GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

PRELIMINARY SERIES

SHEET 21 J/15 (AND PART OF) 21 J/16

MAP 6-1963
GEOLOGY
HAYESVILLE
NEW BRUNSWICK

Scale: One Inch to One Mile = $\frac{1}{63,360}$

Miles

1 ½ 0 1 2 3

PUBLISHED, 1963
COPIES OF THIS MAP MAY BE OBTAINED FROM THE DIRECTOR, GEOLOGICAL SURVEY OF CANADA, OTTAWA

PRINTED BY THE SURVEYS AND MAPPING BRANCH

LEGEND

PALAEOZOIC

DEVONIAN

10	10a, buff, fine- to medium-grained muscovite-biotite quartz monzonite; 10b, dykes of quartz monzonite and greisen, related to 10a; 10c, pink and grey, medium- to coarse-grained muscovite-biotite quartz monzonite; buff and pink fine-grained quartz monzonite; 10d, miarolitic quartz monzonite and syenite facies within 10c
9	Quartz monzonite similar to, and gradational between, quartz monzonite of units 8b and 10a: mainly pink to buff medium-grained biotite quartz monzonite and buff fine-grained quartz monzonite; 9a, miarolitic and pegmatitic syenite
8	8a, grey coarse-grained biotite granodiorite; 8b, pink coarse-grained biotite quartz monzonite; some pink and buff aplite dykes; 8c, buff to pink porphyry, border phase of 8b; 8d, pink and grey coarse-grained biotite quartz monzonite; some pink aplite dykes

DEVONIAN OR EARLIER

7	Grey to green-grey, fine- to medium-grained hornblende diorite

SILURIAN

MIDDLE AND (?) UPPER SILURIAN

6	Grey and green-grey, fine- to coarse-grained quartzose greywacke, grey and dark grey slate
5	Green and grey-green slate and fine-grained greywacke, maroon slate

LOWER (?) AND MIDDLE SILURIAN

4	Grey fine-grained greywacke, coarse-grained lithic greywacke, grey and dark grey slate; 4a, grey and dark grey greywacke, grit, and fine pebble conglomerate; grey and dark grey slate

ORDOVICIAN OR SILURIAN

UPPER ORDOVICIAN OR LOWER SILURIAN

3	3a, pink to buff, fine- to medium-grained, leucocratic biotite quartz monzonite; 3b, pink to grey, medium-grained, cataclastic biotite quartz monzonite and granodiorite with some secondary muscovite; 3c, mainly green-grey cataclastic porphyritic quartz monzonite; 3d, mainly biotite-plagioclase quartz augen gneiss; 3e, pink to buff mylonite

ORDOVICIAN

MIDDLE AND (?) UPPER ORDOVICIAN

2	Greenstone, greywacke-hornfels, carbonaceous hornfels; 2a, mainly green-grey massive greenstone, porphyritic greenstone (hornblende; feldspar) mostly as sills, few as dykes; minor tuff, amygdaloidal and pillowed flows; 2b, greenstone of unit 2a and buff laminated meta-siltstone(?); 2c, mainly grey to white aphanitic rhyolite, tuff; 2d, mainly light to dark grey greywacke and slate; minor grit and pebble conglomerate, dark grey carbonaceous slate and meta-chert, laminated chert and slate; 2e, contact metamorphosed equivalents of unit 2d: brown hornfels and greywacke-hornfels, thin banded brown and white (bleached) hornfels, dark grey carbonaceous hornfels; 2f, graphitic meta-chert and slate; 2g, contact metamorphosed equivalents of unit 2f: dark grey argillite, hornfels, and quartzite; 2h, red and green argillite and slate, commonly with manganiferous carbonate nodules; 2i, contact metamorphosed equivalents of unit 2h: dark maroon and dark grey laminated hornfelsic argillite and dark grey hornfels

CAMBRIAN AND/OR LOWER ORDOVICIAN

1	Light grey to greenish grey laminated fine-grained quartzite, siltstone, and slate, medium- and coarse-grained quartzite, slate and argillite, minor medium grey, and brown, argillite; regionally metamorphosed equivalents (1a, 1b): 1a, biotite-muscovite schist and quartzite; 1b, sillimanite-muscovite-biotite-quartz gneiss and minor pegmatite; contact metamorphosed equivalents (1c, 1d): 1c, slate with ovoid chlorite porphyroblasts and quartzite; 1d, biotite-muscovite spotted argillite and hornfels, quartzite

