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L E G E N D

CHURCHILL AND NAIN PROVINCES

QUATERNARY

Q — *Unconsolidated deposits: mainly drift-covered areas comprising gravel and sand; felsenmeer*

NEOHELIKIAN

NN° — *Nutak dykes: olivine diabase and gabbroic dykes dated by U-Pb baddeleyite at ca. 1268 Ma. The superscript in the symbol* **NN°** *indicates the width of the dyke in metres*

NU — *Umiakovik quartz monzonite: massive, medium- to coarse-grained, pyroxene-fayalite quartz monzonite intruded by minor hornblende-biotite granite, part of the greater Umiakovik Lake Batholith dated by U-Pb zircon at 1319±2 Ma (fayalite quartz monzonite) and at 1316+2/-3 Ma (hornblende-biotite granite). The area of contact metamorphism and injection migmatite surrounding the body is indicated*

CHURCHILL PROVINCE

EARLY PROTEROZOIC

Pg — *Late granitic rocks: pink, massive to mylonitic masses and veins of granite and pegmatite forming migmatite with amphibolite facies gneisses of the western Falcoz zone*

Pgm — *Granitic rocks as in unit* **Pg**, *forming migmatite with granulite facies gneisses of the eastern Falcoz zone*

Pga — *Pink to red, weakly foliated or lineated, leucocratic to alaskitic veins and masses of granite at amphibolite facies in Lac Lomier complex. A number of late pegmatitic veins in Lac Lomier complex indicate U-Pb zircon magmatic ages in the range 1853±2 Ma to 1825±5 Ma*

Po — *Orthopyroxene orthogneiss: undivided homogeneous, brown, medium grained, granoblastic, orthopyroxene-bearing intrusive rocks; L>S fabric*; occurs as a common component, at outcrop scale, in the regional gneisses of unit* **Pq**. *Dated by U-Pb zircon at 1876.8±1.0 Ma (magmatic), and additional zircon growth at 1853.2±1.4 Ma and 1822.6±1.1 Ma*

Pog — *Mainly granitic compositions*

Pot — *Mainly tonalitic and minor dioritic compositions*

Tasiuyak gneiss (PTo-PT)

PT — *Undivided, white, fine- to coarse-grained (metacrystic aggregates), discontinuously layered, mylonitic, dilatexitic L-S tectonite*; contains quartz, Ca-oligoclase or perthite or both, garnet (10-25%), and about 10% collectively of biotite, sillimanite, graphhite, rutile, sulphide, and rarely cordierite; includes numerous layer-concordant and -discordant sheared, white, perthite- or microcline-bearing layers of garnetiferous pegmatite*

PTp — *Rusty metapelite; includes isolated units of feldspathic quartzite less than one metre wide*

PTg — *Perthite granite (anatectite), white, megacrystic, containing <10% biotite and recrystallized garnet, dated by U-Pb zircon at 1858±3 Ma and 1843.8±1.0 Ma reflecting times of melting and deformation; a concordant U-Pb monazite age is 1857.1±1.1 Ma*

PTmg — *Migmatite: dilatexitic paragneiss* (**PT**) *and perthite; granite* (**PTg**)

PTmo — *Migmatite: nebulous mixtures of brown orthopyroxene orthogneiss* (**Po**) *and dilatexitic paragneiss* (**PT**)

PTo — *Tasiuyak-like gneiss: rocks mineralogically similar to Tasiuyak paragneiss, intercalated with metasediments of unit* **PL**, *and containing orthopyroxene locally*

Rocks associated with Tasiuyak gneiss (PTm-PTgn)

PTgn — *Quartzofeldspathic and pelitic gneiss; rusty and flaggy weathering; spinel-rich and locally sapphirine bearing; orthopyroxene, feldspar, hornblende, biotite, cordierite, sillimanite, garnet*

PTum — *Undivided mafic and ultramafic gneiss; contains clinopyroxene, orthopyroxene, garnet, hornblende, olivine, and minor spinel and plagioclase*

