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GEOLOGICAL SURVEY OF CANADA / COMMISSION GÉOLOGIQUE DU CANADA

DESCRIPTIVE NOTES

This map shows the geology across part of the Komaktorvik shear zone along the eastern margin of the Torngat Orogen (Van Kranendonk et al., 1992). It adjoins Map 24P/10 to the west (Van Kranendonk and Wardle, 1994) and Map 24P/8 in the south (Van Kranendonk, 1994). The map area is well-exposed, except in the northwestern corner where the Eclipse River lies within a broad, sandy valley, and in the lowlands north of Eclipse Channel and between it and Ryans Bay, where broad, flat gravel plateaux form the remnants of raised beaches. The central north-south segment and the southeastern corner of the map area are dominated by the rugged Torngat Mountains, including The Horns and unnamed peaks between 3500-4200' in the central part, and the 4400' high Four Peaks region in the southeast. These mountains were created by the excavation of a broad peneplain by massive glaciers during the last ice age, the tiny remnants of which survive in northerly-facing cirques. Narrow arêtes, hanging valleys, moraines, and broad U-shaped valleys are other common glacial features in this area. Rock glaciers, which are flow-banded trains of metre-sized, angular boulders, are common features in hanging valleys. Map coverage of the mountainous terrain was accomplished through helicopter-supported ground traverses from a basecamp located in the west-central part of the map area (see map), into which we were flown by a Twin Otter airplane, from Kuujjuaq, Québec, equipped with tundra tires. Coastal outcrops in Eclipse Channel were visited by an inflatable boat with a 40 hpr outboard engine.

The map area was previously included within a 1:250,000 scale reconnaissance mapping project of northeastern Quebec and northern Labrador (Taylor, 1979), but has not been previously studied in any detail.

Lithology

The map area is underlain in part by rocks derived from Archean protoliths of the Nain Province, including predominantly migmatitic tonalitic orthogneisses [**Agl, Agn, Argn**] that contain inclusions and rafts of garnet- biotite+/-sillimanite paragneiss [**Ams**], variably retrogressed mafic granulite gneiss [**Amf**], white/grey to purple-weathering meta-anorthositic rocks [**Aan**], and metamorphosed ultramafic rocks [**Aum**]. Archean gneisses of the Nain Province are cut by Paleoproterozoic diabasic Avayalik dykes [**Pdb**] (Wardle et al., 1992). Together, these rocks are metamorphosed to the granulite facies in the southeastern part of the map area (Archean and superimposed Paleoproterozoic granulite facies; see below), and variably recrystallized to lower amphibolite-facies conditions throughout the rest of the map area during the Paleoproterozoic. A sample of amphibolite- facies, foliated hornblende tonalite from west of Ryans Bay was dated by U-Pb on zircon as 2802 ± 2 Ma, which is interpreted as a minimum age for this rock (Scott and Machado, 1994).

The Hutton anorthositic suite [**APan, APanl**], of Late Archean or earliest Proterozoic age, has a range in composition from anorthosite to anorthositic gabbro, and includes rare ultramafic pods, patches of solid magnetite (≤30cm x 1 m), and rusty sulphide-rich horizons. Textures vary from pristine, coarse-grained anorthosite with subophitic textures of blue igneous plagioclase feldspar (Labradorite) and recrystallized mafic clots (now composed of hornblende-biotite-epidote) [**APan**], to medium-grained, granoblastic gneisses [**APanl**]. Contact relationships between anorthositic rocks and Archean gneisses are sharp and commonly tectonized, so that a relative age relationship between these units is unknown. Rocks of the Hutton anorthositic suite are cut by the Avayalik dykes [**Pdb**].

In tectonic contact with Archean gneisses are a heterogeneous package of mafic gneisses [**Psmg**]. These rocks are characterized by units with a centimetre- to decimetre- scale layering defined by modal variations between hornblende, epidote, plagioclase, titanite, ilmenite, and quartz. In addition to the well-layered gneisses are layers of homogeneous amphibolite, plagioglase-phyric gabbro, rare horizons of thin quartz-feldspar porphyry, rusty paragneiss, one unit interpreted to be a fragmental andesite, and one outcrop with possible relict pillow structures (Van Kranendonk et al., 1994). These rocks are interpreted to be derived from predominantly mafic volcanic and/or volcaniclastic protoliths and to be Paleoproterozoic in age, because they do not contain Avayalik dykes and are in tectonic contact with Archean Nain Province gneisses. A minimum age is suggested by the oldest intrusive metaplutonic rock, dated to the north of the map area as 1910 ± 2 Ma (Scott et al., 1993).

