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GEOLOGICAL SURVEY OF CANADA   COMMISSION GÉOLOGIQUE DU CANADA

DESCRIPTIVE NOTES

INTRODUCTION

This open file, based on mapping in 1994, is the final map of a series of three open file preliminary maps which depict the geology and mineral occurrences of the High Lake greenstone belt. Open File 2782 (Henderson et al., 1994) covers the north-central part of the belt (76 M/7 and part of M/6), and Open File 2547 (Henderson et al., 1993) covers the central part (76 L/15 and 16, 76 M/2 and part of M/3). A brief synthesis of the geology, geochronology, and mineral occurrences of the greenstone belt is presented by Henderson et al. (1995).

PREVIOUS GEOLOGICAL MAPPING

The entire High Lake greenstone belt was outlined by Fraser (1964) during reconnaissance mapping of the northeastern District of Mackenzie. The northern part of the belt (76 M/10 and part of 15) was mapped previously by Easton et al. (1982), who recognized most of the bedrock units shown on the present map. This map, Open File 2970, adjoins Open File 2782 (76 M/7 and M/6E; Henderson et al., 1993) and Open File 208 (76 M/7; Padgham et al., 1973) to the south, Open File 2965 (76 M/11 and parts of 5, 6, 10, 12, 14, and 15; Relf, 1994) to the west, and EGS 1986-6 (76 M/1, 2, 8, 9, 15, 16; Jackson et al., 1986) to the east. A compilation of the geology and mineral occurrences of the Hepburn Island map sheet (76 M) by Jackson (1989) summarizes earlier work in the area.

DESCRIPTION OF MAP UNITS

No stratigraphic succession is implied by the order of Archean supracrustal units in the legend. The following descriptions are the field characteristics of the mapped formations.

Metamorphosed volcanic, subvolcanic, and volcaniclastic rocks

Mafic rocks

Rocks of mafic composition are recognized as dark-green weathering, foliated to massive, fine to medium grained flows, sills, dykes and breccias. Mafic flows commonly are pillowed, and rarely are amygdaloidal. Mafic volcanic breccias are uncommon. Flow boundaries are poorly-defined, and thicknesses are unknown. Mafic rocks commonly are foliated and recrystallized to actinolite-plagioclase-chlorite schist.

Intermediate rocks

Rocks of intermediate composition are distinguishable as medium-green weathering, foliated to massive, fine to medium grained, massive flows and breccias. White weathering feldspar phenocrysts are common, and quartz phenocrysts are absent in intermediate flows. Intermediate volcaniclastic rocks are common, and clast sizes range from lapilli to breccia, with long dimensions up to ten cm. Carbonate and/or sericite alteration is common in intermediate volcaniclastic rocks. Intermediate breccias generally exhibit pale weathering, aligned elliptical clasts in a darker weathering, well foliated, matrix. Bedding was not observed in intermediate volcaniclastic rocks in the map area.

Felsic rocks

Rocks of felsic composition are distinguished by glassy quartz phenocrysts, with or without white weathering feldspars, in a light-grey weathering, aphanitic matrix. Felsic flows are hard and resistant to alteration. Felsic breccias are less abundant than intermediate breccias, and are recognized by the presence of quartz eyes in clasts. Carbonate-cemented, felsic-intermediate flow-top breccias are common, and in places pass laterally and upwards into marble beds.

Aphanitic felsic, intermediate, and mafic volcanic rocks are distinguished with difficulty mainly on the basis of colour of fresh surfaces.

Metasedimentary rocks

Chemical sedimentary rocks (marble and banded iron-formation)

Marble and banded iron-formation occur west of Arctic Lake along the eastern margin of the Anialik River Volcanic Belt (see also Relf, 1994). Marble occurs also in the High Lake Greenstone Belt between Franklin's Lake and the Kennarctic River, where it is spatially associated with a transition from volcanic rocks to the west and mainly sedimentary rocks to the east. Marble is mainly calcite with some tan weathering iron carbonate. Bedding is poorly preserved, and commonly is folded intrafolially. Banded iron-formation shows thin rusty weathering iron oxide beds and sugary-textured metachert beds.