A	Grey fine- to medium-grained diorite dyke

Rock outcrop . . . . . ×
Geological boundary (defined, approximate and assumed)
Geological boundary (gradational)
Limit of geological mapping
Bedding, tops known (inclined, vertical overturned) (90)
Bedding, tops unknown (inclined, vertical)
Cleavage in slate (inclined, vertical)
Schistosity and gneissosity (inclined)
Foliation, cataclastic (inclined, dip unknown)
Lineation, axis of fold with plunge
Fault (defined, approximate, assumed)
Major anticlinorium, location of axis approximate (upright, overturned)
Major synclinorium, location of axis approximate (upright, overturned)
Major anticlinorium or synclinorium (arrow indicates plunge)
Glacial striae
Lineament from air photographs, drumlinoid topography
Esker and associated gravel and sand
Fossil locality . . . . . Ⓕ
Isotopic age, K-argon method, million years, by laboratories of Geological Survey of Canada (B, biotite; M, muscovite) . . . . . B 392 Ⓐ
Mine adit and drifts
Trench
Mineral occurrence (in bedrock, in quartz vein, in float probably near source)
Isograd, biotite and chlorite (approximate)

MINERALS

Arsenopyrite	asp	Galena	gn
Beryl	by	Molybdenite	mo
Chalcopyrite	cp	Sphalerite	sp
Fluorite	fl	Wolframite	wf

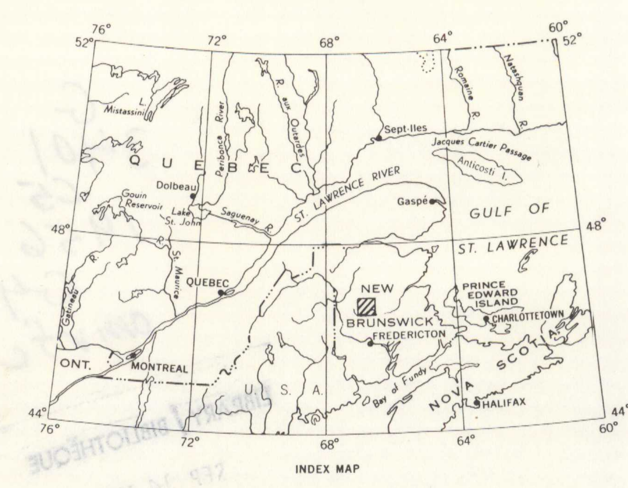
Geology by W.H. Poole, 1959, 1960

Cartography by the Geological Survey of Canada, 1963

Road, gravel
Cart track
Trail
County boundary
Parish boundary
Intermittent stream
Marsh
Contours (interval 50 feet) (750)
Height in feet above mean sea-level 724

Base-map by the Surveys and Mapping Branch, 1957 with revisions to roads by the Geological Survey of Canada, 1963

Approximate magnetic declination, 22° 25' West, decreasing 2.5' annually.



DESCRIPTIVE NOTES

All roads, except the one through Hayesville settlement, are owned and maintained by lumber companies; access is gained through gates tended in summer.

Cambrian and Ordovician sedimentary and volcanic rocks (1, 2) are a continuation of those mapped as Tetagouche Group to the northeast in the Bathurst mining camp[1]. In the area studied, they comprise two distinct groups, which are apparently structurally conformable and are intergradational over several tens of feet. The older group (1) is a quartzose sequence more typical of a semi-stable depositional environment. The northwest edge of the belt of quartzose strata contains the highest grade of regional metamorphism in the area; schist and quartzite (1a) near Slate Island Brook grade southwesterly into gently dipping sillimanite gneiss and pegmatite (1b). Deformed and recrystallized brachiopods collected near Lower Birch Island suggest only an Early Palaeozoic age.

