixes.

BIO CRUISES: BAFFIN 63-005, 70-021, 73-014.  
HUDSON 65-024, 69-050, 71-032, 72-025, 74-026, 75-009, 76-023,  
76-025, 76-029, 77-027, 77-024.  
MINNA 74-023, MARTIN KARLSEN 75-018, 76-019, 77-016,  
DAWSON 70-28 , 71-030.

OTHER CRUISES: SHOUP - 1966  
LYNCH - 1971, 1972; MARIPOSA - 1967  
JEAN CHARCOT 1969, VEMA 30-1970

## ACKNOWLEDGEMENTS

I am most grateful to many of my colleagues from AGC and the Canadian Hydrographic Service for their assistance in collection, reduction and compilation of the data used in this map. I am indebted to the U.S. Naval Oceanographic Office and their scientists (in particular, R.H. Higgs, G.L. Johnson, P.R. Vogt and J. Egloff) in providing me with copies of their magnetic data collected in the Labrador Sea over the past 10 years. I am also grateful to Manik Talwani and Y. Kristoffersen from Lamont-Doherty Geological Observatory for providing us with some of their data collected in the Labrador Sea, to Peter Hood and Peter McGrath of the Geological Survey of Canada for providing copies of their detailed unpublished contoured aeromagnetic maps over Labrador, and to the Greenland Geological Survey for allowing us to use their aeromagnetic data from the west Greenland shelf.

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# LABRADOR SEA

## GRAVITY - BOUGUER ANOMALY

(Based on the International Gravity Formula of 1967 and the International Gravity Standardization Network 1971).

Compiled by S.P. Srivastava, Atlantic Geoscience Centre, Geological Survey of Canada, Bedford Institute of Oceanography, Dartmouth, N.S.

Cartography by the Geoscience Mapping Section of the Canadian Hydrographic Service

GRAVITY CONTOURS IN MILLIGALS

BATHYMETRIC CONTOURS IN METRES

CONTOUR INTERVAL - 10 Milligals except in regions of dense coverage where it is 5 milligals.

Lambert Conformal Projection (Standard Parallels 45°N and 66°N)

Scale 1:2,000,000

The Free Air gravity anomaly is obtained by removing a theoretical value of acceleration due to gravity at sea level ( $g_e$ ) from the observed value ( $g_o$ ) at the same point using the International Gravity Formula 1967:

$$g_e = 978.03185 (1 + 0.005278895 \sin^2 \phi + 0.000023462 \sin^4 \phi) \text{ gal}$$

where  $\phi$  is the latitude at which the measurements are made.

The gravity data on this map were compiled by shipborne gravimeter measurements recorded along ship's tracks at the locations shown. The majority of the data was collected by the Bedford Institute of Oceanography (BIO) during the combined Hydrographic/Geophysical cruises operated by the Canadian Hydrographic Service. Published and unpublished Natural Resource Charts based on high density gravity measurements made by the Bedford Institute of Oceanography on the Labrador shelf and margin have been incorporated in this map. Also included were the data collected on other BIO cruises throughout this region (see list below), published data of other institutions as well as some unpublished data collected by Earth Physics Branch of the Dept. of Energy, Mines and Resources, Ottawa. The distribution of source material is shown below in the figure. The data were primarily collected using Graf-Askania Gss-2 gravimeters mounted on Anschutz gyro stabilized platforms, but in some instances using Graf-Askania Gss-3 gravimeters belonging to the German Hydrographic Institute, or with a LaCoste & Romberg gravimeter (S-S4) belonging to the Earth Physics Branch, Dept. of Energy, Mines and Resources, Ottawa.

Gravity measurements made on BIO cruises operated by Canadian Hydrographic Service (MN74-023, MK75-018, 76-019, 77-016) were adjusted by Dr. A. Folinsbee using the method of Valiant et al (1974) to minimize the crossover errors between various tracks. For other cruises the data were adjusted manually during the contouring process. The majority of crossover errors were less than 10 mgal. Tracks with crossover errors of 10 mgal or more were rejected. The adjusted and unadjusted data were hand contoured on a scale of 1:500,000 and the contoured sheets were subsequently reduced photographically to this 1:2 million scale.

The anomaly field shown on this map is obtained by adding a simple Bouguer correction to the Free Air gravity anomaly. The correction is derived by calculating the gravitational effect of an infinite plate with thickness equal to the depth of water at the point of observation and density equal to the difference between average crustal and sea water densities. The formula used for computing this correction is:

$$B.C. = 0.0419277 D (\rho_c - \rho_w)$$

where D: depth at point of observation, in metres

$\rho_c$ : average crustal density considered here as 2.67 g/cm<sup>3</sup>

$\rho_w$ : seawater density considered here as 1.03 g/cm<sup>3</sup>

The depth values (soundings) used in these calculations were measured and recorded simultaneously with the gravity data. These soundings were also used in

construction of the Bathymetry Map (814A) with one important distinction: depth contours in the Bathymetry Map are based on soundings corrected according to Matthews' Tables, while Bouguer corrections use uncorrected soundings. In most cases, the difference between corrected and uncorrected soundings is less than two percent. This introduces errors in the Bouguer anomaly ranging from less than one milligal in shallow water (1500 m or less) to five milligals in deep water (4000 m).

Also shown are the Bouguer anomaly contours over Labrador extracted from the published maps of the region by the Gravity Division of the Earth Physics Branch, Dept. of Energy, Mines and Resources, Ottawa. Bouguer anomaly contours south of 56°N over Labrador were adjusted to bring them to the new gravity reference field of 1967. Because the corrections were applied to the published contoured maps of this region rather than to the original data, some minor differences may exist in the trends of the contours displayed here from those which would have been produced had the corrected data been recontoured. Bouguer anomaly contours over western Greenland were extracted from published measurements made by the Geodetic Institute of Denmark. These measurements were also adjusted to bring them to the new gravity reference field of 1967.

The primary navigation system used during collection of the majority of the data used in the preparation of this map since 1972 consisted of a combination of Rho-Rho Loran-C and Satellite Navigation giving a continuous positional accuracy of 100 m or better. Data collected prior to 1972 used mainly linear interpolation between Satellite and Celestial navigation fixes. No cross-coupling corrections were applied to the data, though on some of the cruises the combined output from two Gss-2 gravimeters mounted back to back were used to obtain the gravity values which were free from cross-coupling errors. The gravity values for each cruise were adjusted for the drift of the gravimeters used, as a result of repeated calibrations at the nearest harbours to the survey area whose base values were connected to the International Gravity Standardization Network (I.G.S.N. 71).

BIO CRUISES: HUDSON 65-024, 69-050, 71-032, 72-025, 74-026, 75-009, 76-023, 76-025, 76-029, 77-027, 77-024.  
BAFFIN 70-021, 73-014. MINNA 74-023. MARTIN KARLSEN 75-018, 76-019, 77-016.

LAMONT-DOHERTY CRUISES: VEMA 30

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## LEGENDS

LABRADOR SEA

GRAVITY - FREE AIR ANOMALY

(Based on the International Gravity Formula of 1967 and the International Gravity Standardization Network 1971).

Compiled by S.P. Srivastava, Atlantic Geoscience Centre, Geological Survey of Canada, Bedford Institute of Oceanography, Dartmouth, N.S.

Cartography by the Geoscience Mapping Section of the Canadian Hydrographic Service

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