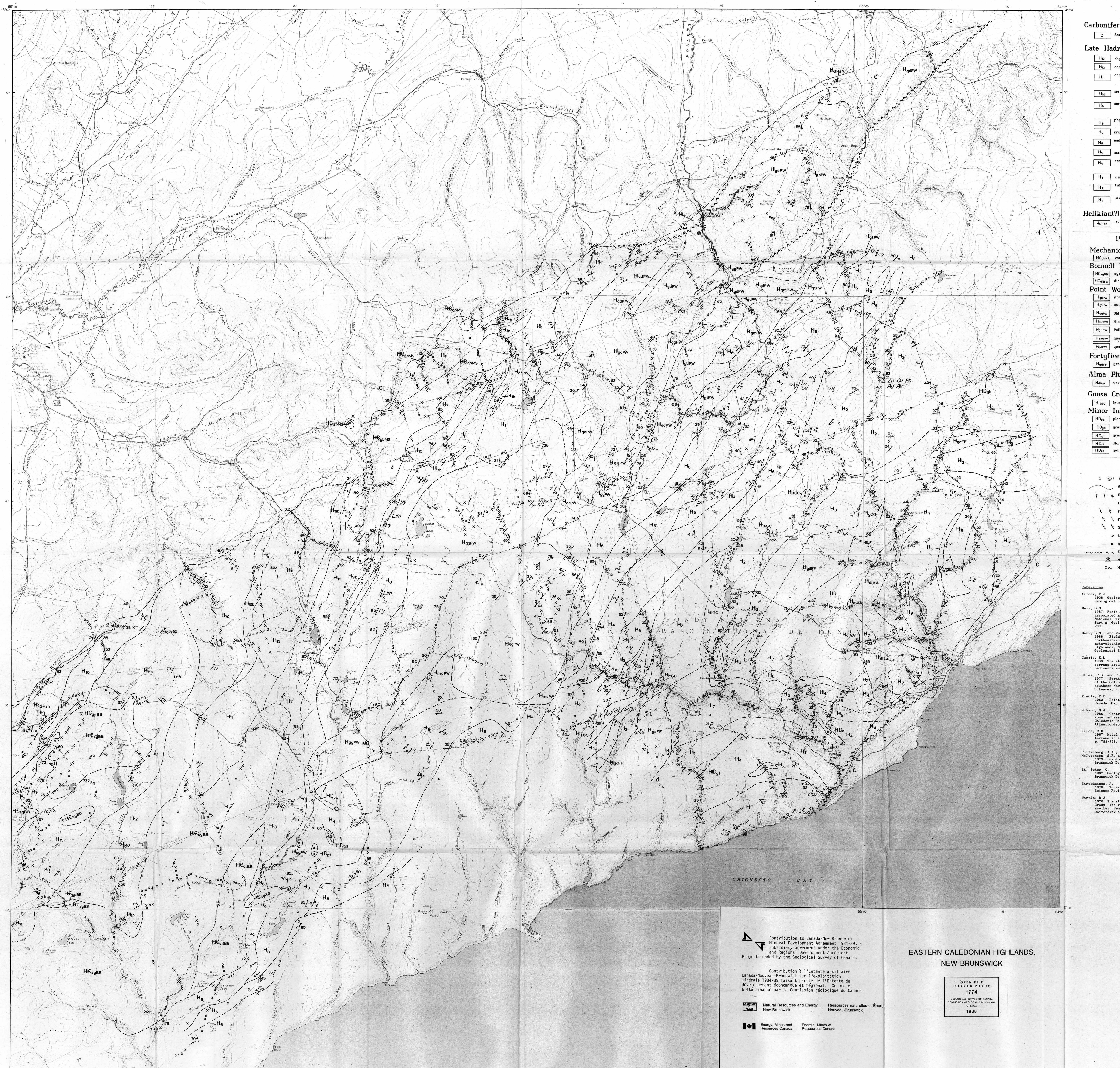

LEGEND

Carboniferous

C	Sandstone, conglomerate, limestone

Late Hadrynian

H_{13}	rhyolite (spherulitic)
H_{12}	conglomerate (epiclastic); b, basaltic lense
H_{11}	crystal lapilli tuff (mafic to intermediate composition; heterogenous clast composition and size; distinctive black colour; b, basaltic lense
H_{10}	metasedimentary rocks; mainly laminated fine-grained siltstone and chert (green, grey); rare black lapilli tuff and breccia
H_9	metasedimentary rocks; abundant volcanogenic conglomerate; laminated siltstones and cherts; locally phyllitic arkose; b, basaltic lense
H_8	phyllitic crystal tuffs (grey-green; intermediate to felsic); b, basaltic lense
H_7	crystal meta-tuff; abundant grey pyritiferous felsite
H_6	mainly massive to amygdaloidal metabasalt; minor mafic tuffaceous schists and phyllites
H_5	mainly meta-rhyolite and rhyolitic tuff; locally ignimbritic
H_4	red, maroon, and grey slate, phyllite, arkosic metasiltstone and metasandstone; metaconglomerate; minor grey to green quartzite
H_3	massive meta-arkosic siltstone, sandstone, and conglomerate
H_2	tuffaceous phyllite, chloritic schist; minor slate, felsite, and meta-arkose
H_1	mainly mafic schists, phyllites, and meta-tuffs; minor flows: b, basaltic; r, rhyolitic

Helikian(?)

H_{GHsh}	schist and gneiss, minor marble (=Greenhead Group/Brookville gneiss?)

Plutonic Units

Mechanic Settlement Pluton

HЄ$_{gbMS}$	varied gabbroic rocks

Bonnell Brook Pluton

HЄ$_{sgBB}$	syenogranite (gp is granophyric)
HЄ$_{diBB}$	diorite

Point Wolfe River Pluton

H_{gpPW}	granite porphyry
H_{gtPW}	Blueberry Hill granite
H_{ggPW}	Old Shepody Road granite/granodiorite