Slate and siltstone

Black, graphitic slate and grey siltstone beds occur in a narrow belt in the area between Franklin's Lake and the Kennarctic River, and separate volcanic rocks to the west from thick bedded psammitic metagreywacke to the east. The slate-siltstone unit is thin bedded, and consists of about equal proportions of the two lithologies. Grading and channeling are common, and ball-and pillow structure is not uncommon.

Metagreywacke

Metagreywacke is thick bedded, grey weathering, and normally graded from psammite to pelite. In general, the metagreywacke unit youngs to the west, but younging reversals are common, and not generally attributable to systematic folding. These reversals could be synsedimentary slump structures. Contacts between slate-siltstone and greywacke are gradational across and along strike. Metagreywacke overlies felsic volcanic rocks to the south, and is truncated by granodiorite east of the Kennarctic River.

Plutonic rock units

Gabbro

Gabbro is coarse grained, massive, dark green weathering, and forms small ellipsoidal plutons.

Diorite

Diorite is massive, dark weathering, medium to coarse grained, and weakly foliated. Hornblende is the most abundant accessory mineral, and biotite generally is present. Diorite commonly contains abundant inclusions of finer-grained, probably volcanic rocks.

Granodiorite

Massive, weakly foliated, red to grey weathering, coarse grained granodiorite is the most common plutonic rock in the map area. Biotite and/or hornblende are principal accessory minerals. Muscovite is absent, except as sericitic alteration of plagioclase. A preliminary age (U-Pb zircon) of 2605+5/-3 Ma (Villeneuve and van Breemen, 1994, p. 45) was obtained from granodiorite collected northeast of Franklin's Lake.

Granite

Granite occurs as a north-trending elliptical pluton located east of Franklin's and Arctic lakes. It is massive, light grey and pink weathering, coarse grained and unfoliated. Muscovite and biotite are ubiquitous accessory minerals, and muscovite commonly forms radiating glomerophenocrysts several cm in diameter. A preliminary age (U-Pb zircon) of 2580+/-8 Ma (Villeneuve and van Breemen, 1994, p. 45) was obtained from granite collected northeast of Franklin's Lake.

Diabase

Sills and dykes of form suites of different orientation and age in the region. Northwesterly-striking dykes up to 20 m wide probably belong to the Mackenzie swarm dated elsewhere at 1.27 Ga (LeCheminant and Heaman, 1989). Widespread remnants of diabase sheets are probably correlative with the Coronation sills emplaced during the 723-718 Ma Franklin igneous event (Heaman et al., 1992).

DEFORMATION AND METAMORPHISM

Metasedimentary rocks in the High Lake belt show evidence of multiple folding and cleavage. The main folds in bedding trend north-northeast, and plunge very steeply. These folds overprint an older fold set, rarely observed, with subhorizontal hinges. The main cleavage, which in many places is the first cleavage, transects the limbs of the sub vertical folds in a clockwise sense (i.e. the cleavage strikes east of north-northeast-striking fold axial surfaces). In slates, the main cleavage is a slaty cleavage with quartz-rich microlithons and chlorite-muscovite-rich cleavage domains that commonly are cut by one or two steeply-dipping crenulation cleavages. The youngest folds are found in the northernmost outcrops of cordierite-andalusite grade metagreywacke, and are mesoscopic northeast-striking and steeply plunging structures.

In summary, the regional structural history involves two periods of folding (F_1 and F_2), and a northeast-striking regional cleavage (S_3). Several younger steeply dipping crenulation cleavages (S_4, etc.) and mesoscale folds are locally significant in the metasedimentary rocks along the Kennarctic River. The S_3 fabric is the regional cleavage in the metavolcanic rocks, as well as in the surrounding granodiorite plutons. Therefore the S_3 cleavage is younger than the 2605+5/-3 Ma age of the granodiorite.

In the northern part of the belt of metasedimentary rocks along the Kennarctic River, biotite, cordierite and andalusite porphyroblasts appear to have formed contemporaneously with the S_3 cleavage. The cordierite isograd shown south of Grumpy Lake is incompletley defined, pending petrographic studies.

