GEOLOGICAL SURVEY OF CANADA — COMMISSION GÉOLOGIQUE DU CANADA

EXPLANATORY NOTES

Introduction

The accompanying map presents the results of geological mapping of mainly Late Precambrian to Early Cambrian rocks in the area between the Saint John River and St. Martins in southern New Brunswick. Mapping was done during the summers of 1989 and 1990. The map adjoins the map previously open filed by Barr and White (1989). Cambrian, Carboniferous, and Triassic rocks were not generally covered in this mapping project; distribution of these units has been taken mainly from Ruitenberg et al. (1979), Nadon and Middleton (1985), and Currie (1989).

On-going U-Pb dating (Bevier and Barr 1990; Bevier et al. 1990; White et al. 1990) continues to change our interpretation of the ages of the map units in this area, and perhaps the stratigraphic relations. Hence this map is preliminary in terms of the interpretation of ages and stratigraphy, and formal names have yet to be assigned to the map units.

Overview of Precambrian Stratigraphy

Our new mapping, combined with radiometric dating and petrological studies (Barr and White 1989; Bevier and Barr 1990; Bevier et al. 1990; White et al. 1990), have resulted in revision of previously accepted stratigraphy in the Caledonia Highlands. We propose the presence of two distinct tectonostratigraphic domains, termed Brookville and Caledonia, in the map area. These two domains have different lithologic components and are in faulted contact; hence they are termed terranes following the criteria suggested by Coney et al. (1980). On the basis of similarities in stratigraphy and igneous and metamorphic histories, we tentatively correlate the Brookville terrane with the Bras d'Or terrane of central Cape Breton Island, and the Caledonia terrane with the Mira terrane of southeastern Cape Breton Island (Barr and Raeside 1989).

1. Brookville terrane

The Brookville Gneiss, Green Head Group, and associated plutonic units constitute the Brookville terrane. These units are in faulted contact with volcanic and sedimentary units of the Caledonia terrane to the southeast.

The Brookville Gneiss includes paragneiss with calc-silicate lenses, narrow layers of marble, and granodioritic to tonalitic orthogneiss. The paragneiss is locally migmatitic and contains a low-pressure mineral assemblage (cordierite ± andalusite + biotite + K-feldspar). A minimum age of ca. 640 Ma obtained for detrital zircon from the Brookville paragneiss indicates that the maximum age of the sedimentary protolith is ca. 640 Ma (Bevier et al. 1990). Associated orthogneiss has an igneous crystallization age of 605 ± 3 Ma, and was metamorphosed to amphibolite facies at 564 ± 6 Ma (Bevier et al. 1990).

The Green Head Group consists of locally stromatolitic marble, calcareous pelite, and quartzite. Zones of mylonitization are common in the marble, especially near contacts with the Brookville Gneiss. If the Helikian age of the Green Head Group suggested by Hofmann (1974) on the basis of stromatolites is correct, then the gneiss appears to be younger than the Green Head Group, and hence cannot be considered "basement" to the Green Head Group as has been previously assumed (e.g. Currie 1986, 1987; Nance 1987).

The Brookville Gneiss and Green Head Group were intruded by varied plutonic units (previously collectively termed the Golden Grove Suite) that range from strongly foliated to unfoliated, and from gabbroic to granitic. Their petrology has been described by White et al. (1990). The late Precambrian igneous age and ca. 564 Ma metamorphic age for orthogneiss in the Brookville Gneiss indicates that the less deformed plutons in the terrane are probably younger than about 564 Ma, an interpretation supported by 538 Ma U-Pb (zircon) ages for the Rockwood Park Granodiorite (White et al. 1990) and French Village Quartz Diorite (M.L. Bevier, personal communication, 1991).