H_{mdPW}	Microdiorite/granodiorite
H_{gdPW}	Pollett River granodiorite
H_{qmPW}	quartz monzodiorite/tonalite
H_{qdPW}	quartz diorite/tonalite

Fortyfive River Pluton

H_{gdFF}	granodiorite

Alma Pluton

H_{diAA}	varied dioritic rocks

Goose Creek Leucotonalite

H_{ltGC}	leucotonalite

Minor Intrusive Units

HD_{pp}	plagioclase porphyry
HD_{gd}	granodiorite
HD_{gt}	granite, syenite
HD_{di}	diorite
HD_{gb}	gabbro, diorite

SYMBOLS

Rock outcrop, area of outcrop
Geological boundary (defined, approximate, assumed)
Bedding (inclined, vertical, overturned)
Flow in intrusive rocks (inclined, vertical)
Flow in extrusive rocks (inclined, vertical)
Foliation (inclined, vertical)
Gneissosity (inclined, vertical)
Lineation
Axis of minor fold
Fault (defined, approximate, assumed)
Mineral prospect (abandoned)
Mineral occurrence Copper......Cu
Pyrite ....Py
Limonitic Till ....Lim

References

Alcock, F.J.
1938: Geology of Saint John region, New Brunswick. Geological Survey of Canada, Memoir 216.

Barr, S.M.
1987: Field relations, petrology and age of plutonic and associated metavolcanic and metasedimentary rocks, Fundy National Park area, New Brunswick. in Current Research, Part A, Geological Survey of Canada, Paper 87-1A, p. 263-280.

Barr, S.M., and White, C.E.
1988. Field relations, petrology, and age of the northeastern Point Wolfe River Pluton and associated metavolcanic and metasedimentary rocks, eastern Caledonian Highlands, New Brunswick. in Current Research, Part B, Geological Survey of Canada, Paper 88-1B, p. 55-67.

Currie, K.L.
1986: The stratigraphy and structure of the Avalonian terrane around Saint John, New Brunswick. Maritime Sediments and Atlantic Geology, v. 22, p. 278-295.

