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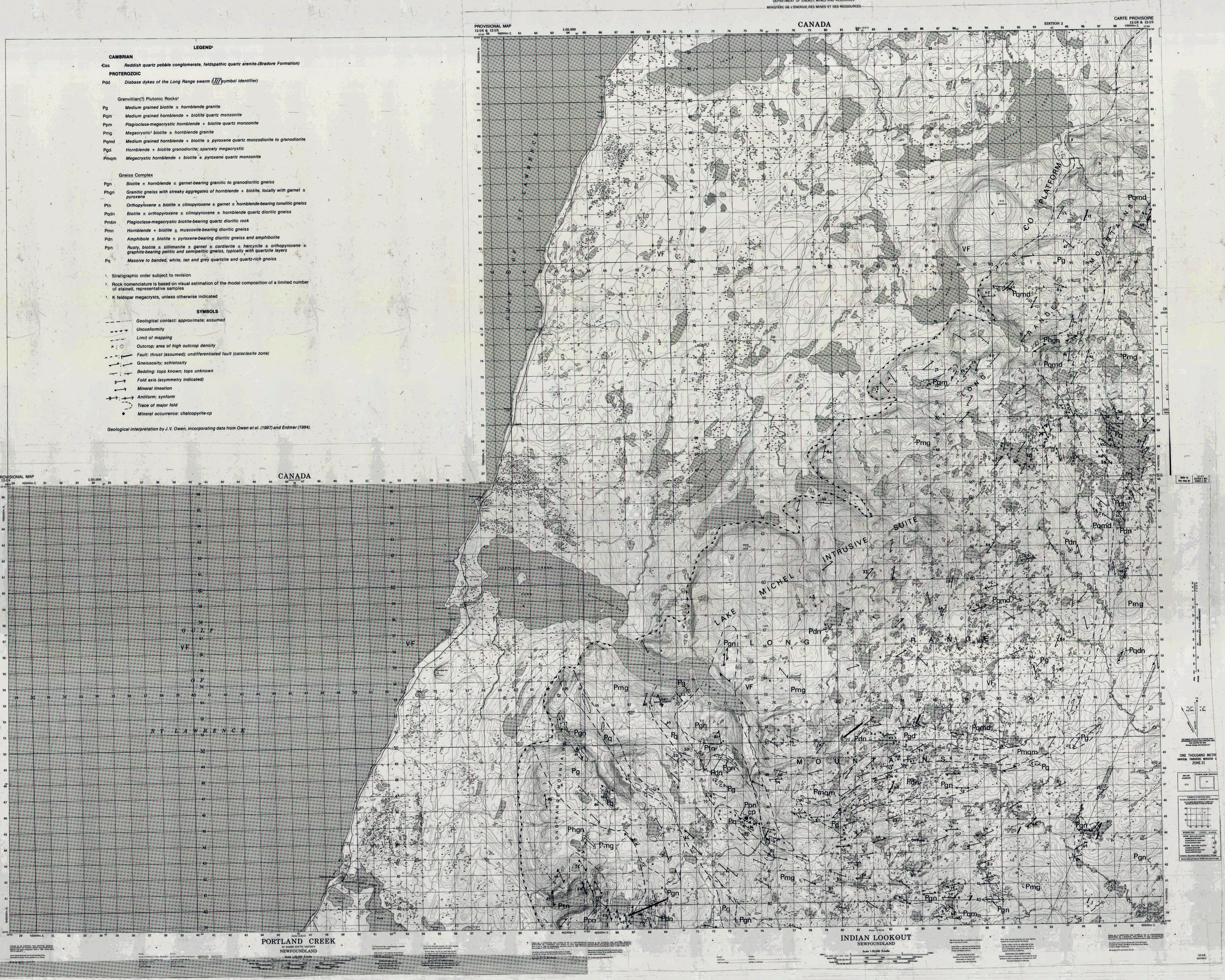

LEGEND[1]

CAMBRIAN

Ꞓss — Reddish quartz pebble conglomerate, feldspathic quartz arenite (Bradore Formation)

PROTEROZOIC

Pdd — Diabase dykes of the Long Range swarm (symbol identifier)

Grenvillian(?) Plutonic Rocks[2]

- Pg — Medium grained biotite ± hornblende granite
- Pqm — Medium grained hornblende + biotite quartz monzonite
- Ppm — Plagioclase-megacrystic hornblende + biotite quartz monzonite
- Pmg — Megacrystic[3] biotite ± hornblende granite
- Pqmd — Medium grained hornblende + biotite ± pyroxene quartz monzodiorite to granodiorite
- Pgd — Hornblende + biotite granodiorite; sparcely megacrystic
- Pmqm — Megacrystic hornblende + biotite ± pyroxene quartz monzonite

