GEOLOGICAL SURVEY OF CANADA COMMISSION GÉOLOGIQUE DU CANADA

OPEN FILE 2964

CARTOGRAPHIC OVERLAY OF GEOLOGY ON SHADED TOTAL FIELD MAGNETIC DATA

SLAVE CRATON AND ENVIRONS

DISTRICT OF MACKENZIE

NORTHWEST TERRITORIES

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

Kilometres 25 0 25 50 75 Kilometres

Lambert Conformal Conic Projection
Standard Parallels 61°30'N and 67°30'N
Projection conique conforme de Lambert
Parallèles d'échelle conservée 61°30'N et 67°30'N

NATMAP
CARTNAT
Canada's National Geoscience Mapping Program
Le Programme national de cartographie géoscientifique du Canada

Natural Resources Canada / Ressources naturelles Canada

Canada

Copies of this map may be obtained from the Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario, K1A 0E8 3303 33rd Street, N.W., Calgary, Alberta, T2L 2A7 100 West Pender Street, Vancouver, B.C. V6B 1R8

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LEGEND

Neoproterozoic

0.72 Ga:
Franklin sills in Coppermine homocline: gabbro, diabase

0.78 Ga:
Hottah sheets in Wopmay orogen: gabbro, diabase

Neoproterozoic and/or Mesoproterozoic

Rae Group in Coppermine homocline: sandstone, siltstone, dolomite, shale; includes undifferentiated Franklin sills

Mesoproterozoic

Husky Creek Formation in Coppermine homocline; Algak Formation in Bathurst Inlet and Kent Peninsula: red sandstone, siltstone, minor basalt

1.27 Ga:
Copper Creek Formation in Coppermine homocline; Elaktalik Formation in Bathurst Inlet and Kent Peninsula: plateau basalt, minor gabbro

1.27 Ga:
Fortress cone sheets in Great Slave Lake; unnamed sills in Wopmay orogen and Coppermine homocline: gabbro, diabase

1.27 Ga:
Muskox intrusion in Wopmay orogen: serpentinized dunite and peridotite, pyroxenite, gabbro, picritic border phase and feeder dyke, hybrid upper border phase

Kendall River, Sulky and Greenhorn Lakes formations (Dismal Lakes Group) in Coppermine homocline; Parry Bay and Kanuyak formations in Bathurst Inlet and Kent Peninsula; Loudoux Point Formation in Thelon basin: dolomite

LeRoux, Fort Confidence and Dease Lake formations (Dismal Lakes Group) in Coppermine homocline: sandstone, shale, dolomite

Mesoproterozoic and/or Paleoproterozoic

Western Channel sheets in Coppermine homocline: diabase, gabbro

Paleoproterozoic

1.88 Ga:
Nanisivik volcanic complex (Hornby Bay Group) in Coppermine homocline: mafic and felsic tuffs, flows and plugs, sandstone, shale, dolomite

Kaerbok Formation (Hornby Bay Group) in Coppermine homocline: sandstone, mudstone, dolomite

East River Formation (Hornby Bay Group) in Coppermine homocline: dolomite, minor quartzite, mudstone

Lady Nye Formation (Hornby Bay Group) in Coppermine homocline; Elliot Formation in Bathurst Inlet and Kent Peninsula; Thelon Formation in Thelon basin: sandstone, conglomerate, siltstone, dolomite

Bigbear and Fault River formations (Hornby Bay Group) in Coppermine homocline and Wopmay orogen: sandstone, conglomerate

Tinney Cove Formation in Bathurst Inlet; Et-then Group in Great Slave Lake: conglomerate, sandstone

1.87 - 1.84 Ga:
Great Bear and Bishop intrusive suites in Wopmay orogen; Compton leucolithe in Great Slave Lake: subgranite-series granite, granodiorite, quartz monzonite, quartz diorite, diorite

1.87 - 1.86 Ga:
MacTavish Supergroup in Wopmay orogen: rhyolite, rhyodacite, dacite, andesite, basalt; gabbro, intrusive felsic porphyry; sandstone, conglomerate, siltstone

1.89 - 1.87 Ga:
Hepburn intrusive suite in Wopmay orogen; Butte Island intrusive suite in Great Slave Lake: ilmenite-series granite, granodiorite, tonalite, quartz diorite, diorite hornblendite, norite, peridotite

Morel sills in Wopmay orogen and Kilohigok basin: gabbro, diabase

Takiyuak Formation in Wopmay orogen; Brown Sound and Amagok formations in Kilohigok basin; Christie Bay Group in Great Slave Lake: red sandstone, siltstone, limestone, dolomite, basalt, hebridites(?) magnetosite

1.88 Ga:
Redrock Group in Wopmay orogen; Peacock Hills and Kluvik formations in Kilohigok basin; Kahochella and Pethei groups in Great Slave Lake: greywacke, argillite, concretionary argillite, argillaceous limestone, limestone, dolomite, basalt