Nain Province rocks, the Hutton anorthositic suite, and the layered mafic gneisses are all cut by a suite of Paleoproterozoic metaplutonic rocks (the DTG suite), which has a range in composition from diorite and gabbro [**Pid**], through tonalite and granodiorite [**PiDTG**], to youngest monzodiorite [**Pimd**] and granite [**Pigr**] (Van Kranendonk and Scott, 1992; Van Kranendonk et al., 1993, 1994). Tonalitic compositions are by far the most voluminous and display a range in texture from homogeneous, medium-grained rocks, to those with a gneissic character that is commonly seen to be obtained through partial assimilation of their host Archean gneisses. These rocks do not contain Avayalik dykes, and have been dated outside of the map area by U-Pb on zircon, as between 1910-1885 Ma (Scott et al., 1993; Scott and Machado, 1992, 1994). Coarse-grained K-feldspar megacrystic granite [**Pigt**], characterized by a porphyroclastic texture (≤40% K-feldspar megacrysts, up to 5 cm in long dimension) and a strongly- developed schistosity defined by aligned micas, cuts Archean gneisses in the map area, and rocks of the Hutton anorthositic suite immediately to the south (Van Kranendonk, 1994). This granite may represent a separate unit from the DTG suite, as indicated by cross-cutting relationships, the absence of complex structural fabric elements, and the age of a similar rock from Killinek Island that has been dated as 1864 ± 2 Ma (Scott and Machado, 1992).

Cutting across all previous rock units within the Komaktorvik shear zone are a set of fine- to medium-grained, equigranular, olive green-weathering (hornblende-plagioclase+/-garnet) mafic dykes [**Pdg**] . These N-S striking dykes have highly irregular intrusion forms and are weakly deformed relative to strongly sheared country rocks; features which suggest a syn-tectonic emplacement during Komaktorvik shear deformation (Van Kranendonk et al., 1994).

Metamorphic rocks of the map area are cut by fresh, brown-weathering diabase dykes which strike generally east- west. A K-Ar age of 524 ± 78 Ma has been obtained from one such dyke located north of the map area (Taylor, 1979: Map 24P/15).

Structural geology

The map area is dominated by Archean structures in Archean granulite-facies gneisses in the southeast, and by structures related to the formation of the north-south striking Komaktorvik shear zone located within the central part of the map area (Van Kranendonk et al., 1992).

Archean Nain gneisses contain evidence of a polycyclic tectonic history which may span from ≥3.6-2.56 Ga (cf. Bridgwater and Schiøtte, 1991; Bridgwater and Wardle, 1992). Migmatitic, heterogeneous orthogneisses contain an early set of intrafolial isoclinal folds that affect a first generation of leucosome veins. These rocks and their complex structures are cut by homogeneous, leucocratic tonalite sheets, which are themselves folded and foliated by a later generation of strucutres (D_n). The second foliation is axial planar to a set of upright, close to tight folds, whose moderately south-plunging axes (F_n) are parallel to granulite-facies mineral lineations (L_n) defined by orthopyroxene, hornblende and quartz. The second set of structures is believed to be Late Archean in age (ca. 2770 Ma: Scott and Machado, 1994). A set of narrow, retrograde shear zones in the granulite-facies gneisses (not shown on map), may have formed at ca. 2650 Ma, the age of monazite in amphibolite-facies granitic rocks from north of the map area (Scott and Machado, 1994).

Archean structures are cut by Avayalik dykes and subsequently affected by multiple sets of Paleoproterozoic structures, only some of which are present in the map area. An early set of Paleoproterozoic structures (D_{n+1}) can be recognized in some outcrops, for example on the western shore of Ryans Bay and the southern shore of Eclipse Channel, where heterogeneous, layered and strongly foliated rocks of the DTG suite are interpreted as containing a strong S_{n+1} fabric. These rocks are cut by N-S striking tonalite dykes which contain a biotite foliation, which is interpreted to be S_{n+3}. A possible age constraint for the D_{n+1} deformation is provided by the oldest metamorphic U-Pb date of 1870 ± 3 Ma (Scott and Machado, 1994), obtained from monazite from a sample of Tasiuyak gneiss located in map sheet 24P/7 (Van Kranendonk, 1993). No linear fabric elements associated with D_{n+1} have been recognized.