Gneiss Complex

- Pgn — Biotite ± hornblende ± garnet-bearing granitic to granodioritic gneiss
- Phgn — Granitic gneiss with streaky aggregates of hornblende + biotite, locally with garnet ± pyroxene
- Ptn — Orthopyroxene ± biotite ± clinopyroxene ± garnet ± hornblende-bearing tonalitic gneiss
- Pqdn — Biotite ± orthopyroxene ± clinopyroxene ± hornblende quartz dioritic gneiss
- Pmbn — Plagioclase-megacrystic biotite-bearing quartz dioritic rock
- Pmn — Hornblende + biotite ± muscovite-bearing dioritic gneiss
- Pdn — Amphibole ± biotite ± pyroxene-bearing dioritic gneiss and amphibolite
- Ppn — Rusty, biotite ± sillimanite ± garnet ± cordierite ± hercynite ± orthopyroxene ± graphite-bearing pelitic and semipelitic gneiss, typically with quartzite layers
- Pq — Massive to banded, white, tan and grey quartzite and quartz-rich gneiss

1. Stratigraphic order subject to revision
2. Rock nomenclature is based on visual estimation of the modal composition of a limited number of stained, representative samples
3. K feldspar megacrysts, unless otherwise indicated

SYMBOLS

- Geological contact: approximate; assumed
- Unconformity
- Limit of mapping
- Outcrop; area of high outcrop density
- Fault: thrust (assumed); undifferentiated fault (cataclasite zone)
- Gneissosity; schistosity
- Bedding: tops known; tops unknown
- Fold axis (asymmetry indicated)
- Mineral lineation
- Antiform; synform
- Trace of major fold
- Mineral occurrence: chalcopyrite-cp

Geological interpretation by J.V. Owen, incorporating data from Owen et al. (1987) and Erdmer (1984).

MARGINAL NOTES

The Long Range Inlier in the Lake Michel area consists of Middle Proterozoic gneisses intruded by granitic plutons of Grenvillian age, and by late Proterozoic mafic dykes of the Long Range swarm.

The gneiss complex has been metamorphosed at amphibolite to granulite facies, and in places shows evidence of a low grade metamorphic overprint. Most of the gneiss units are leucocratic, quartzofeldspathic rocks; their relative ages are unknown from field relations. The dominant unit is pale gray or rose, granitic to granodioritic gneiss (unit Pgn) containing biotite, in places with hornblende±garnet. This unit is texturally diverse, and includes migmatitic rocks with narrow, leucocratic segregations, and more homogeneous, typically granoblastic gneiss. Granitic gneiss with streaky-aggregates of hornblende, biotite and/or pyroxene or garnet is distinguished as unit Phgn. Two types of quartz dioritic-tonalitic gneiss have been recognized. In contrast to more granitic compositions, these plagioclase- and quartz-rich rocks characteristically contain pyroxenes, and are typically associated with pelitic gneiss. Unit Ptn is white or pale gray tonalitic (to granodioritic) gneiss containing orthopyroxene in association with various combinations of clinopyroxene, biotite, garnet, and/or hornblende. In places the unit is migmatitic e.g. with patchy, orthopyroxene-bearing leucocratic segregations in a biotite-bearing paleosome. Unit Pqdn is gray, biotite-bearing quartz dioritic gneiss locally containing, orthopyroxene, clinopyroxene and/or hornblende. A texturally-distinct, plagioclase-megacrystic quartz dioritic rock with a schistose fabric defined by biotite is distinguished as unit Pmbn.

Gneissic rocks unequivocally derived from supracrustal protoliths constitute less than 5% of the gneiss complex. Migmatitic pelitic gneisses (unit Ppn) are rusty rocks containing sillimanite, garnet, and biotite, locally with cordierite, hercynite, orthopyroxene and/or rare gedrite. Quartzite and quartz-rich gneiss is a conspicuous component of some pelite sequences, and, where predominant, is distinguished as unit Pq. Semipelitic gneiss containing garnet, biotite, orthopyroxene and graphite is associated with a sequence of pelitic (unit Ppn) and quartz dioritic (unit Pqdn) gneisses truncated by the Lake Michel intrusive suite* (formerly the Lake Michel pluton; Bostock, 1983) along its east-central margin. Mafic gneiss (unit Pdn), including orthopyroxene-plagioclase rocks, forms bands within the pelites at this locality. Elsewhere, unit Pdn includes hornblende-bearing amphibolite and dioritic gneiss; a hornblende + biotite ± muscovite-bearing variant is distinguished as unit Pmn.

Preliminary geobarometry of the gneiss complex indicates pressures of ca. 600 MPa, consistent with the presence of sillimanite in pelitic rocks, of stable orthopyroxene + garnet in semipelitic and tonalitic gneiss, and the apparent absence of stable, coexisting clinopyroxene + garnet in any of the gneisses. Temperature estimates for gneisses in the map area range from about 600–750°C, somewhat less that the 800±50°C for gneisses farther to the southwest (Owen and Erdmer, 1986).

