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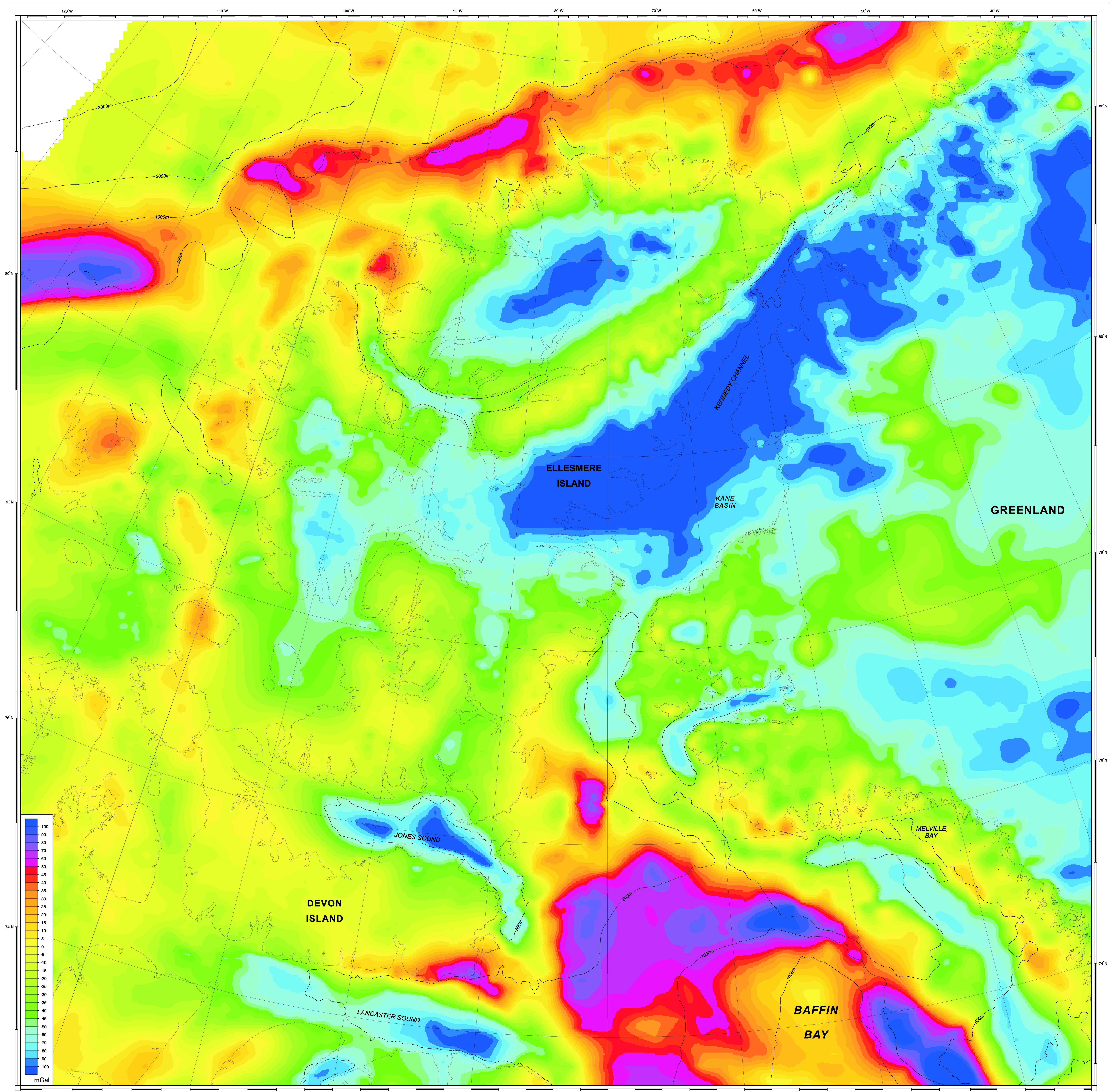
GEUS