Giles, P.S. and Ruitenberg, A.A.
1977: Stratigraphy, paleogeography, and tectonic setting of the Coldbrook Group in the Caledonia Highlands of southern New Brunswick. Canadian Journal of Earth Sciences, v. 14, p. 1263-1275.

Kindle, E.D.
1962: Point Wolfe sheet (21H/11E). Geological Survey of Canada, Map 1109A.

McLeod, M.J.
1986: Contrasting geology across the Cradle Brook thrust zone: subaerial vs. marine Precambrian environments, Caledonia Highlands, New Brunswick. Maritime Sediments and Atlantic Geology, v. 22, p. 296-307.

Nance, R.D.
1987: Model for the Precambrian evolution of the Avalon terrane in southern New Brunswick, Canada. Geology, v. 15, p. 753-756.

Ruitenberg, A.A., Giles, P.S., Venugopal, D.V., Buttimer, S.M., McCutcheon, S.R. and Chandra, J.
1979: Geology and mineral deposits, Caledonia area. New Brunswick Department of Natural Resources, Memoir 1, 165p.

St. Peter, C.
1987: Geology of the Moncton sub-basin. Plate 87-102. New Brunswick Department of Natural Resources and Energy.

Streckeisen, A.
1976: To each plutonic rock its proper name. Earth Science Reviews, v. 12, p. 1-13.

Wardle, R.J.
1978: The stratigraphy and tectonics of the Greenhead Group: its relation to Hadrynian and Palaeozoic rocks, southern New Brunswick. Unpublished Ph.D. thesis, University of New Brunswick.

MARGINAL NOTES TO THE GEOLOGICAL MAPS OF THE CENTRAL CALEDONIAN HIGHLANDS, SOUTHERN NEW BRUNSWICK (PARTS OF 21H/6,10,11,14,15)

Introduction

The map area is accessible by paved roads and a network of logging roads, the latter branching mainly from the Old Shepody Road which crosses the area from west to east. Fundy National Park is included in the map area, and is covered by a network of excellent hiking trails. Throughout the area, the best outcrops occur in stream and river sections, but roadcuts, especially along the newer logging roads, locally provide good exposure.

Metamorphic, Volcanic, and Sedimentary Units

Schist, gneiss, and marble (map unit HGHsh), assigned to the Green Head Group and/or Brookville gneiss (Wardle, 1978; Currie, 1986; Nance, 1987), occur adjacent to the faulted northern margin of the Caledonian Highlands. These include cordierite-bearing muscovite schist, garnet-quartz-feldspar gneiss, and marble. A small area of marble also occurs northeast of Gowland Mountain in the northwestern extremity of the map area.

The Late Hadrynian map units (H1 through 13) are defined primarily on the basis of lithology. The preliminary assessment is that all of these rocks may be stratigraphically equivalent to the Coldbrook Group (e.g. Alcock, 1938; Kindle, 1962; Giles and Ruitenberg, 1977); however, some may be younger (Eocambrian or Cambrian) or older (equivalents of the Martinon Formation; see Currie, 1986, and Nance, 1987, for recent summaries of stratigraphy in the region). The inferred stratigraphic sequence 1 through 13 should be viewed as preliminary, pending completion of the mapping to the northeast, south and west of the present map area. Stratigraphic interpretations are hampered by heterogeneity of the rocks, by the probability of rapid lateral facies variations and lateral discontinuity of units, and by variably intense regional and localized deformation. All of these units have apparently been regionally metamorphosed to lower greenschist facies, as indicated by mineral assemblages, but textural and mineralogical effects of metamorphism vary markedly with lithology.

Unit H1 is characterized by fine-grained mafic to intermediate pyroclastic rocks, now strongly cleaved mafic phyllites and chloritic schists. However, the unit also includes intermediate to felsic crystal tuff and rare lithic tuff, as well as minor basaltic flows. It occurs in two separate areas which may not be correlative (although lithologically similar): in the coastal area of Fundy National Park and in the north between the Mechanic Settlement area and Pollett River, where it is well exposed in the river gorge above Elgin. Locally grey felsite layers and quartz veins with abundant pyrite are present in the unit in both areas.