ECONOMIC GEOLOGY

Numerous gossans and two mineral occurrences (#1 and #2 in 76 M/10) are recorded on the map. The Grumpy gold occurrence (Fraser, 1986) is associated with a gold-bearing quartz vein that cuts granitoid rocks just south of Grumpy Lake. The Cygnet gold occurrence (Ellis and Strand, 1994) is associated with quartz veins that cut metasedimentary rocks about three km west of the Grumpy occurrence. Arsenopyrite is a significant component of both occurrences, as it is in many other gold occurrences in the Central Domain of the High Lake greenstone belt (Henderson et al., 1995). The Central Domain is characterized by an abundance of metasedimentary rocks and the presence of young (circa 2.6 Ga) felsic volcanic rocks dated to the south of 76 M/10 (e.g. Ares Dacite: Henderson et al., 1995).

ACKNOWLEDGMENTS

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REFERENCES

Easton, R.M., Ellis, C.E., Dean, M., and Bailey, G., Bruneau, H.C., and Walroth, J.
1982: Geology of the Typhoon Point map area, High Lake greenstone belt (76 M/10 and 76 M/15 south-half); INAC, NAP, Geology Division Yellowknife EGS 1982-6, scale 1: 31 680.

Ellis, C., and Strand, P.
1994: Slave structural province: base metals and gold; in Kusick, R. and Goff, S.P. compilers, Exploration Overview 1994, Northwest Territories, Mining, Exploration and Geological Investigations, NWT Geological Mapping Division, Department of Indian Affairs and Northern Development, Yellowknife, November 1994, p. 10

Fraser, J.A.
1964: Geology notes on the northeastern District of Mackenzie, NWT; Geological Survey of Canada Paper 63-40, 20 p. (with map 45-1963, scale 1: 506 880).

Fraser, S. and Muller, F.,
1986: Geology of the Grumpy claim group, Hepburn Island area, Mackenzie District, NWT; Department of Indian Affairs and Northern Development, NWT Geology Division, Yellowknife, NWT, Assessment Report 081982, 16 p.

Heaman, L.M., LeCheminant, A.N., and Rainbird, R.H.
1992: Nature and timing of Franklin igneous events, Canada: Implications for a Late Proterozoic mantle plume and the break-up of Laurentia; Earth and Planetary Science Letters, v. 109, p. 117-131.

Henderson, J.R., Henderson, M.N., and Kerswill, J.A.
1994: Preliminary geological map of north-central High Lake greenstone belt, NWT, NTS 76 M/6 East, 76 M/7; Geological Survey of Canada Open file 2782, scale 1: 50 000.

Henderson, J.R., Arias, Z., Henderson, M.N., Lemkow, D., Wright, T.O., Rice, R. and Kerswill, J.A.
1993: Preliminary geological map of central High Lake greenstone belt; Geological Survey of Canada Open file 2547, scale 1: 50 000.

Henderson, J.R., Kerswill, J.A., Henderson, M.N., Villeneuve, M., Petch, C.A., Dehls, J.F. and O'Keefe, M.D.,
1995: Geology and mineral occurrences of the High Lake greenstone belt, Archean Structural Province, Northwest Territories; in Geological Survey of Canada, Current Research 1995-C, p. 97-106

Jackson, V.A., Bell, R., Bishop, S., Daniels, A., Howson, S., Kerr, D.E., and Treganza, M.
1986: Preliminary geology of the eastern Hepburn Island area, NTS 76 M/1, 2, 8, 9, 15, 16; Indian and Northern Affairs Canada, Geology Division, Yellowknife, EGS 1986-6, scale 1: 50 000.

Jackson, V.A.
1989: Preliminary geological compilation of Hepburn Island map area (76 M); Indian and Northern Affairs Canada, Geology Division, Yellowknife, EGS 1989-11, 1:125 000 scale map with marginal text and figures.

LeCheminant, A.N., and Heaman, L.M.
1989: Mackenzie igneous events, Canada: Middle Proterozoic hotspot magmatism associated with ocean opening: Earth and Planetary Science Letters, v. 96, p. 38-48.