Kort & Matrikelstyrelsen



Gravity Anomaly of the Innuitian 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, Bouguer gravity values are generally negative and correspond to a thick continental crust and therefore a greater depth to higher density mantle rocks. However, over most of the Innuitian Region (outlined by Trettin, 1989) gravity values are generally neutral to slightly positive. This can be partially explained by regionally shallow Moho depths (20 km to 25 km) (Forsyth et al., 1998) as well a regional overprinting of the Tertiary Eurekan Orogeny. Three major uplifts have been identified, each the result of a different tectonic response (Stephenson and Ricketts, 1990): 1) Cornwall Arch (CA), 2) Princess Margaret Arch (PMA), and 3) Grantland Uplift (GU). The Cornwall Arch and Princess Margaret Arch, delineated by north south trending gravity highs (20 to 30 mGal), are attributed to upwarped mantle resulting from crustal shortening during the Eurekan Orogeny. The Princess Margaret Arch, however, has several closely associated thrust faults. The Grantland Uplift has a corresponding broad gravity low (~-100 mGal) and is attributed to a highly thickened crust (the Proterozoic Deep Water Province) which is in isostatic equilibrium. A localized gravity high on northwestern Ellesmere Island (~50 mGal) is associated with a large volcanic complex. On Greenland and southeast Ellesmere Island, neutral gravity values (-20 to 0 mGal) correlate with the distribution of Archean rocks. Gravity values over much of Greenland are particularly low due to crustal depression under the thick ice sheet. There is a large negative gravity anomaly (<-150 mGal) that extends from Ellesmere Island, across Kane Basin, Kennedy Channel, and continues across North Greenland. This feature has been attributed to significant crustal thickening from continental collision during the Eurekan Orogeny (Jackson and Koppen, 1985).

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 Arctic shelf, this feature varies in amplitude from 40 to 120 mGal with localized highs the result of a prograded sedimentary sequence (Forsyth, et al., 1998). 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). Gravity lows are commonly observed in many of the deep water channels, partially the result of the channels being over deepened by glacial scouring. This is consistent with the large gravity values on southeastern Devon Island, where high mountains are adjacent to a deep channel. Some channels, however, are fault bounded (Lancaster Sound and Jones Sound) and thought to represent failed rifts during the opening of Baffin Bay (Trettin, 1989). The effect of this rifting (and subsequent convergence) had a complex regional influence. The gravity high (~80 mGal) off southeastern Ellesmere Island, is attributed to a mantle high associated with the rifting process (Reid and Jackson, 1997).

Forsyth, D.A., Broome, J., Embry, A.F., and Halpenny, J.F.
1990: Features of the Canadian polar margin; *in* Arctic Geoscience; J.R. Webber, D.A. Forsyth, A.F. Embry and S.M. Blasco (ed). Arctic Geoscience, Marine Geology, v. 93, p. 147-177.

Forsyth, D.A., Asudeh, I., White, D., Jackson, R., Stevenson, R.A., Embry, A.F., and Argyle, M.
1998: Sedimentary basins and basement highs beneath the polar shelf north of Axel Heiberg and Meigen islands. Bulletin of Canadian Petroleum Geology, v. 46, no.1, p. 12-29.

Jackson, H.R. and Koppen, L.
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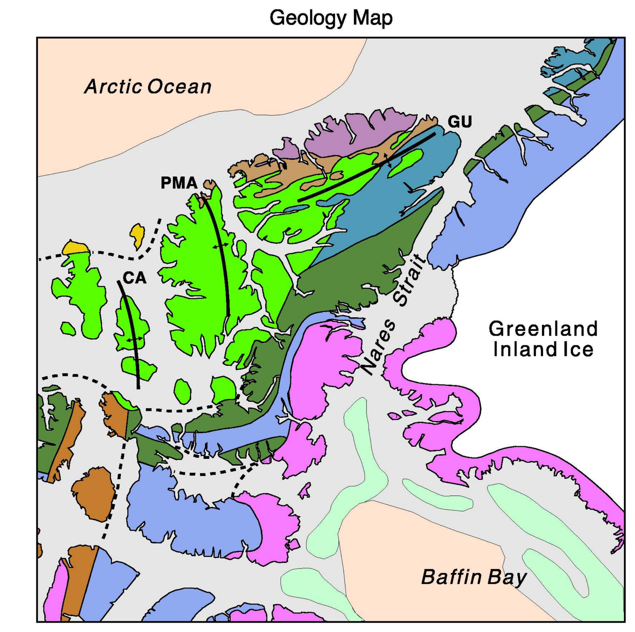
Reid, I. and Jackson, H.R.
1997: Crustal structure of northern Baffin Bay: Seismic refraction results and tectonic implications, Journal of Geophysical Research, v. 102, p. 523-542.