2. Caledonia terrane

The Caledonia terrane consists mainly of volcanic and sedimentary rocks that are essentially unmetamorphosed or metamorphosed only to lower greenschist facies. Slivers of higher grade rocks (mylonitic mica schist, albite porphyroblastic schist, and minor marble of the Hammondvale metamorphic unit) occur on the northwestern margin of the Caledonia terrane, but it is not yet clear if these rocks belong to the Caledonia terrane because lithologically they have some similarity to the Green Head Group.

Most of the volcanic and sedimentary rocks were previously assigned to the Late Hadrynian Coldbrook Group (e.g. Ruitenberg et al. 1979). We have made a preliminary three-fold division that includes most of these rocks, based on contrasts in lithologic character and on radiometric dating of correlative units and plutons that intruded them farther east in the Caledonia Highlands (Bevier and Barr (1990):

(i.) Small areas of well cleaved intermediate and felsic crystal tuff in the southeastern part of the map area are assigned the Older Late Hadrynian sequence. This sequence is interpreted to correspond to sequence A of Barr and White (1988c) in the central Caledonia Highlands, where similar tuffaceous units have been intruded by calc-alkalic dioritic to granitic plutons with ages ca. 610 - 625 Ma (Barr and White 1988c; Bevier and Barr 1990). In the present map area these units occur in association with plutons lithologically similar to the Cape Spencer pluton (ca. 625 Ma; Watters 1987). Pervasive Carboniferous faulting and deformation in this part of the map area make field relations difficult to interpret.

(ii.) Volcanic and sedimentary rocks assigned to the Late Hadrynian sequence form much of the present map area and are generally less deformed and metamorphosed than those of the Older Late Hadrynian sequence. Distinctive intermediate to felsic lithic lapilli tuffs, crystal tuffs, and laminated siliceous siltstones are typical of this package. These rocks occur in the "type area" of the Coldbrook Group northeast of Saint John. The absolute age is not yet known, but a minimum age of 550 Ma is assigned on the basis of the U-Pb age of 550 ± 1 Ma for the Bonnell Brook syenogranite which intruded these rocks east of the present map area (Bevier and Barr 1990).

(iii.) The third sequence of units, here assigned a Late Hadrynian - Early Cambrian age, is dominated by basalt and rhyolite flows with overlying (and in places interlayered) redbeds. Based on mapping to the east, Barr and White (1988a, b, c; 1989) assumed that these units and the underlying Late Hadrynian units form a single sequence (sequence B of Barr and White, 1988c). However, the two are separated here because of lithological differences and the fact that ca. 550 Ma plutons (Bonnell Brook syenogranite and equivalents) intruded the Late Hadrynian sequence but not the Late Hadrynian - Early Cambrian sequence. A rhyolite flow east of the present map area in the latter sequence has an age of ca. 550 Ma age (Bevier and Barr 1990), and hence these rhyolite flows appear to be co-magmatic with felsic units of the Bonnell Brook Pluton (Barr and White 1988c). Separate basalt, rhyolite, and redbed units can be mapped in much of the Late Hadrynian - Early Cambrian package; however, some units appear to consist of interlayered basalt, rhyolite, and/or redbeds. Distinctive maroon quartzite-pebble conglomerate is a common component of the top redbed unit. This lithology has been assigned previously to the basal unit of the Lower Cambrian Ratcliffe Brook Formation of the Saint John Group (e.g. Tanoli and Pickerill 1988, 1990; McCutcheon 1987; Hofmann and Patel 1989); however, our mapping suggests that it is more closely associated with the underlying volcanic sequence than with the Saint John Group.

Plutonic units in the Caledonia terrane in the map area (as well as farther east in the terrane) are of two main types - bimodal granite and quartz diorite/gabbro plutons (Bonnell Brook, Upham Mountain, Baxters Mountain) and granodioritic plutons (Emerson Creek, Black River). The latter are older, based on the U-Pb age of ca. 625 Ma for the lithologically similar Cape Spencer pluton located south of the present map area (Watters 1987). The former are ca. 550 Ma, based on the age of the Bonnell Brook syenogranite east of the present map area (Bevier and Barr 1990). Gabbroic parts of the ca. 550 Ma plutons are similar to the Duck Lake and Saint John River gabbros in the Brookville terrane, and may be of similar age.