Unit H2 is characterized by fine-grained, strongly cleaved tuffaceous and volcanogenic sedimentary rocks. The latter are dominantly slates and phyllites, with rare quartz-rich, medium- to fine-grained arkosic members. Rocks of this unit host the Teahan Zn-Cu-Pb-Ag-Au prospect (see Economic Geology section below).

Unit H3 appears to overlie the Teahan unit, based on consistent younging directions within unit H3, and consists of arkosic sandstone, conglomerate, and siltstone. Clasts are generally subangular and poorly sorted, and consist mainly of quartz with less abundant potassium feldspar and albite. Lithic fragments are mainly of quartzitic and felsic volcanic composition. This unit was informally termed the Fortyfive River arkose by Ruitenberg et al. (1979). Unit H4 is also mainly sedimentary; it overlies unit H3, at least locally, but may in part be laterally equivalent. Unit H4 is finer grained and less arkosic than H3. The most abundant lithology is grey slate with lenses of distinctive muscovite-bearing quartzite. Also present are red to maroon slate, phyllite, meta-siltstone, meta-sandstone, meta-conglomerate, tuffaceous layers, and varied mafic and porphyry dykes/sills.

Unit H5 consists of rhyolitic rocks, varying from pink to grey in colour, and from massive to strongly cleaved. Massive, aphanitic varieties appear welded and ignimbritic, locally with well displayed flow banding. Some horizons contain feldspar and quartz crystals and, locally, pumice fragments. Interbedded mafic tuffs and flows occur rarely. Unit H6 is interpreted to overlie the rhyolites and is mainly a series of basaltic flows which vary from massive to amygdaloidal (near flow tops). Amygdales are typically large (up to 2 cm or more in maximum diameter) and filled with chlorite and/or epidote. Only minor mafic tuffaceous horizons are present in unit H6. Similar massive to amygdaloidal basalts occur widely throughout the map area, mainly at higher stratigraphic levels (in map units H8, 9, 11, and 12), but also in unit H1.

Units H7 and H8 both are mainly crystal tuff units which are lithologically similar (and possibly correlative). Unit H7 occurs in the southeastern part of the map area, where it appears to overlie Unit H6. The most abundant lithology is massive, medium-grained crystal meta-tuff with 20-50% plagioclase (now albite) crystals in a sericitic groundmass. A second characteristic rock type is grey pyritic felsite, consisting mainly of microcrystalline quartz and sericite, with abundant pyrite. Mafic and porphyry sills and dykes are also very common. Unit H8 occurs to the south and north of the western end of the Point Wolfe River Pluton. It is dominantly composed of dacitic crystal tuff, similar to that of Unit H7, with minor mafic tuff and local occurrences of grey felsite as in unit H7.

Unit H9 is a heterogeneous unit including massive conglomerate, dark grey laminated siltstone/mudstone, dacitic crystal tuff (or porphyry), and fine-grained andesitic ash-tuff (or siltstone). The conglomerates contain subangular to subrounded volcanic clasts, and are similar to some in unit H12, whereas some other lithologies included in the unit have similarities to units H8 and H10.

Unit H10 is a distinctive fine-grained sedimentary unit consisting of grey- and buff-weathered laminated siliceous siltstones with mudstone and fine sandstone layers. These rocks are generally massive and uncleaved. In sharp contrast, unit H11 is mainly volcanic breccia (or lapilli tuff). Although basaltic rocks occur locally (also mainly as lapilli tuffs but locally amygdaloidal flows), unit H11 is typically of dacitic composition. The rocks (both dacitic and basaltic) tend to be massive and black on the fresh surface, but texture is best seen on buff- to grey-weathered surfaces. Lapilli range up to 1 m or more in extent, and are varied in texture (but much less so in composition). Some consist themselves of lapilli tuff with large flattened pumice fragments. Rare lapilli of laminated siltstone (as in underlying unit H10) are present. Unit H12 consists of massive epiclastic conglomerate, typically with small subangular to subrounded volcanic clasts of dacitic and rhyolitic composition in a feldspar-rich matrix. The clasts are poorly sorted and rarely more than 1 or 2 cm in size.