D_{n+2} structures of the Abloviak shear zone are generally not recognized in the map area. However, a set of NNE and SSW-plunging, tight folds of gneissosity in retrogressed Archean gneisses in the southwestern corner of the map area, that have different orientations from the regionally-developed set of SW-plunging D_{n+3} folds (see below), may represent F_{n+2} folds.

Third generation structures (D_{n+3}) are the most prominent across the central and western parts of the map area, and vary in orientation and intensity across the 12 km wide, N-S striking Komaktorvik shear zone (**KSZ**). In the east, S_{n+3} foliations in retrogressed Archean gneisses and rocks of the **DTG** suite are steeply east-dipping and contain a weak NE-plunging lineation defined by hornblende and quartz. Adjacent to the eastern margin of the **KSZ**, megacrystic granites contain a protomylonitic to mylonitic schistosity in which are found downdip elongation lineations defined by biotite, quartz and stretched quartzo-feldspathic aggregates, and kinematic indicators of east-side-up and sinistral horizontal displacement. These give way to the fabric elements of the **KSZ**, which include N-S striking, steeply west-dipping protomylonitic to mylonitic schistosities with abundant kinematic indicators of oblique, sinistral, east-side-up shear, and SSW-plunging linear fabric elements including tight folds (F_{n+3}) and mineral elongation lineations (L_{n+3}) defined by hornblende and quartz. The margins of the high strain zone are saw-toothed in the plane of the map, with narrow zones of high strain splaying off from the main N-S shear zone, particularly along its western margin and in the northeastern part of the map area. Folds have an S-asymmetry across the eastern half of the **KSZ**, but give way to symmetrical and z-asymmetrical folds across the western part of the zone, where the trend of axes varies from SW to N. West of the **KSZ**, D_{n+3} fabric elements swing to the SW, where tightly folded rocks contain moderate to shallow NE-dipping foliations and moderately SW-plunging linear fabric elements. Rare kinematic indicators in these lower amphibolite-facies, annealed rocks, suggest a west-side-up, dextral sense of displacement.

The east-west changes in orientations of planar and linear D_{n+3} fabric elements across the **KSZ** (change from steeply east-dipping to moderately west-dipping foliations, the change in strike of the foliations, and the opposing senses of displacement) are interpreted to reflect their formation within the hinge zone of a crustal-scale disharmonic fold profile which developed off of the bend in the Abloviak shear zone during late, cross-orogen shortening and flexure (Van Kranendonk et al., 1993). The western limb of this s-asymmetric fold is located to the west of the present map area and does not contain penetrative D_{n+3} fabric elements. The eastern limb of the fold, however, is represented by the **KSZ** [...]

Metamorphism

[...]

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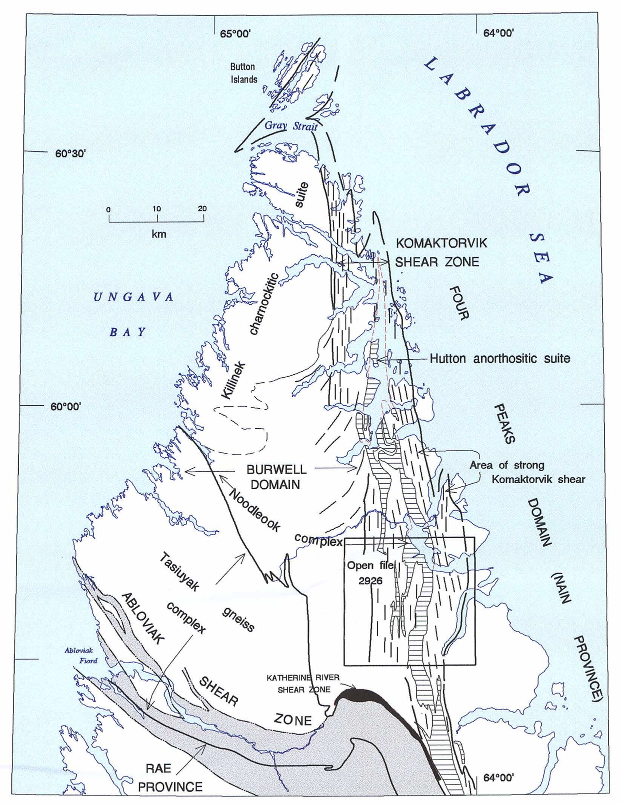