The younger group (2) is a greenstone-greywacke assemblage typical of the unstable depositional environment of a eugeosyncline. Volcanic rocks and their intrusive equivalents (2a, 2b, 2c) occur at the base of the assemblage. They pinch and swell along strike, are thickest between the middle part of Sisters and Rocky Brooks, and thin and pinch out towards the south. Most of the younger group is greywacke and slate (2d), and hornfels (2e). Characteristics of these rocks vary from place to place along and across strike so that marker beds are rare. Ill-defined units, 1/4 to 1 mile wide, can be traced for only a few miles before they grade into other strata with slightly different characteristics; most of these effects are apparently caused by facies changes rather than by faults and complex plunging folds. Only weak evidence of the narrow and distinct slate and meta-chert formations (2f, 2g, 2h, 2i) lying above the quartzose strata (1) in the southeast are found in the northwest limb of the major synclinorium. Carbonaceous rocks occur principally in the lower parts of the assemblage. Graptolites found within carbonaceous slate and meta-chert are Middle Ordovician and possibly also Upper Ordovician.

Granitic rocks (3) have intruded and metamorphosed only the quartzose strata (1). They comprise normal calc-alkaline quartz monzonite and granodiorite, which became pervasively sheared and partly recrystallized almost certainly before deposition of the Silurian sequence (4-6). Trends at variance with typical northeast Devonian trends are confined to these old granites and the quartzose strata (1) in this map-area. Cataclastic granitic rocks and mylonite occur within a few miles south of the fault zone consisting of mylonite and crushed mylonite on the northern edge of the map-area. Granitic rocks farther south are progressively less cataclastic. Isotopic dates confirm the pre-Devonian age of these intrusions.

A sequence that comprises Middle Silurian and possibly also Lower and Upper Silurian strata is separated from older rocks by major faults. The entire sequence comprises graded beds of greywacke and slate and intercalated thicker units of slate; some grits and conglomerate occur in basal parts of graded beds in the lowermost part of the sequence (4a). Detritus in greywacke and coarser rocks indicates a source area of metamorphic rocks with deformed quartz not unlike presently exposed pre-Silurian rocks (1-3). Graptolites from the lower formation (4) south of the map-area[2] are Middle Silurian (Wenlock); graptolites from units 4 and 6 of this area are Silurian monograptids. Upper parts of the youngest formation (6) are undated and could be partly Upper Silurian

Diorite (7) is massive and largely undeformed. It appears to have been metamorphosed by Devonian granite (8d). It is probably Devonian, but could conceivably be Ordovician or Silurian.

Devonian granitic rocks (8-10) and their metamorphic aureoles are wholly within pre-Silurian rocks (1-3). All are late tectonic intrusions with sharp discordant contacts and hornfelsed wall-rocks. These granitic rocks are typically homogeneous and undeformed, and lack mineral orientation. They contain few pegmatite dykes and some aplite dykes, and, for the most part, lack inclusions. Areal extent of metamorphic rocks, the few contacts observed in outcrop, and, to a lesser degree, the configuration of granitic contacts relative to topography all indicate that granitic bodies 10a and 10c have steep walls and gently sloping and irregular roofs. This type of granitic rock rock probably underlies the entire central part of the map-area at not too great depth.

Hornfels borders the Devonian intrusions (8-10), whereas schist and gneiss border the pre-Devonian intrusions (3). Metamorphic isograds around the Devonian bodies mark the approximate location of the first appearance of indicator minerals, chlorite and biotite. Chlorite in argillite and slate of the quartzose strata appears as small round or oblong knots (1c); first appearance of chlorite could not be recognized in slates of the greywacke family (2e). First-appearing biotite imparts a brown colour to siltstone of the quartzose strata (1d) and a dark brown cast to otherwise grey greywacke of the younger group (2e). The apparent continuity of the chlorite isograd in the quartzose strata and the biotite isograd in the younger greywacke must be controlled by chemical composition of the rocks, particularly of iron and magnesium. The isograds were not recognized in gneiss (1b), greenstones (2a, 2b), or old granitic rocks (3).

Structure of the rocks locally is very complex, but regionally appears simple in gross aspect. A belt comprising the two oldest groups of strata (1, 2) in the form of faulted synclinoria and anticlinoria lies in fault-contact with a belt of Silurian strata (4-6) in the form of the northwestern limb and central zone of a synclinorium. The axial zones of these major folds are located only approximately. Dips of most beds and cleavage exceed 60 degrees; plunges of minor folds vary unsystematically from nearly vertical to nearly horizontal. Many beds are overturned; through the central part of the map-area, most of the beds with known direction of tops are overturned to the southeast, whereas in the southeastern third of the map-area many beds are overturned to the northwest. Nearly all of the strata lying between points at least as far west as the mouth of Burnthill Brook and as far east as the granite contact near the mouth of Clearwater Brook are nearly homoclinal and overturned to the southeast.

