GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

PRELIMINARY SERIES

SHEETS 21G AND 21J (PARTS OF)

PUBLISHED, 1959
COPIES OF THIS MAP MAY BE OBTAINED FROM THE DIRECTOR, GEOLOGICAL SURVEY OF CANADA, OTTAWA

LEGEND

PALAEOZOIC

CARBONIFEROUS
PENNSYLVANIAN

27	Grey to green and brown sandstone, grit, and conglomerate; minor grey, green, and red siltstone and shale; 27a, includes some 25
26	Hard and soft, buff, green, and red mottled siltstone, sandstone, and conglomerate
25	White and grey quartz-pebble conglomerate, grit, and sandstone; 25a, locally beneath unit 26;

MISSISSIPPIAN AND/OR PENNSYLVANIAN

24	Basalt and andesite
23	Red and minor green conglomerate, grit, and sandstone; minor red siltstone and shale; in places calcareous cement and limestone nodules; 23a, recomposed granite arkose (may be younger)
22	Rhyolite flows, breccia, and tuff; red shale at base

DEVONIAN

21	Diabase and diorite sills, dykes (in part older than 19 and 20)
20	Quartz monzonite, granodiorite, granite, mainly with biotite; minor syenite
19	Diorite, quartz diorite, gabbro; 19a, gabbro
18	Grey to green siltstone and sandstone, conglomerate

SILURIAN AND DEVONIAN (Undivided)

17	Grey to green slate and siltstone, greywacke; minor conglomerate; 17a, includes Ordovician

SILURIAN OR DEVONIAN

16	Granophyre, porphyritic rhyolite, quartz-feldspar porphyry; 16a, rhyolite sills and dykes; 16b, mainly feldspar-quartz porphyry
15	Andesite, basalt, mainly amygdaloidal, some porphyritic; 15a, related intrusions

SILURIAN
MIDDLE SILURIAN (Mainly)

14	Grey to green slate, greywacke, conglomerate
13	Dark grey calcareous slate; buff and grey-green slate, greywacke
12	Grey to green and red slate, greywacke; manganiferous iron-formation; minor limestone
11	Grey to green slate and greywacke; minor dark grey calcareous slate, limestone, conglomerate; 11a, mainly limestone and argillaceous limestone; 11b, mainly conglomerate; 11c, may be Ordovician
10	Grey quartzose greywacke and slate
9	Green slate and lithic greywacke, maroon slate; minor grey-maroon lithic greywacke
8	Grey fine-grained greywacke, grey and dark grey slate, minor grit; 8a, light green and grey slate; minor maroon slate with manganiferous carbonate nodules; 8b, includes pebble-conglomerate; 8c, includes some undifferentiated A
7	Black, pyritic, carbonaceous slate

ORDOVICIAN OR SILURIAN

6	Amygdaloidal basalt

ORDOVICIAN (Mainly)

5	Light grey quartzite, siltstone, slate; 5a, includes quartzite-pebble conglomerate
4	Red, green, and grey slate and chert with manganiferous carbonate nodules
3	Black carbonaceous slate and chert
2	Thin-bedded dark grey argillite, slate, and fine-grained greywacke; minor grit; 2a, light coloured volcanic rocks
1	Grey and grey-green slate, argillite, and greywacke; minor grit, conglomerate, quartzite, and green and maroon slate, black chert; 1a, mainly basic volcanic rocks; 1b, mainly rhyolite

---

A	Metamorphic rocks: biotite hornfels, schist, and gneiss, greenstone; Aa, includes a few bodies of 19a

Drift-covered area . . . .
Geological boundary (defined, approximate, assumed). . . . .
Limit of geological mapping . . . .
Bedding, tops known (horizontal, inclined, vertical, overturned). . . . .
Bedding, tops unknown (inclined, vertical, dip unknown). . . . .
Schistosity, cleavage (inclined, vertical, dip unknown) . . . .
Lineation, fold with plunge of axis . . . .
Fault (defined, approximate, assumed). . . . .
Glacial striae . . . .
Esker . . . .
Mineral prospect or occurrence . . . . Pb ×
Shaft . . . . ◪
Fossil locality (discovered or re-examined since 1905; discovered before 1905, location approximate). . . . . Ⓕ ⓕ

AGE OF FOSSIL COLLECTIONS

Ordovician	O	Silurian	S	Silurian or Devonian	S/D
Palaeozoic	P	Devonian	D		

MINERAL SYMBOLS

Antimony	Sb	Iron	Fe
Barite	ba	Lead	Pb
Coal	C	Manganese	Mn
Copper	Cu	Molybdenum	Mo
Gold	Au	Silver	Ag
Zinc	Zn		

Geology by F.D. Anderson (1950-1954), H.A. Lee (1951, 1954), and W.H. Poole (1956-1958), Geological Survey of Canada; W.M. Tupper (1955) and J.M. Patterson (1956-1957), New Brunswick Department of Lands and Mines; A.C. Freeze (1936) thesis, University of New Brunswick. Geology compiled by F.D. Anderson and W.H. Poole, 1959.

