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GEUS

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Gravity Anomaly of the Baffin Bay Region

Gravity anomalies, the differences between measured data and a theoretical model (a rotating homogeneous ellipsoid), are produced by lateral variations of mass in the Earth. These anomalies are attributed to: 1) variability in rock densities due to lithological changes, 2) rapid changes in topography (or bathymetry), and 3) isostatic compensation of mass loading (or mass deficit) on a regional or local scale. Variations at shallow depths are better resolved than deep sources. Gravity measurements at sea are at the same vertical elevation (sea level) and anomaly values referred to as free air gravity. Onshore, anomaly values are further adjusted to account for the extra mass between sea level and the elevation at which data are measured. This is referred to as Bouguer gravity.

Onshore, negative Bouguer gravity values correspond to a thick continental crust and therefore a greater depth to higher density mantle rocks. On Baffin Island, variations of the gravity values correlate with the Archean terranes described by Hoffman (1989). This variability has been directly attributed to differences in metamorphic grade with amphibolite grade rocks having slightly more positive gravity values than the granulite facies rocks (Woodside and Verhoef, 1989). On Greenland, gravity values are particularly low (<100 mGal) due to crustal depression under the thick ice sheet. At the southern edge of the map, the reworked Archean rocks have a sharp contrast with the rocks of the Nain Province. This is a localized feature, as the gravity values drop quickly to a regional low (~120 mGal) on the eastern edge of Disko Island.

A prominent feature associated with the shelf region is a large positive free air anomaly that follows the shelf break (~500 m). This anomaly is predominantly caused by the combined effect of a thick continental crust adjacent to thin oceanic crust and the large bathymetric gradient associated with the slope region (Keen et al., 1990). Along the Baffin shelf the amplitude of this feature varies in amplitude from 20 to 120 mGal. A local high, seaward of Home Bay, is associated with a prograded sedimentary sequence. Adjacent to Bylot Island, the high amplitude anomaly has been attributed to the proximity of the mountains on Baffin Island, the narrow shelf, and the rapid transition to oceanic crust (Keen et al., 1990). The gravity high near Cape Dyer correlates with volcanic rocks in the seabed. These Paleogene volcanic rocks are broadly distributed on the Greenland shelf (Clarke and Pederson, 1976) coincident with the large area of positive gravity in the Disko Island region. In Melville Bay, an elongated negative anomaly is associated with the Melville Bay graben. Seaward of the graben, a particularly high amplitude shelf edge anomaly (~120 mGal) is observed. It is unclear whether this is related to the graben structure or an uncompensated sedimentary rock sequence. A broad area of northern Baffin Bay has a positive gravity anomaly (>40 mGal) which has been attributed to a thick sequence of uncompensated sedimentary rocks (Reid and Jackson, 1997).

In the deep water area of Baffin Bay the gravity anomalies have lower amplitudes than on the shelf and land area. Northwest trending linear lows (~30 mGal) are observed in the centre of the basin and have been used to delineate an extinct spreading ridge (Srivastava et al., 1981). This gravity low cuts the broad positive anomalies in northern Baffin Bay, suggesting that the sedimentary basin overlies oceanic crust. In central and southern Baffin Bay, the linear low has been offset, suggesting that there were well established transform faults active during the rifting history of the basin.

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Keen, C.E., Loncarevic, B.D., Reid, I., Woodside, J., Haworth, R.T., and Williams, H.
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Reid, I. and Jackson, H.R.
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Srivastava, S.P., Falconer, R.P.H., and MacLean, B.
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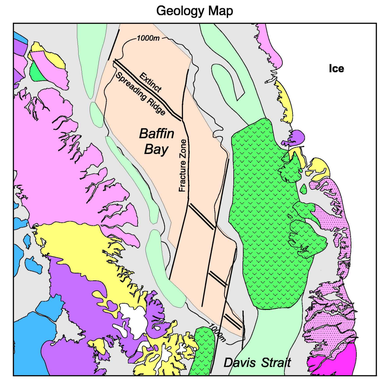
Geology Map



Data Sources

The data sets used to produce this map include land station and marine surface measurements. Data distribution and coverage are shown on the insert map. The average spacing of the regional observations is from 5-10 km for the land and between 2-30 km for the ship tracks. Station data for Canada and its margins were provided by the Geophysical Data Centre, Continental Geoscience Division, GSC Ottawa. Marine survey data were collected by the Atlantic Geoscience Centre (now GSC Atlantic) and merged into the National Gravity Data Base (Earth Physics Branch, 1985). Station data and gridded Bouguer data for Greenland and its margins were provided by the National Survey and Cadastre Denmark. All data were gridded and interpolated using a minimum curvature method (Smith and Wessel, 1990) with a final resolution of 5 km.

The rock density used for the Bouguer correction was 2670 kg/m^3. Where gravity was measured on a lake or glacier, densities of 1000 kg/m^3 and 900 kg/m^3 were used for water and ice respectively. The Bouguer gravity often has an additional terrain correction applied to minimize the effect of rugged topography. This correction was only applied in some coastal regions where measurements were made adjacent to fjords. All Bouguer corrections were made by the contributing organizations.

Geophysical Data Centre
2000: Canadian National Gravity Database. Geological Survey of Canada, 615 Booth Street, Ottawa.

Earth Physics Branch
1985: Integration of Atlantic Geoscience Centre marine gravity data into the National Gravity Database. Geological Survey of Canada, Open File Report 8532, Ottawa.

National Survey and Cadastre Denmark (Kort & Matrikelstyrelsen)
1998: National Gravity Database. Rentemestervej 8, 2400 Copenhagen NV, Denmark.

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1990: Gridding with continuous curvature splines in tension. Geophysics, v. 55, p. 293-305.

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Copies of this map can be obtained from
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CANADIAN - GREENLAND MARGINS
THEMATIC MAP SERIES

PHYSIOGRAPHY, GRAVITY and MAGNETICS

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Canada

OPEN FILE 3934C

GRAVITY ANOMALY MAP
BOUGUER ON LAND, FREE AIR AT SEA

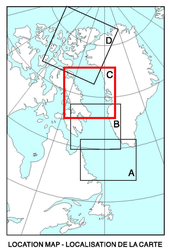
BAFFIN BAY REGION

CANADIAN AND GREENLAND ARCTIC

Scale 1:1 500 000 - Échelle 1/1 500 000

kilometres 25 0 50 100 150 200 kilomètres

Lambert Conformal Conic Projection
Standard Parallels 65°N and 75°N CM = 55°W



LOCATION MAP - LOCALISATION DE LA CARTE

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GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
OTTAWA
02/2001

This map is one of a set of four (GSC Open file 3934A-D) covering the gravity anomaly of the Canadian and Greenland Arctic:

Open File 3934A: Gravity Anomaly Map, Labrador Sea Region
Open File 3934B: Gravity Anomaly Map, Davis Strait Region
Open File 3934C: Gravity Anomaly Map, Baffin Bay Region
Open File 3934D: Gravity Anomaly Map, Innuitian Region

Gravity Anomaly Map of the Baffin Bay Region

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