1.90 - 1.89 Ga:
Akaitcho, Grace and lower Beil Island Bay groups of Hottah terrane in Wopmay orogen: basalt, gabbro, rhyolite, intrusive porphyry, arkose, pelite, marble

upper Noniecho Group (Theluthili and Tatson formations) in Churchill hinterland: conglomerate, arkose

middle Noniecho Group (Chief Nataway and Nwashindezzi formations) in Churchill hinterland: siltstone, arkose

lower Noniecho Group (Hajimar and Tronka Chua formations) in Churchill hinterland: conglomerate, arkose

1.97 - 1.89 Ga:
Epworth Group in Wopmay orogen; Bear Creek Group in Kilohigok basin; Wilson Island and Sloan groups in Great Slave Lake: arkose, quartzite, siltstone, argillaceous dolomite, dolomite, basalt, rhyolite

1.94 - 1.91 Ga:
Tatson-Thelon magmatic zone: ilmenite-series granite

1.99 - 1.91 Ga:
Tatson-Thelon magmatic zone: magnetite-series granite, charnockite, granodiorite, tonalite, enderbite, quartz diorite, diorite, gabbro

Kimmirut Group in Kilohigok basin: quartzite, dolomite

Union Island Group in Great Slave Lake: dolomite, shale, siltstone, basalt, quartzite, conglomerate

2.02 Ga:
Melville Group in Wopmay orogen: basalt, gabbro, dolomite, argillite, siltstone, arkose, conglomerate

Snare Group in Wopmay orogen (equivalent to Melville, Epworth and/or Grant groups): quartzite, siltstone, pelite, dolomite, basalt

2.19 - 2.02 Ga:
Big Spruce, Blackford and Booth River intrusive suites in Slave craton: alkaline, peralkaline and subalkaline granite, quartz syenite, diorite, gabbro, foyaite, ijolite, carbonatite

Paleoproterozoic and/or Archean

Intrusive suites of Hottah terrane (conjectural south of latitude 66 N) in Wopmay orogen: granite, granodiorite, tonalite, quartz diorite, amphibolite

Holly Lake metamorphic suite of Hottah terrane in Wopmay orogen: quartzite, siltstone, pelite, mafic and intermediate volcanic rocks, amphibolite

undersaturated intrusive suites in Churchill hinterland: nepheline syenite, syenite

felsic intrusive suites in Churchill hinterland: granite, granodiorite, quartz diorite

mafic intrusive suites in Churchill hinterland: gabbro, diorite, peridotite

metamorphic suites in Churchill hinterland: paragneiss, quartzite, marble, amphibolite, iron-formation

gneiss complexes in Churchill hinterland: granitic, granodioritic, tonalitic and dioritic orthogneisses, in part hypersthene-bearing, minor paragneiss, mafic and ultramafic enclaves

Archean

undifferentiated granitoids in Slave craton and deformed equivalents in Wopmay orogen: granite, granodiorite, tonalite, quartz diorite, diorite, gabbro

2.61 - 2.56 Ga:
undeformed granitoids in Slave craton: granite, granodiorite, tonalite

2.63 - 2.59 Ga:
deformed granitoids in Slave craton younger than Yellowknife volcanics: tonalite, granodiorite, granite, quartz diorite, diorite, gabbro

undifferentiated gneiss complexes in Slave craton: paragneiss, orthogneiss, includes possible pre-Yellowknife Supergroup rocks

Yellowknife Supergroup in Slave craton: greywacke, pelite, minor quartzite, paragneiss, iron-formation, marble, volcanics, metamorphic equivalents; includes minor pre-Yellowknife Supergroup metasedimentary rocks

2.69 - 2.65 Ga:
deformed granitoids in Slave craton coeval with Yellowknife volcanics: tonalite, granodiorite, quartz diorite, diorite, gabbro, anorthosite

2.69 - 2.66 Ga:
Yellowknife Supergroup in Slave craton: mainly rhyodacitic and rhyolitic volcanic and related intrusive rocks, derived sediments; minor basalt, andesite, dacite; metamorphic equivalents

Yellowknife Supergroup in Slave craton: mainly andesitic and dacitic volcanic and related intrusive rocks, derived sediments; minor basalt, rhyodacite, rhyolite; metamorphic equivalents

2.71 - 2.69 Ga:
Yellowknife Supergroup in Slave craton: mainly basaltic volcanic and related intrusive rocks; minor andesite, rhyodacite, rhyolite; metamorphic equivalents, includes minor pre-Yellowknife Supergroup metavolcanic rocks

3.2 - 2.9 Ga:
Point Lake and Sleepy Dragon gneiss complexes in Slave craton: granitic, granodioritic, tonalitic and dioritic orthogneiss, minor paragneiss, mafic and ultramafic enclaves

4.0 - 3.4 Ga:
Acasta gneiss complex in Slave craton: granitic, granodioritic, tonalitic and dioritic orthogneiss, minor paragneiss, mafic and ultramafic enclaves

Geological boundary, defined

Fault, (unknown type)

Fault, (transcurrent, arrows indicate relative movement)

Fault (normal displacement)

Thrust fault, (teeth in direction of dip)

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Cartographic overlay of Geology, Slave craton and environs (OF 3559) on shaded total field magnetic data, District of Mackenzie, Northwest Territories Geological Survey of Canada, Open file 2964, scale 1:1 000 000

INTRODUCTION

Integration of airborne magnetic data with geological maps has traditionally been performed on a contour overlay basis, whereby the contours of the aeromagnetic data are overlaid onto the geological maps either directly, or in the form of transparencies. The map depicted in this open file presents a new approach to the integration of these two data types. Using a computer-based Geographic Information System, a Hue-Saturation-Value (HSV) colour transformation has been used to combine aeromagnetic data with a geological map.