PTu — *Ultramafic*

PTm — *Mafic*

Lac Lomier complex

Metasedimentary rocks

PL — *Undivided, granoblastic, garnetiferous quartzofeldspathic paragneiss (garnet, orthopyroxene); feldspathic quartzite; calcsilicate and impure marble (vesuvianite, diopside, forsterite, calcite, garnet); metapelite (garnet, sillimanite, cordierite, biotite); metasemipelite (garnet, orthopyroxene, biotite); locally includes rocks similar in mineralogy to Tasiuyak paragneiss*

- **PLp** — *Mainly metasemipelite and minor metapelite*
- **PLm** — *Mainly calcsilicate rocks and impure marble*
- **PLd** — *Diopside gneiss; quartz-rich*
- **PLi** — *Magnetite iron-formation; a singular occurrence in amphibolite and calcsilicate rocks; indicated as* **PLm,i**

Basic rocks and amphibolite (Pba-Pb)

Pb — *Undivided, foliated, basic rocks and layered amphibolite (hornblende, clinopyroxene, orthopyroxene, plagioclase)*

Pbb — *Basic rocks; medium to coarse grained, texturally variable, probably derived from gabbro and dioritic rocks; minor amphibolite, L>S fabric**

Pba — *Layered amphibolite; fine to medium grained (±garnet); generally associated with layers of rusty Fe-sulphide facies adjacent to metasediments of unit* **PL**; *probably derived from mafic volcanic rocks; S>L fabric**

Layered quartzofeldspathic gneiss, orthogneiss, and migmatite (Pqa-Pq)

Pq — *Undivided rocks of Lac Lomier complex at granulite and amphibolite facies containing abundant remnants of amphibolite and basic rocks* (**Pb**) *and metasediments* (**PL**); *includes orthopyroxene orthogneiss rocks* (**Po**), *and synkinematic amphibolite facies granitoids and pegmatite* (**Pg**)

Pqa — *Strip of quartzofeldspathic layered gneisses of unknown affinity in the Nain-Churchill boundary zone at Proterozoic amphibolite and granulite facies; Napaktok dykes* (**PN**), *characteristic of Nain Province, are absent from these gneisses suggesting affinity to the Churchill (Rae) Province. The eastern amphibolite facies portion of the strip locally contains gabbroic anorthosite (unit* **Abd**) *typical also to Nain Province*

NAIN PROVINCE

EARLY PROTEROZOIC

Late intrusive rocks (Pig-Pi)

Pi — *Granite; massive, pink-grey, medium to coarse grained; biotite, ± hornblende, microcline microperthite, zoned plagioclase, and strained quartz; accessories include zircon, allanite, apatite, magnetite, and fluorite; these rocks appear to be confined to the Labrador Sea shelf on Stirrup, White Bear, Saddle, and Opingivuksuak islands where U-Pb zircon ages of rocks from the latter three islands yielded 1776 +3/-2 Ma, 1774+2/-1 Ma, and 1774+2/-1 Ma, respectively*

Pia — *Alaskite; massive, brick-red weathering, masses (e.g. Coopers Island) and dykes that intrude the early Proterozoic Mugford Group* (**PM**) *and Napaktok dykes* (**PN**)

Pig — *Gabbro; a singular occurrence of massive, coarse grained, plagioclase porphyritic, hornblende leucogabbro, located on the western side of Opingivituk Island; intruded by cogenetic granite* (**Pi**)

Intrusive contact

MUGFORD GROUP (PMm-PMv)
Stratiform, weakly foliated rocks in prehnite-pumpellyite-quartz facies and chlorite-epidote-actinolite±quartz greenschist facies

PMv — *Upper volcanic unit; agglomerate, breccia, minor basaltic flows and sills*

PMa — *Middle sedimentary unit; argillite, calcareous argillite*

PMb — *Lower volcanic unit; massive and pillowed basalt, volcanic breccia, agglomerate, minor interbedded argillite and chert; numerous basalt sills near base*

PMs — *Lower sedimentary unit; black slate, argillite dolostone, mudstone breccia, chert; intruded by basaltic sills*

PMc — *Basal clastic unit; purple sandstone, flaggy sandstone, and minor conglomerate; the unit is rarely intruded by basaltic sills, and is confined to the northwestern part of the group*