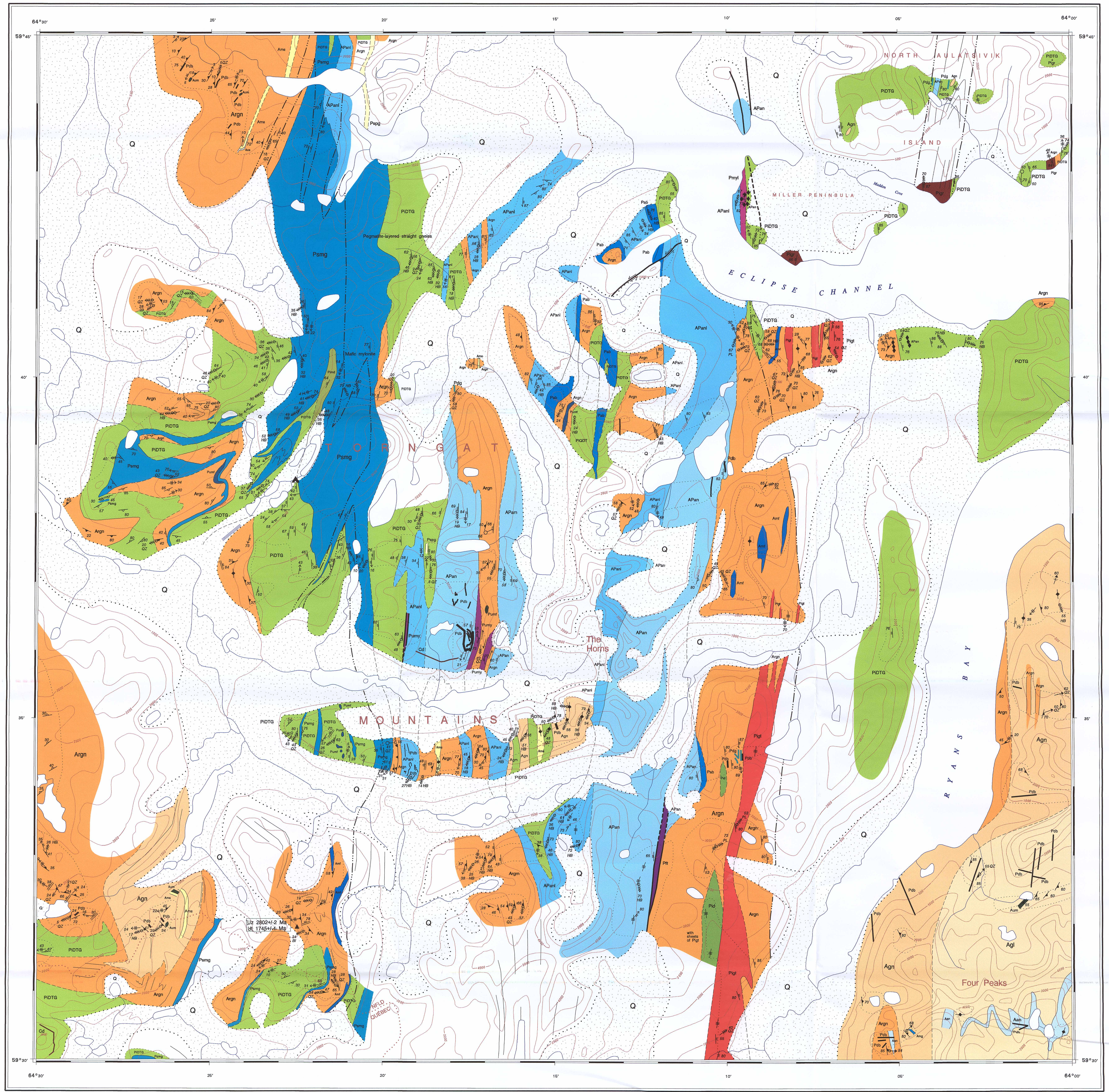
Structural (UPPER CASE) and lithological (lower case) subdivisions of the northern part of the Paleoproterozoic Torngat Orogen, Labrador, Québec and Northwest Territories (after Van Kranendonk et al., 1992). Location of map area outlined by square box.

COOPERATION AGREEMENT MINERAL DEVELOPMENT / ENTENTE DE COOPÉRATION SUR L'EXPLOITATION MINÉRALE

Contribution to Canada-Newfoundland Cooperation Agreement on Mineral Development (1990-1994), a subsidiary agreement under the Economic and Regional Development Agreement.