Other Units

The Saint John Group has not been mapped in detail during the present study but has been described by others (e.g. Tanoli and pickerill 1988 and references cited therein). As discussed above, the area shown as part of this unit on the present map excludes the quartzite-pebble conglomerate unit and associated redbeds that have previously been considered to be the basal unit of the Lower Cambrian Ratcliffe Brook Formation of the Saint John Group (Tanoli and Pickerill 1988, 1990; Hofmann and Patel 1989), but are here considered to be the uppermost unit of the Late Precambrian-Early Cambrian volcanic-sedimentary sequence.

An area of rhyolite centred on Highway 111 west of Gardiner Creek appears to be of Devonian age, based on a U-Pb date from zircon (R. Doig, pers. comm. 1990). The relationship of this rhyolite to other units in the area is not yet known.

Epidotized basaltic rocks occurring in small areas near the Bay of Fundy are placed in a separate Carboniferous or older map unit. These rocks also occur with minor intermixed sedimentary rocks on Quaco Head, as well as farther east along the coast (Barr and White 1989). These rocks are unlike the Late Hadrynian - Early Cambrian basaltic and sedimentary units and may be as young as Carboniferous.

Distribution of Carboniferous and Triassic sedimentary units in the map area is mainly taken from other workers (Ruitenberg et al. 1979; Nadon and Middleton 1985; Currie 1989).

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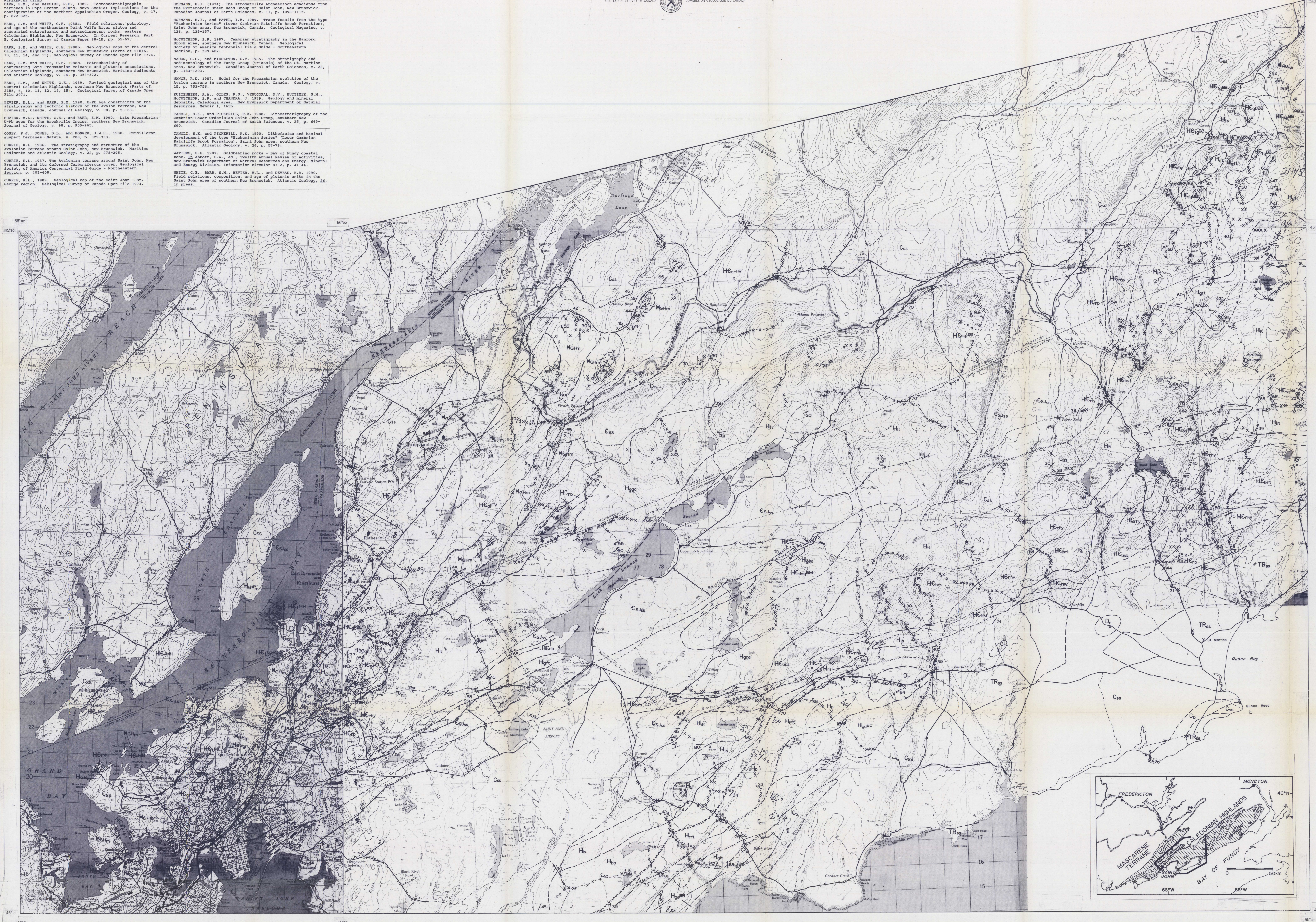