Mugford dykes

PMx — *Breccia dykes; phreatomagmatic mixtures of gneissic wall rock and igneous, mafic fragments and vein masses*

PMm — *Basic dykes; basaltic and andesitic rocks intruding basal sediments of Mugford Group and Nain basement*

RAMAH GROUP

PR — *Undivided, metasedimentary schist remnants in the foreland zone of the Torngat Orogen probably derived from the Roxsell Harbour Formation (not in map area) of Ramah Group, including pelite, quartzite, greywacke, and minor amounts of calcsilicate, conglomerate and mafic sills; the intensity of deformation (mainly Abloviak shear) increases southward; metamorphic mineral assemblages include sillimanite-biotite-garnet (±muscovite), perthite-hornblende-garnet, and hornblende-garnet in addition to plagioclase and quartz*

Unconformity (mainly tectonic)

PN° — *Napaktok dykes: tholeiitic, clinopyroxene diabase and medium grained gabbroic rocks, locally plagioclase porphyritic; the dykes are progressively altered from prehnite-pumpellyite and lowermost greenschist facies in the east to amphibolite facies in the west (foreland zone) where hornblende-garnet develops in foliated amphibolite dykes. Most dykes have sheared margins and mylonitic wall rocks (the sense of shear is indicated in some). The Proterozoic hornblende isograd in Nain Province is based on the first appearance of hornblende, in the presence of biotite and quartz, in these dykes. The superscript in the symbol* **PN°** *indicates the width of the dyke in metres*

PW — *Wheeler Mountain granite: weakly foliated, coarse grained, pink to grey-pink hornblende-biotite granite; microcline microperthite, zoned plagioclase, highly strained to polygonal quartz, and chloritized biotite; accessory minerals include zircon, allanite, apatite, opaque oxide, and fluorite; intruded by Napaktok dykes* (**PN**). *Dated by U-Pb zircon at 2137±2 Ma and 2134+3/-1 Ma. The area of contact metamorphism and injection migmatite surrounding the body is indicated*

Intrusive contact

LATE ARCHEAN

The Archean rocks in Nain Province are overprinted by Proterozoic metamorphism that ranges from granulite facies in the Torngat Orogen, to upper amphibolite facies in the Nain foreland zone and to lowermost greenschist facies in eastern Nain Province. Minerals of rocks listed below reflect Archean assemblages; the main period of granulite facies metamorphism occurred at ca. 2.7 to 2.8 Ga. The age of the rocks and times of deformation range from ca. 3600 to 2560 Ma

Ag — *Granitic rocks; undivided granitic rocks*

Aog — *Okak Harbour granite; massive to weakly foliated grey, medium grained, biotite granite intruded as subhorizontal sheets 5 to 20 m thick. Dated by U-Pb zircon at ca. 2560 Ma*

Agb — *Areas of abundant, late, pink granitic veins and small irregular masses of pegmatitic biotite granite*

Au — *Ultramafic rocks: rusty brown weathered, coarse grained, variably serpentinized, massive to locally layered, pyroxene-olivine-bearing rocks intruded into units* (**Ap, Aa, Am**, *and* **Ab**)

Aus — *Mainly serpentinite*

Intrusive contact

EARLY AND MIDDLE ARCHEAN

Layered basic, mafic, and ultramafic rocks

Ab — *Undivided meta-anorthosite, metagabbroic anorthosite, metagabbro, metadioritic rocks, amphibolite, and ultramafic rocks in granulite facies overprinted by Proterozoic amphibolite facies in rocks of the tectonic foreland; probably derived from layered intrusions of more than one age. Three principal regional associations are recognized*

Okak Harbour type (Aba1-Aba)

Aba — *Anorthosite and gabbroic anorthosite; white, homogeneous and striped components; CI 5 to 20; hornblende-plagioclase±clinopyroxene; minor layers of gabbroic and ultramafic rocks*

Aba1 — *Amphibolite, minor gabbro, and ultramafic rocks*

Sarah Lake type (associated with metasediments) (Aban3-Aban)

Aban — *Anorthosite; CI<10, coarse grained, white to pale lilac to buff-coloured; garnet-plagioclase-clinopyroxene*