Contribution à l'Entente de coopération Canada-Terre-Neuve sur l'exploitation minérale (1990-1994), entente auxiliaire négociée en vertu de l'Entente Canada/Terre-Neuve de développement économique et régional.

Canada — Newfoundland / Terre-Neuve



LEGEND

Q — Unconsolidated Quaternary deposits and felsenmeer

Cd — Brown-weathering, undeformed diabase/microgabbro dykes with delicate ophitic texture; locally with plagioclase agglomerate texture. K-Ar=524+/-78 on an east-west striking dyke in map area 24P/15 (Taylor,1979); others may be Neoproterozoic

PALEOPROTEROZOIC ROCKS

Pft — Fault breccia and cataclasite laced with pseudotachylite veins.

Pumy — Amphibolite- to greenschist-facies mylonite and ultramylonite.

Pmyl — Amphibolite-facies ductile shear zone and/or mylonite.

META-IGNEOUS ROCKS

Mafic dykes

Pdg — Pale green weathering, garnet-hornblende-plagioclase dykes, with equigranular to poorly developed diabasic textures. Cuts Paleoproterozoic plutonic rocks and Archean gneisses: probably emplaced during Komaktrovik shear deformation

Pdb — Avayalik meta-diabase dykes, locally with plagioclase-phenocrystic texture. Dykes vary from brown-weathering garnet-clinopyroxene-hornblende-plagioclase quartz granulites with characteristic black feldspar megacrysts where found in unit Agl, to hornblende-plagioclase ± garnet ± epidote amphibolites within and to the west of the Komaktorvik shear zone.

Pigt — K-feldspar megacrystic granite, with augen to mylonitic texture. Intrudes rocks of the Hutton anorthositic suite. Sample from McLelan Straight dated as 1864 ± 2 Ma (Scott et al., 1993)

Pigr — Grey- to pink-weathering, medium- to coarse-grained foliated granite to quartz monzodiorite, locally porphyritic granite to granodiorite: Henry granite.

PiDTG — Polyphase intrusive suite, varying from mafic diorite, through tonalite and granodiorite, to granite and quartz monzodiorite; at amphibolite facies. Dominantly (>80%) homogeneous, leucocratic tonalite to quartz diorite (hornblende-biotite ± epidote), with inclusions of plagioclase-phyric diorite and metagabbro, and layered mafic gneiss (Psmg); cut by porphyritic gabbro sheets and numerous phases of leucocratic veins and pegmatitic granite. Textures vary from weakly-foliated meta-plutonic rocks to migmatitic orthogneisses that locally show complex isoclinal folding

Pimd — Migmatitic, pink and grey monzodiorite gneiss: part of the PiDTG suite.

Pid — Homogeneous, hornblende-biotite diorite, locally with 20% granite veins: colour index = 40-60%. Dated at Eclipse Channel by U-Pb on zircon, as 1891 ± 2 (Scott et al., 1993)

SUPRACRUSTAL ROCKS

Pspg — Grey- to buff-weathering paragneiss with red garnet and biotite, abundant leucosome and complex migmatitic character

Psmg — Centimetre-layered mafic gneiss, interlayered with plagioclase-phyric and more homogeneous amphibolites; intruded by Paleoproterozoic PiDTG suite

Pab — Homogeneous, equigranular mafic amphibolite to granulite; layering generally not present.

Pumf — Massive to foliated, homogeneous, to layered pyroxenite (clinopyroxene-hornblende ± anthopyllite).

ARCHEAN AND/ OR PROTEROZOIC ROCKS

HUTTON ANORTHOSITIC COMPLEX

APan — White meta-anorthosite, gabbroic anorthosite and leucogabbro; commonly with relic igneous textures and compositional layering, and locally with igneous mineralogy (blue plagioclase and coarse-grained orthopyroxene). Gabbroic anorthosite is dominant, but unit is compositionally heterogeneous.

APanl — Granoblastic, recrystallized anorthositic gneiss, derived from APan, at amphibolite facies. Contains variable amounts of leucocratic veins and is characterized by disrupted mafic layers and cm-dm scale layering. Locally recrystallized to a granoblastic garnet-hornblende gneiss

ARCHEAN ROCKS

Nain Province

Agl — Unsubdivided tonalite-granodiorite orthogneiss and migmatite, with highly variable composition and texture: typically complex, very well-layered and heterogeous migmatites with <50% of mafic gneiss (Amf), anorthositic gneiss (Aan) and metasedimentary gneiss (Ams). Metamorphosed under Late Archean granulite-facies, cut by Avayalik dykes (Pdb), and metamorphosed under Paleoproterozoic granulite-facies (garnet-clinopyroxene) conditions