The mineral rights (with some minerals excluded) of the central part of the map-area are owned by a lumber company.

Burnt Hill Tungsten mine, with more than 4,000 feet of drifts and crosscuts, represents the only known attempt to extract minerals from the map-area. It has not operated since 1956. All other mineral concentrations, shown as occurrences on the map, are small.

All economic minerals of interest are contained in the two oldest groups of strata (1, 2) and in the younger granitic rocks (8-10). Pre-Devonian granitic rocks (3) are barren save for some accessory magnetite and allanite, and a few crystals of beryl in a block of pegmatite. Silurian strata (4-6) contain only pyrite in quartz and carbonate-quartz veins.

Two distinct assemblages of economic metals occur in the map-area, viz. tungsten-molybdenum-tin and copper-lead-zinc. Northwest-trending quartz veins containing wolframite and molybdenite cut hornfels and quartzite (1c, 1d) in the tungsten mine and vicinity. The veins contain other minerals in minor and accessory amounts, such as arsenopyrite, base-metal sulphides, native bismuth, cassiterite, topaz, beryl, fluorite, and apatite[4]. A few quartz veins, which contain lesser amounts of a few of these minerals, cut the same host rocks northeast of the mine. Similar northwest-trending quartz veins cut granitic rocks (10a and 10c). Wolframite is an accessory mineral in a quartz vein found along Sisters Brook in greywacke-hornfels (2e) not far from dykes (10b). Greisen borders most quartz veins in granitic rocks (10a, 10c) and some veins in metamorphosed quartzose strata (1d).

Grab samples of 3 1/2-foot-wide veins of quartz and greisen in quartz monzonite (8d) near Little Dungarvon River average less then 1 per cent each of zinc and copper. A large piece of float of similar lithology found near Dungarvon River probably came from a different occurrence.

Almost all base-metal sulphide minerals of the copper-lead-zinc mineral assemblage are confined to the greenstone-greywacke assemblage (2) and their metamorphic equivalents. Disseminated sulphides occur in a brecciated rhodochrosite-rhodonite-quartz rock, previously interpreted as a dyke[3], on the north side of Southwest Miramichi River valley 1/2 mile east of the mouth of Fall Brook. Two grab samples averaged less than 1 per cent each of lead and zinc.

A grab sample of barite-rhodochrosite-quartz nodules in red and green slate (2h) near Lower Birch Island contained 26.7 per cent Mn. The enclosing slates contain less than 10 per cent Fe_2O_3 and 0.75 per cent Mn.

Unusually dark brown soil along the road about 1/2 mile east and northeast of Lower Birch Island contains anomalously high amounts of copper and zinc, as indicated by geochemical analysis[5].

Close spatial relationship of tin and tungsten minerals to granitic rocks (9 and 10) and their metamorphic aureole was confirmed by X-ray fluorescence analysis of treated placer pan concentrates collected from many streams throughout the area.

[1] Smith, C.H.: Bathurst-Newcastle Area, New Brunswick; Geol. Surv., Canada, Map 1-1957 (1957).
[2] Anderson, F.D., and Poole, W.H.: Woodstock-Fredericton, York, Carleton, Sunbury, and Northumberland Counties, New Brunswick; Geol. Surv., Canada, Map 37-1959 (1959).
[3] Poole, W.H.: Hayesville and McNamee Map-areas, York, Northumberland, and Carleton Counties, New Brunswick; Geol. Surv., Canada, Paper 60-15 (1960).
[4] Victor, I.: Burnt Hill Wolframite Deposit, New Brunswick, Canada; Econ. Geol., vol. 52, No. 2, pp. 149-168a (1957).
[5] Gilbert, M.A.: Field and Laboratory Methods Used by the Geological Survey of Canada in Geochemical Surveys. No. 1, Laboratory Methods for Determining Copper, Zinc, and Lead; Geol. Surv., Canada, Paper 59-3 (1959).

MAP 6-1963
HAYESVILLE
NEW BRUNSWICK