Aban1 — *Dioritic and minor gabbroic rocks (± orthopyroxene)*

Aban2 — *Gabbro; minor amphibolite and ultramafic rocks*

Aban3 — *Ultramafic rocks; layered to massive; hornblende, clinopyroxene, orthopyroxene, olivine, spinel*

Tectonic foreland type (west of Ramah Group)

Abd — *Anorthosite, gabbroic anorthosite, and diorite, associated with minor amphibolite and ultramafic rocks; texturally variable rocks occurring as tectonic remnants overprinted by Proterozoic upper amphibolite facies metamorphism*

Metadedimentary rocks

Am — *Undivided schistose and layered rocks injected by coarse grained, granitoid material; generally intercalated with layered amphibolite* (**Aag**)

Amp — *Metapelite, garnet-sillimanite-biotite-cordierite; metasemipelite, garnet-orthopyroxene-biotite; granoblastic, quartz-rich, quartzofeldspathic paragneiss*

Amq — *Quartzite; pale green weathering*

Ami — *Iron-formation; magnetite-orthopyroxene-quartz-green spinel ± grunerite; commonly interlayered with "quartzite" (chert); may occur in combination with units* **Amp,q,i**

Amc — *Impure marble and calcsilicate rocks; diopside-carbonate±forsterite. These suburnits may occur in combination as* **Amp,q,i,c**

Amm — *Migmatite; areas of metasediment and amphibolite containing abundant (up to 60%)*

Intrusive contact

Amphibolite and basic gneiss (Aau-Aa)

Aa — *Undivided rocks, commonly injected with up to 30% coarse grained granitic material; the rocks contain hornblende, plagioclase, clinopyroxene, and orthopyroxene*

Aab — *Basic rocks; homogeneous, medium to coarse grained, black to dark green, locally plagioclase-phyric rocks; probably derived from mainly gabbro and dioritic rocks; intrudes metasediments* (**Am**) *locally*

Aau — *Undivided ultramafic rocks*

Ap — *Metaplutonic rocks, gneisses, and migmatite: undivided, leucocratic and minor mesocratic, polydeformed, compositionally and texturally hybrid metaplutonic rocks of several generations; in part older and younger than rocks of units* **Aa, Am, Ab**; *subdivisions below characterize the main rock types of the map area and are indicated en carte without geological boundaries*

Apq — *Heterolithic quartzofeldspathic gneiss; layered, schlieric and gneissic felsic and mafic components in dominantly granodioritic rocks underlying Mugford Group (Kaumajet Mountains); prograde amphibolite facies in these rocks in an Archean feature probably representing upper levels of Nain crust*

Apti — *Megacrystic K-feldspar granodiorite, L>S fabric**

Apo — *Metaplutonic orthogneiss; areas of relatively homogeneous gneissic and minor layered, well preserved orthopyroxene-bearing rocks of tonalitic and granodioritic composition; locally, L>S fabric**

Apt — *Tonalitic to granodioritic metaplutonic gneiss; generally well layered and locally straightened; contains subtly discordant sheets of amphibolite, up to 3 m wide, probably derived from Saglek dykes (not in map area); characterized by pre- and post-Saglek dyke leucosomes.*
Isolated masses of metaplutonic rocks of unit (**Apt**)*: Parkavik Island tonalite gneiss* (**Apt1**)*: U-Pb zircon age 3219 ±3 Ma (magmatic) and a second period of zircon growth at ca. 2990 Ma. Coopers Island gneissic tonalite* (**Apt2**)*; dated by U-Pb zircon at ca. 2960 Ma. Pistolet Bay structure gneissic tonalite* (**Apt3**)

Apm — *Migmatite; rocks of unit* **Apt** *containing metaplutonic rocks listed above, and intruded by white granitoid and ortyopyroxene-bearing leucosomes; includes late Archean and possibly Proterozoic migmatite on Okak and eastern islands*

Agr — *Areas of well preserved Archean granulite facies rocks*

*Footnote: *L tectonites are dominated by linear fabric elements*
S tectonites are dominated by planar fabric elements