The youngest unit is interpreted to be unit H13, consisting of relatively homogeneous pink spherulitic rhyolite. Texture is distinctive, with plagioclase microphenocrysts in a spherulitic groundmass of mainly quartz and potassium feldspar. This unit is interpreted to be the extrusive (or nearly extrusive) correlative of the Bonnell Brook syenogranite (see below).

Carboniferous sedimentary rocks (including limestone of the Windsor Group and clastic rocks of the Horton and Hopewell groups; St. Peter, 1987) are in unconformable or faulted contact with the Late Hadrynian units along the northern margin of the map area. These units are not included in the present mapping.

Plutonic Units

Plutonic rocks in the map area are divided into 6 major plutons and also occur in several minor (unnamed) bodies. Pluton names generally follow those assigned by Ruitenberg et al. (1979). The plutonic rocks are named according to the terminology of Streckeisen (1977). Ages of the plutonic units (and hence their host rocks) are based on radiometric age data reported by Barr (1987), Barr and White (1988), and other as yet unpublished data.

The Goose Creek leucotonalite forms several small intrusions, all within map unit H2. It is a grey, leucocratic, medium-grained rock, consisting mainly of quartz and plagioclase (now albite) and abundant secondary epidote. Most samples are characterized by abundant granophyric intergrowth of quartz and albite.

The Alma Pluton, located northwest and west of the village of Alma, consists of varied dioritic rocks ranging from diorite through quartz diorite to tonalite. Locally the rocks display well developed layering and banding of probable cumulate origin. The major minerals are medium-grained plagioclase and amphibole.

The Fortyfive River Pluton consists of three separate elongate bodies, all of which are composed of medium-grained pink to green (altered) granodiorite. Texture is subporphyritic, with subhedral plagioclase in a groundmass of quartz, potassium-feldspar, and amphibole (now mainly replaced by chlorite, epidote, actinolite, and other secondary minerals).

The Point Wolfe River Pluton is the largest intrusion in the map area. It is composite, consisting of seven separate mappable units. Several small areas of quartz diorite to tonalite with varied fine- to medium-grained textures occur in the northern half of the pluton, and similar lithologies also occur as abundant xenoliths in the Pollett River granodiorite. An area of coarse-grained quartz monzodiorite to tonalite occurs in the northern part of the pluton, and coarse-grained granite (Blueberry Hill) forms the southeastern margin of the pluton in that area. The latter unit is generally intensely sheared to a protomylonite but locally the original coarse-grained texture, dominated by quartz, plagioclase, and K-feldspar, is preserved. A large area of granite porphyry (feldspar and quartz in a fine-grained granitic groundmass) occurs in the northernmost extension of the pluton; it tends to be intensely deformed and altered, and contains abundant mafic xenoliths. Most of the northern part of the pluton consists of the Pollett River granodiorite, a medium-grained rock with subporphyritic texture locally similar to the Fortyfive River granodiorite. Especially in the northern extension of the pluton, the Pollett River granodiorite contains abundant dioritic and mafic volcanic(?) xenoliths, and in many places is strongly sheared and cataclased. The southern half of the Point Wolfe River Pluton is mainly a distinctive quartz-porphyritic granodiorite gradational locally to granite, termed the Old Shepody Road unit. This unit also forms several small bodies in the northern part of the pluton, and is inferred to be the youngest unit. Minor areas of fine-grained (micro)diorite and granodiorite occur along the southern margins of the Old Shepody Road granodiorite. The latter also contains abundant fine-grained syenogranitic dykes which are interpreted to be co-magmatic with the Bonnell Brook syenogranite.