Agn — As Agl above, but with Paleoproterozoic amphibolite-facies overprint on Archean granulite-facies mineral assemblages

Argn — As Agl above, but fully retrogressed to Paleoproterozoic amphibolite-facies mineral assemblages

Acs — Impure marble (olivine-diopside-phlogopite-calcite) and calc-silicate rocks

Ams — Metasedimentary gneisses: predominantly rusty brown weathering garnet-biotite ± sillimanite paragneiss and metapelite, but also with rare, thin layers of garnetiferous silicate iron formation, impure marble, and quartzo-feldspathic gneiss of unknown derivation

Aan — Purple to grey, garnetiferous (<40%), granoblastic meta-anorthosite, layered anorthositic gabbro and metagabbro: as sheets or disrupted trains of tectonic inclusions. Other than local, compositional layering, igneous textures and mineralogy are not preseved in these thoroughly recrystallized, granulite-facies rocks, which were intruded by the surrounding Archean tonalite gneiss Agl and that experienced Late Archean deformation

Amf — Equigranular, homogeneous to layered mafic gneiss locally with plagioclase megacrysts

Amg — Layered mafic granulite gneiss, derived from layered gabbroic complex

Aum — Ultramafic rocks; tan coloured meta-dunite or dark brown pyroxenite

Lithological contact (defined, inferred)
Trace of gneissosity from airphoto interpretation
Fault (defined with shear sense where known, inferred)
Limit of visited outcrop
Limit of unconsolidated sedimentary cover + felsenmeer
Eastern and western limits of high strain Paleoproterozoic deformation in the Komaktorvik shear zone (D_{n+3})
(D_{n+3}) reverse fault; teeth on hanging wall.
Location and U-Pb age of geochronology sample: (Uz=zircon;Ut=titanite) — Uz 2802+/-2 Ma
Dyke inclined (Pdb)
Inclusion of meta-anorthosite to -gabbro (APan)
Basecamp
Airstrip

Paleoproterozoic fabric elements

D_{n+4} fabric elements: Ultramylonites and faults
Brittle fault and ultramylonite, with movement unknown: inclined.
Inclined brittle fault or ultramylonite: reverse
Lineations on brittle faults and ultramylonites: mineral elongation

D_{n+3} fabric elements: amphibolite facies
Inclined schistosity: no movement sense, sinistral.
Vertical schistosity: no movement sense.
Fold axial plane: inclined, vertical
Fold axis: symmetrical, s-asymmetric, z-asymmetric
Lineation: mineral elongation, striping

D_{n+2} fabric elements: granulite facies
Fold axis: symmetrical.
Lineation: striping

D_{n+1} fabric elements
Schistosity or gneissosity: inclined, vertical

Archean fabric elements (Dn)
Gneissosity: inclined, vertical
Fold axis: symmetrical.
Lineation: mineral elongation,striping.

Abbreviations: BI=biotite, HB=hornblende, PL=plagioclase, QZ=quartz

Geology by M.J. Van Kranendonk, R.J. Wardle, F.C. Mengel, L.M. Campbell, R. Churchill, S. Schwartz, L. Godin, and L. Reid, 1991-1993, Geological Survey of Canada

Digital map compilation by M.J. Van Kranendonk, Geological Survey of Canada

Digital cartography by S.J. Frohberg, Geological Survey of Canada

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

Digital base map assembled and modified by the Geological Survey of Canada from digital bases compiled by the Surveys, Mapping and Remote Sensing Branch

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

Magnetic declination 1994, 33°19' W, decreasing 12.9' annually

Elevations in feet above mean sea level

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OTTAWA
11/1994

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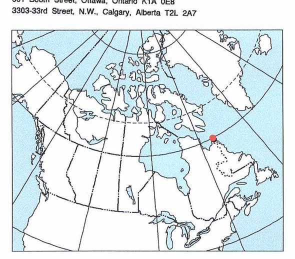
GEOLOGY

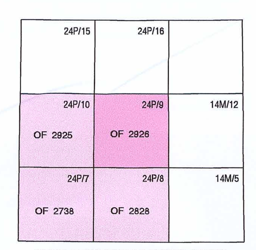
RYANS BAY

NEWFOUNDLAND (LABRADOR) - QUÉBEC

Scale 1:50 000 - Échelle 1/50 000



LOCATION MAP - LOCALISATION DE LA CARTE



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