LATE PRECAMBRIAN - EARLY CAMBRIAN GEOLOGY, SAINT JOHN - ST. MARTINS AREA, SOUTHERN NEW BRUNSWICK (Parts of 21 H/5, 21 H/12, and 21 G/8)

LEGEND

TRIASSIC

- TR$_{ss}$ — Sandstone, siltstone, conglomerate

CARBONIFEROUS

- C$_{ss}$ — Sandstone, siltstone, conglomerate

CARBONIFEROUS OR OLDER

- C$_{b}$ — Epidotized basalt

DEVONIAN (?) (based on U-Pb date)

- D$_{r}$ — Rhyolitic flows and lithic tuff; minor red siltstone

CAMBRIAN

SAINT JOHN GROUP

- ЄSJ$_{ss}$ — Shale, siltstone, sandstone; minor quartzite, limestone (includes Ratcliffe Brook Formation except the quartzite-pebble conglomerate and associated redbeds that are assigned to unit HЄ$_{rb}$ below)

LATE HADRYNIAN - EARLY CAMBRIAN (ca. 550 Ma and younger)

- HЄ$_{rb}$ — Micaceous siltstone and sandstone (mainly red, locally grey); red conglomerate; quartzite-pebble conglomerate and underlying red tuffaceous siltstone
- HЄ$_{brs}$ — Amygdaloidal basalt flows; locally with interlayered rhyolite and red conglomerate/sandstone
- HЄ$_{rhy}$ — Pink to red to grey, commonly flow-banded rhyolite and rhyolitic tuff. Locally pyritiferous.
- HЄ$_{bst}$ — Amygdaloidal basalt flows
- HЄ$_{brt}$ — Interlayered amygdaloidal basalt, basaltic tuff, rhyolite, rhyolitic to dacitic tuff

LATE HADRYNIAN (ca. 550 Ma and older)