Geology by I. Ermanovics, M.J. Van Kranendonk, F.C. Mengel, and L. Corriveau (1987-89); R. Vande Kemp (1987); R. Sherlock, F. Falardeau, and N. Rasmussen (1988); R. Girard[2], K. Bethune, S. Hammer, and D. Scott (1989)

Previous geology by F. Taylor (1978); geology of Mugford Group after W.R. Smyth[2] (1976), location of sulphide mineralization and chemical analyses from R. Girard[2] (1990)

Map compilation and interpretation by I. Ermanovics, M.J. Van Kranendonk; and in part by R. Girard[2]

[1] *Ministère de l'Énergie et des Ressources du Québec*
[2] *Geological Survey Branch, Newfoundland Department of Mines and Energy*

Rock outcrop ×

Geological boundary (defined, approximate, assumed)

Map unit less than 50 metres wide

Lineament (from aerial photographs); may be fault

Approximate limit of contact metamorphism and injection migmatite surrounding Umiakovik and Wheeler Mountain intrusions; ornament indicates high temperature side

Isotopic age in millions of years; Uz, U-Pb zircon analysis; Mz, U-Pb monazite analysis; rock type (map unit) from which age was obtained may be indicated, e.g. **Pga**, *Uz 1847* ▼

Location of sulphide mineralization (mainly pyrrhotite and minor pyrite, chalcopyrite, sphalerite, and galena, among others), and chemical analysis detailed and reported in Girard, 1990 ×

EARLY PROTEROZOIC

Bedding, top known (inclined, horizontal) 30 +

Pillow lava, top known (inclined) 12

Foliation and cleavage (inclined, vertical, dip unknown); axial planar or associated with shear zones; cuts bedding in Proterozoic Mugford Group and overprints gneissosity in Archean Nain Province; transposes layering in the tectonic foreland zone 60

Mineral lineation resulting from intersection of planes (may be combined with Archean gneissic layering and gneissosity); mainly Proterozoic but may be late Archean 25

Gneissic layering and gneissosity (inclined, vertical, horizontal); includes transposed layering and secondary foliation resulting from shear 60

Mineral lineation (angle of plunge inclined, horizontal) (may be combined with gneissic layering and gneissosity) 65

Plunge of axis of small fold (inclined, horizontal) 70

Structural trend (from aerial photographs)

Shallow-dip fault (thrust movement inferred)

Shear zone (sense of shear may be indicated); M, U, C, P are zones of mylonite, ultramylonite, cataclastite-shatter faults, and pseudotachylite, respectively M

Shear sense indicated on margin of Napaktok dyke and wall rock PN

Zones of protomylonite, mylonite, ultramylonite, and tectonic breccia of subvertical, east-verging fault zones, metres to hundreds of metres wide in the tectonic foreland (vertical and inclined attitude of plane, and plunge of dip parallel lineation indicated)

Antiform, synform (plunge may be indicated)

Orthopyroxene isograd (symbol on upgrade side)

Hornblende isograd (symbol on upgrade side)

ARCHEAN

Gneissosity in high strain zone (inclined, vertical); straightened gneiss may be Proterozoic 70 90

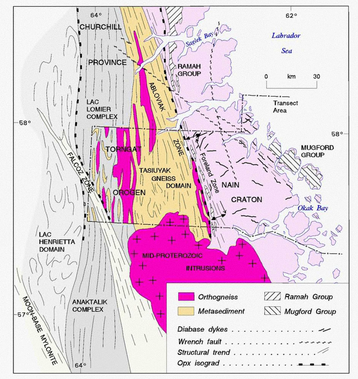
Gneissic layering and gneissosity (inclined, vertical, horizontal) 15

Plunge of mineral lineation and axis of small fold (may be combined with gneissic layering and gneissosity); composite Archean fabric or age unknown 20 60

Plunge of mineral lineation and axis of small fold (may be combined with gneissic layering and gneissosity, Proterozoic foliation and cleavage); main phase Archean deformation associated with isoclinal recumbent folds and with subsequently refolded fabrics on upright axial planes 10 25

Upright antiform, synform (plunge may be indicated); cross-hatch indicates refolded fold on upright axial plane

Overturned antiform, synform (plunge may be indicated)



Geological sketch map and lithotectonic subdivisions of map areas

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