DATA COMPONENTS

The airborne total field magnetic data used in the production of this map was compiled from the archives of the National Aeromagnetic Database, Geophysical Data Centre, Geological Survey of Canada. The aeromagnetic measurements were derived from a number of surveys flown over the region with an approximately 800 metre flight line spacing and a 305 metre mean terrain clearance. The constituent surveys were re-levelled to remove discontinuities between survey areas. The levelled data were interpolated onto a 200 metre grid.

The geological map information used in the production of this map was derived from Geological Survey of Canada Open File 2559, 1993, Hoffman, P. and Hall, L., Geology, Slave craton and environs, District of Mackenzie, Northwest Territories; 1:1,000,000.

The hydrographic base used in the production of this map was derived from the 1:1,000,000 Digital Chart of the World database distributed by E.S.R.I.. This data was further modified by Geoscience Information and Communications Division Geological Survey of Canada.

Portions of the cartographic design and layout used in this map were produced by M. Methot, Geological Survey of Canada.

MAP PRODUCTION PROCEDURE

Shaded-Relief Imaging of Airborne Magnetic Data

The airborne magnetic data was processed to produce a shaded-relief image. This is a useful process for enhancing the high frequency components of the magnetic data which may distinguish structural and lithological variations (Broome, 1990). Shaded-relief images are produced by illuminating the gridded aeromagnetic data with an imaginary light source and calculating the apparent reflectance of the magnetic surface as defined by the magnetic intensity. The maximum reflectance of any magnetic feature occurs when that feature strikes perpendicular to the direction of the illumination source. For the magnetic data used in this map, an illumination azimuth of 65 degrees and illumination elevation of 45 degrees was applied. This is perpendicular to the average strike of Mackenzie dykes (335 degrees), in the region. The shaded-relief image used in this map is shown in Figure 2.

Hue-Saturation-Value Transformation

Integration of the shaded-relief magnetic data with the lithology of the region was performed using the HSV colour transformation (Harris et al., 1994). This colour transformation allows for the integration of multiple data sets by assigning a particular data set to either the hue, saturation or value component. The geometry of this color system is shown in Figure 1. Hue specifies the colour hue as a integer between 0 and 360, in which each hue is an angular measure around the colour cone. Saturation is a measure of the hues departure from a neutral colour such as gray. When saturation is 100, the colour is fully saturated. When saturation is 0, the colour will appear gray. Value is a measure of the percentage of black and white and varies between 0 and 100. A colour with a value set to 100 will appear white, while a colour with a value set to 0 will appear black.

In this map, the geological information was used to modulate the hue and saturation components of the map (Figure 3), while the shaded-relief magnetic data was used to modulate the value (or black and white) component (Figure 2). Line work comprising structural elements, hydrographic masks, and annotation have been overlaid on the integrated image to improve the information content of the map as a whole.

ACKNOLWLEDGMENTS

D. Viljoen is thanked for his vital technical knowledge of ARC/INFO. J. Broome, J. Harris, and J. King are thanked for constructive review of the map product.

REFERENCES

Broome, J. H. 1990; Generation and interpretation of geophysical images with examples from the Rae Province, northwest Canadian shield; Geophysics, v. 55, no. 8, p. 977-987

Harris, J. R., Bowie, C., Rencz, A, Graham, D. 1994; Computer enhancement techniques for the integration of remotely sensed, geophysical, and thematic data for the geosciences; Canadian Journal of Remote Sensing, v. 20, no. 3

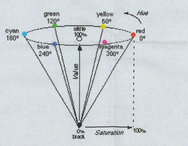

Figure 1 : HSV Colour Model

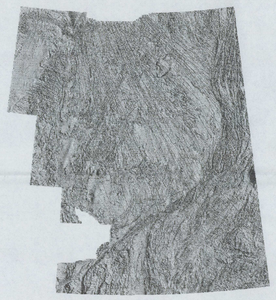

Figure 2 : Shaded-Relief Aeromagnetics

Figure 3 : Colour-Coded Geology

Data Integration by C. Bowie, 1994, Geological Survey of Canada

Components of this map are also available in CD-ROM format as GSC Open File 3559 (geology and hydrology) and GSC Open File 3974 (integrated shaded magnetics and geology).

Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Copies of the topographical editions covering this map area may be obtained from the Canada Map Office, Natural Resources Canada, Ottawa, Ontario, K1A 0E9

The proximity of the North Magnetic Pole causes the magnetic compass to be erratic in this area

Mean magnetic declination 1993, 37° 41' East, increasing 20.1° annually. Readings vary from 15 17' E in the SE corner to 59 25' E in the NW corner