Stephenson, R.A. and Ricketts, B.D.
1990: Bouguer gravity anomalies and speculations on the regional crustal structure of the Eurekan Orogen, Arctic Canada. Marine Geology, v. 93, p. 401-420.

Trettin, H.P.
1989: The Arctic Islands - Chapter 16, *in* The Geology of North America - An overview; A.W. Bally and A.R. Palmer (ed). Boulder, Colorado, Geological Society of America, The Geology of North America, v. A.

Geology Map



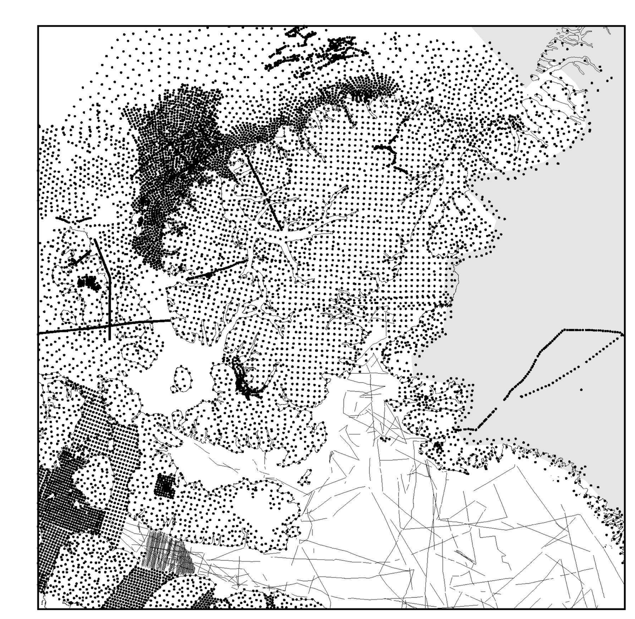
Oceanic crust
Sedimentary basin
Continental crust

ARCTIC COASTAL PLAIN
IV Upper Tertiary - Recent

SVERDRUP BASIN
III Carboniferous - Lower Tertiary

CANADIAN SHIELD
I Archean - Lower Proterozoic

FRANKLINIAN MOBILE BELT (II)
Pearya — Middle Proterozoic - Upper Silurian
Deep-Water Province
Sedimentary-Volcanic Subprovince — Cambrian - Devonian
Sedimentary Subprovince — Lower Cambrian - Devonian
Shelf Province — Lower Cambrian - Upper Silurian
Arctic Platform — Cambrian - Devonian
Boothia Uplift



gridded aerogravity
station gravity
marine survey data

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 5-30 km for the ships 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 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 were 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 8532, Ottawa.

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

Smith, W.H.F. and Wessel, P.
1990 Gridding with continuous curvature splines in tension. Geophysics, v. 55, p. 293-305.

Acknowledgements

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Copies of this map can be obtained from
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web: http://agcwww.bio.ns.ca

CANADIAN - GREENLAND MARGINS
THEMATIC MAP SERIES

PHYSIOGRAPHY, GRAVITY and MAGNETICS

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Canada

OPEN FILE 3934D

GRAVITY ANOMALY MAP
BOUGUER ON LAND, FREE AIR AT SEA

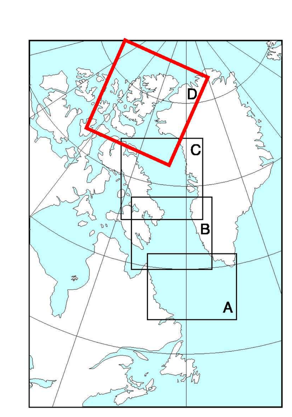
INNUITIAN REGION

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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3934D
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 Innuitian Region

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2001: Gravity Anomaly Map of the Innuitian Region, Canadian and Greenland Arctic. Geological Survey of Canada, Open File 3934D, scale 1:1 500 000.