- H$_{ggd}$ — Grey-green dacitic tuff, flows and crystal tuff
- H$_{lt}$ — Volcanogenic lapilli tuff; typically with dacitic to rhyolitic subrounded to subangular clasts; colour varies from grey to black to pink to orange (limonitic) and rarely red; black dacitic lapilli and grey crystal tuffs occur locally
- H$_{gft}$ — Dark grey to black lapilli and crystal tuff; dacitic to rhyolitic composition; locally flow-banded
- H$_{grd}$ — Grey to reddish-grey banded rhyolite to dacite, rhyolitic lapilli tuff and minor crystal tuff; abundant pink rhyolite/felsite dykes(?) and mafic dykes (feeders to basalt flows in younger sequence?)
- H$_{ilt}$ — Mainly intermediate lapilli tuff; grey to black dacite
- H$_{ls}$ — Laminated black to grey to green siliceous siltstone
- H$_{bf}$ — Bloomington Mountain brown felsite
- H$_{ba}$ — Green epidotized basaltic and andesitic rocks; locally includes plagioclase porphyry and green dacitic sheets

OLDER LATE HADRYNIAN (ca. 600 Ma and older)

- H$_{rft}$ — Pink to red to buff felsic crystal tuff, locally flow-banded; well cleaved, minor red siltstone/tuff; dacitic porphyry (H$_{p}$)
- H$_{git}$ — Grey intermediate crystal tuff; well cleaved

LATE HADRYNIAN

BROOKVILLE GNEISS

- HBG$_{gn}$ — Banded cordierite-biotite K-feldspar migmatitic paragneiss, cordierite-andalusite-biotite-K-feldspar paragneiss, hornblende-bearing paragneiss, marble, and granodioritic to tonalite orthogneiss

HELIKIAN OR HADRYNIAN

HAMMONDVALE METAMORPHIC UNIT

- HHM$_{sh}$ — Mica schist, albite porphyroblastic schist (locally garnet-bearing), minor marble

GREEN HEAD GROUP

- HGH$_{m}$ — Marble (locally stromatolitic), minor calcareous pelite and quartzite

PLUTONIC UNITS

LATE HADRYNIAN - EARLY CAMBRIAN (ca. 530-550 Ma)

- HЄ$_{gb}$DL — Duck Lake Gabbro
- HЄ$_{gb}$SJ — Saint John River gabbro
- HЄ$_{sg}$UM — Upham Mountain Pluton (syenogranite, minor diorite and gabbro)
- HЄ$_{dsg}$BM — Baxters Mountain Pluton (diorite, gabbro, syenogranite)
- Bonnell Brook Pluton
  - HЄ$_{fg}$BB — Fine-grained syenogranite
  - HЄ$_{sg}$BB — Syenogranite
  - HЄ$_{gb}$BB — Gabbro
- HЄ$_{gr}$ — Fairville (F), Chalet Lake (CL), and Hammond River (HR) plutons (K-feldspar megacrystic monzogranite and granodiorite)
- HЄ$_{gd}$RP — Rockwood Park Granodiorite
- HЄ$_{t}$ — Narrows (N) and Mayflower Lake (ML) plutons (quartz diorite to tonalite)
- HЄ$_{t}$MH — Milkish Head Pluton (quartz diorite, tonalite, granodiorite)
- HЄ$_{di}$ — French Village Quartz Diorite (FV) and other dioritic plutons (quartz diorite to diorite and gabbro)
- HЄ$_{dg}$ — Deformed granitoid rocks (strongly foliated granitic to dioritic rocks that may be in part equivalent the above plutonic units)

LATE HADRYNIAN (ca. 610 - 625 Ma)

- H$_{gd}$BR — Black River pluton (sheared granite and granodiorite)
- H$_{gd}$EC — Emerson Creek pluton (sheared granite and granodiorite)

SYMBOLS

- Rock outcrop, area of outcrop
- Geological boundary (defined, approximate, assumed)
- Bedding and volcanic layering (inclined, vertical, overturned)
- Layering in intrusive rocks (inclined, vertical)
- Foliation (inclined, vertical)
- Gneissosity (inclined, vertical)
- Cataclastic foliation (inclined, vertical)
- Fault

Geology by S.M. Barr and C.E. White

Scale 1:50 000 - Échelle 1/50 000

Kilometres 1 0 1 2 3 4 Kilomètres

Universal Transverse Mercator Projection — Projection transverse universelle de Mercator

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