The gneiss complex was intruded by granitic (s.l.) plutons of Grenvillian age (ca. 1042 Ma; Erdmer, 1986). The largest of these, the Lake Michel intrusive suite (LMIS), comprises at least seven lithologic variants: hornblende + biotite ± pyroxene-bearing megacrystic quartz monzonite (unit Pmqm), hornblende + biotite ± pyroxene-bearing quartz monzodiorite to granodiorite (unit Pqmd), sparsely-megacrystic hornblende + biotite granodiorite (unit Pgd), megacrystic biotite±hornblende granite (unit Pmg), plagioclase-megacrystic hornblende + biotite quartz monzonite (unit Ppm), medium grained hornblende + biotite quartz monzonite (Pqm) and medium grained biotite± hornblende granite (unit Pg). Dykes of medium grained granite (unit Pg) cut megacrystic granite (unit Pmg); the relative ages of other intrusive units are unknown from field relations. Smaller plutons in the map area consist of megacrystic and/or non-megacrystic biotite ± hornblende granite (units Pmg, Pg). Some of the small bodies of medium grained granite (unit Pg) are spatially associated with diatexitic granitic gneiss (unit Pgn), and may be anatectic granites predating the Grenvillian plutons. However, at least two of the larger granitoid bodies in the eastern part of the map area appear to be composite plutons which include facies also seen in the LMIS. The Little Cat Arm pluton* contains both megacrystic biotite ± hornblende granite (unit Pmg) and medium grained biotite ± hornblende granite (unit Pg). The smaller pluton near the headwaters of the Little Harbour Deep River includes relatively leucocratic, white weathering biotite granite (unit Pg), megacrystic hornblende + biotite ± pyroxene-bearing quartz monzonite-granodiorite (unit Pmqm), and medium grained, hornblende + biotite quartz monzonite (unit Pqm). Megacrystic biotite ± hornblende granite (unit Pmg) is the sole rock type identified in the Pigeon Cove pluton*.

The gneiss complex and Grenvillian plutons are cut by mafic dykes of the ca. 605 Ma Long Range swarm (LRD; unit Pdd), and are unconformably overlain by flat-lying conglomerates and arenites of the lower Cambrian Bradore Formation (unit Ꞓss).

The most conspicuous structural features of the gneiss complex are large, NW-plunging folds developed prior to emplacement of the LRD. Although their age relative to the Grenvillian plutons is uncertain (Owen *et al.*, 1987), several observations indicate that they are late Grenvillian structures. For example, the Little Cat Arm pluton contains a NW-trending planar fabric approximately parallel to the axial surface of a large fold hinge in gneisses enveloping the intrusion, indicating that this fold postdates emplacement of the granite. The LMIS is of particular interest since narrow enclaves of gneisses and pyroxene-bearing granitoid rocks (units Pmqm, Pqmd) outline a quasi-concentric structure which may either be a primary feature related to the mechanism(s) of plutonic emplacement (e.g. Bateman, 1984), or a large fold hinge analagous to the NW-plunging structures developed in the country rock. Significantly, the curvilinear structure of the LMIS is also defined by schistose fabrics largely, or exclusively, of tectonic origin, suggesting that this feature is a large fold hinge developed after emplacement and initial deformation of this composite intrusion. Large gneissic enclaves separate individual plutons of the LMIS and thus appear to have controlled their emplacement. Some of these enclaves can be traced along strike into the country rock and may thus be *in situ*.

Paleozoic tectonometamorphic features are recorded by the LRD (Owen and Machin, 1987; Owen *et al.*, in prep.). Their mineralogy indicates polyphase recrystallization near the greenschist-amphibolite facies transition. Dykes within a few kilometers of White Bay contain a penetrative, planar tectonic fabric. Similarly-oriented, vertical to SE-dipping S-fabrics associated with NE- and SW-plunging folds are developed in the gneiss complex and deformed megacrystic granite (unit Pmg) along the eastern margin of the inlier. Similarly oriented fabrics of ?Devonian age have been described from deformed cover rocks NE of the inlier at Canada Bay (Knight, 1987) but these appear to have formed at lower metamorphic grade (greenschist facies) and are possibly younger than the ductile Paleozoic fabrics in the inlier which are known to predate the ca. 398 Ma Devils Room granite (Erdmer, 1986; Owen *et al.*, in prep.). Steep cataclasite zones in the western part of the map area are interpreted to coincide with high level faults. The brittle, E-dipping Long Range frontal thrust separating the inlier from cover rocks in the foreland to the west (Cawood and Williams, 1986) appears to be discontinuous to the NE of Blue Mountain.

Rock units of potential economic interest include rusty pelitic gneiss (unit Ppn), which locally contains traces of chalcopyrite in addition to iron sulphide, and the basal conglomeratic member of the Bradore Formation, which contains concentrations of heavy minerals in thin (mm-scale) laminae.

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* informal names, introduced here

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GEOLOGY OF THE CENTRAL PART OF THE LONG RANGE INLIER, WESTERN NEWFOUNDLAND

J.V. Owen, 1987

Part 1 of 3

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