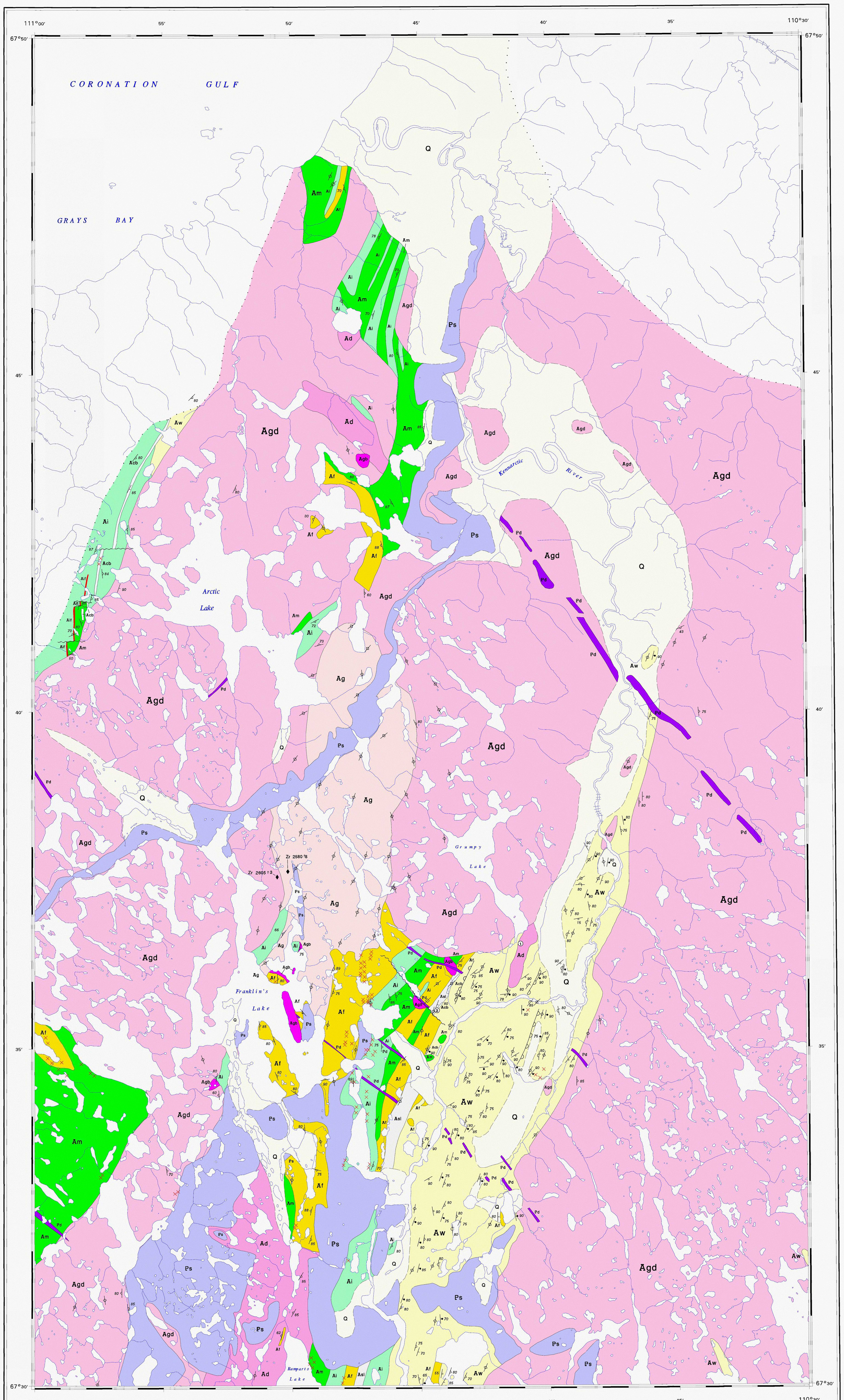
Padgham, W.A., Jefferson, C.W., Hughes, D.R. and Shegelski, R.J.
1973: Geology of the High Lake area NWT (76 M/7); Geological Survey of Canada, Open File 208, scale 1: 50 000.