The Bonnell Brook Pluton occurs in several separate bodies in the southeastern part of the map area, and extends beyond the map area to the east (Ruitenberg et al., 1979). It consists mainly of relatively homogeneous syenogranite which varies in grain size from medium-grained equigranular to fine-grained microporphyritic, the latter with mainly plagioclase microphenocrysts in a granophyric groundmass. This textural variant tends to occur along the margins of the pluton and is interpreted as a chilled facies. The syenogranite contains minor (less than 3%) biotite, amphibole, sphene, and allanite. Along the southeastern margin of the pluton an extensive area of diorite to quartz diorite is developed. It varies in grain size from medium to coarse and is cut by abundant dykes of the syenogranite, as well as minor fine-grained granodiorite.

The Mechanic Settlement Pluton occurs near the northern margin of the Caledonian Highlands in the vicinity of the community of Mechanic Settlement. It is mainly of gabbroic composition, but grades to diorite and granodiorite, and is a layered intrusion. Ultramafic layers contain abundant olivine and orthopyroxene. Rocks of map units H1 and H10 display hornfelsing and development of biotite adjacent to the pluton.

Minor intrusive units, all of uncertain age, occur throughout the map area. Various dykes, mainly mafic in composition, occur widely in most map units, including the plutons, and are not shown on the map. However, larger mappable intrusions include: (a) plagioclase porphyry of dioritic composition southwest of the Point Wolfe River Pluton in unit H9; (b) fine- to medium-grained granodiorite within map unit H10; (c) scattered isolated bodies of varied granitic to syenitic compositions; (d) a dyke(?) of massive, coarse-grained diorite in map unit H4 northeast of Point Wolfe River; (e) bodies of gabbroic to dioritic composition within unit H2 in the upper part of Fortyfive River.

Structural Geology

Most of the map units, especially those including and east of unit H8, are pervasively deformed, with fine-grained metasedimentary and metatuffaceous units displaying a strong phyllitic foliation (S1) and more massive and/or competent units a less intensely penetrative S1 foliation. Primary layering and bedding (So) are generally subparallel to the S1 foliation. In the northern and central parts of the map area, the S1 foliation strikes essentially northeast and dips mainly at moderate to steep angles to the northwest. In the southern part of the area, strikes and dips of S1 are more variable. Large-scale folding or doming on an axis trending NE-SW can partly explain changes in So and S1 orientations in the southern part of the map area, whereas a synclinal structure is inferred in the northwestern part of the map area. Possibly related D2 structural features include crenulation and crenulation cleavage (S2) in fine-grained rocks. Inhomogeneously developed shear foliations (S2) in the plutonic units are also attributed to D2. Sub-parallelism of S2 and S1 foliations suggests that later movements essentially along S1 (transposition) may have occurred, which can explain at least in part the cataclastic overprint observed in many of the metavolcanic and metasedimentary units. Local deviations (cross-folding; kinking) in the main D1 and D2 structural trends can be attributed to other, presumably younger, tectonic events.

Faults also contribute to the structural complexity; the dominant trend is northeast but weaker fault systems trend north-northeast and north. Faults are shown on the map only when there is direct geological evidence for their presence.

Economic Geology

Copper, gold, and silver were reportedly mined from quartz veins in unit H1 near the coast about 3 km southwest of the mouth of Point Wolfe River, and gossan zones and quartz veining are widely developed elsewhere in this unit. Map unit H2 hosts the Teahan Zn-Cu-Pb-Ag-Au deposit (Ruitenberg et al., 1979). Rocks outcropping in the vicinity of the deposit are a mixed sequence of tuffaceous and mafic phyllitic rocks, typical of the unit as a whole, but in the area of the old shaft, float is mainly quartz-rich schist, carbonate-quartz-talc rock, and vein quartz. Abundant pyritiferous grey felsites are abundant in map units H7 and 8 and suggest potential for gold mineralization.

The mafic to ultramafic layered Mechanic Settlement Pluton has potential for platinum and related mineralization.

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Energy, Mines and Resources Canada — Énergie, Mines et Ressources Canada

EASTERN CALEDONIAN HIGHLANDS, NEW BRUNSWICK

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