Relf, C.
1994: Northern Anialik River Volcanic Belt and the Northeastern Kangguyak Gneiss Belt, Northwest Territories; Geological Survey of Canada, Open File 2965, scale 1:50 000

Villeneuve, M.E. and van Breemen, O.
1994: A compilation of U-Pb age data from the Slave Province; Geological Survey of Canada Open File 2972, 53 p.

MINERAL OCCURRENCE TABLE (OPEN FILE 2970)

NTS	ID	NAME	PRINCIPAL COMMODITIES	TYPE	STATUS	HOST ROCK (MAP UNIT)	REFERENCE
76 M/10	1	Grumpy	Au-As	Gold	Trenched	Granitoid	AR 081982
76 M/10	2	Cygnet	Au-As	Gold	Trenched	Wacke, SS	Ellis and Strand (1994)



LEGEND

QUATERNARY

Q — Unconsolidated sediments

PROTEROZOIC

Pd / Ps — Diabase dykes and sills

ARCHEAN

Ag — Muscovite-biotite granite

Agd — Hornblende/biotite granodiorite

Ad — Diorite

Agb — Gabbro

Asl — Shale, siltstone

Acb — Marble

Aif — Iron formation

Aw — Metagreywacke

Af — Felsic metavolcanic rocks

Ai — Intermediate metavolcanic rocks

Am — Mafic metavolcanic rocks

Geological boundary (defined, approximate)

Limit of geological mapping

Bedding, facing known (inclined, overturned) — 70, 65

Bedding, facing unknown (inclined) — 80

Main cleavage or foliation (S_3) (inclined, vertical) — 70

Secondary cleavage or foliation (S_4) (inclined) — 86

Igneous layering (inclined, vertical) — 70

Fault (approximate)

U-Pb zircon age (Ma)

Mineral occurrence — 1

Cordierite isograd (ornament on cordierite side)

Gossan

Geology by J.R. Henderson, M.N. Henderson, J.A. Kerswill, J.F. Dehls, and M.D. O'Keefe, 1994

Digital map compilation by M.N. Henderson, Geological Survey of Canada

Electrostatic plot produced by the Geological Survey of Canada

Digital cartography by P. Corrigan, Geological Survey of Canada

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

Digital base map assembled and modified from topographical maps published by Geomatics 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 1995, 29°52' East, decreasing 25.3' annually. Readings vary from 29°21' E in the SE corner to 30°23' E in the NW corner of the map

Part of the Canada-NWT Minerals Initiative 1991-1996 and NATMAP Slave Province Project

Geographical names subject to revision

CANADA-NWT MINERAL INITIATIVES 1991-1996

Canada — CANADA-GNWT ECONOMIC DEVELOPMENT AGREEMENT

Copies of this map may be obtained from the Geological Survey of Canada 601 Booth Street, Ottawa, Ontario K1A 0E8

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OPEN FILE 2970

GEOLOGY

GEOLOGY AND MINERAL OCCURRENCES OF NORTHERN HIGH LAKE GREENSTONE BELT

DISTRICT OF MACKENZIE

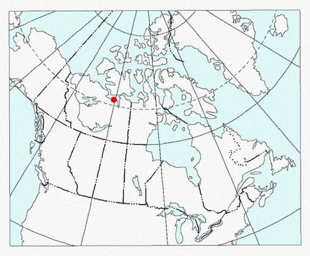
NORTHWEST TERRITORIES

Scale 1:50 000 - Échelle 1/50 000

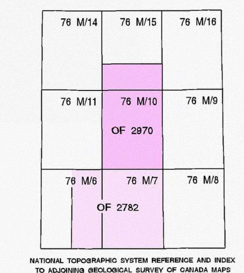
Kilometres 1 0 1 2 3 4 Kilomètres

Transverse Mercator Projection
CM 110°45', Scale Factor 1

Projection transverse de Mercator
M.C. 110°45', facteur d'échelle 1



LOCATION MAP



NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO ADJOINING GEOLOGICAL SURVEY OF CANADA MAPS

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