Approximate magnetic declination, 21° 58′ West

Cartography by the Geological Survey of Canada, 1959

Air photographs covering this area may be obtained through the National Air Photographic Library, Topographical Survey, Ottawa, Ontario

In response to public demand for earlier publication, Preliminary Series maps are now being issued in this simplified form, thereby effecting a substantial saving in time. There is no loss of information, but the maps will be clearer to read if all or some of the map-units are hand-coloured.

DESCRIPTIVE NOTES

The map-area embraces the southern end of a belt of granitic batholiths and deformed early Palaeozoic rocks that extends northeasterly from Maine to Bathurst. The rocks of the area may be divided into two main structural units:

1. Pre-Carboniferous sedimentary and volcanic strata, intensely deformed, but regionally metamorphosed to slate grade.
2. Carboniferous coarse-grained sediments mostly undisturbed and locally including basic and acidic volcanic rocks.

The pre-Carboniferous rocks are mainly slate and greywacke with little detrital feldspar. Graded beds are few and crossbedding is extremely rare. These rocks have been separated on a lithological basis involving such features as colour, gross proportions of argillaceous and arenaceous rocks, and presence or absence of volcanic rocks, limestone, and conglomerate. In nearly all cases the relative age of the formations is unknown. Fossils are rare and mostly non-diagnostic. The strata are highly folded, exposures are few and most are small and disturbed, and reasonable estimates of thicknesses and stratigraphic succession cannot be made. As a result, the pre-Carboniferous map-units as listed in the legend have little or no stratigraphic significance.

Areally, a central, southwesterly trending belt of Ordovician rocks (1-5) is flanked by Silurian rocks (7-14) and a granitic batholith (20).

The Ordovician and Silurian rocks are lithologically similar and unrecognized areas of one may be found in the other as a consequence of folding or faulting. Altered and somewhat schistose basic volcanic rocks (1a), light coloured volcanic rocks (2a), and rhyolite (1b) appear to be restricted to Ordovician strata. Quartzite (orthoquartzite) (5), quartzite-pebble conglomerate (5a), and chert (3, 4) are restricted to Ordovician strata in the northeastern part of the belt. Diorite and gabbro (19) and most of the basic sills and dykes (21) are also largely restricted to the Ordovician strata. Graptolites on Bull Creek (1a) and Eel River near Benton (1), and trilobites in highly deformed rocks (17a) on the Becaguimec River, are definitely Ordovician, whereas the brachiopods near Rocky Brook and on Middle Hayden Brook are designated as probably Ordovician.

Strata of known Silurian age lack volcanic rocks and in the south and west are weakly characterized by scattered pods of limestone and calcareous argillite, and locally by more gentle dips of the beds. Manganiferous iron formation (12) in the west is Silurian, but similar iron- and manganese-bearing beds occur in Ordovician rocks near Oak Mountain (1) and Meductic (1), and northeast of the Napadogan-Cross Creek Settlement road (4).

The Silurian units of the east and west belts can not be correlated lithologically although some are undoubtedly equivalent in age. Graptolites on Tay River, Grand John Brook, and nearby Nashwaak River (8), and shells north of Skiff Lake (11a) all in the east belt, and the graptolites of the Meduxnekeag River (12) in the west belt, are all definitely Middle Silurian but occur in rock assemblages whose gross characteristics are very different.

The Silurian rocks (7-14) are everywhere apparently conformable structurally with the Ordovician rocks (1-5) but the stratigraphic relations are uncertain and may be different in different places. The northwestern contact is partly a fault, but near Debec Junction it is probably an angular unconformity. Along the southeastern contact in the north, the abrupt change in the lithologies of widely different rock assemblages (5, 6, 7) suggest a disconformable contact. On the other hand, a fossiliferous bed a few feet thick on the easternmost edge and stratigraphic top of the east belt of quartzite (5) is present for over 11 miles along the contact, indicating a lack of erosion at the top of unit 5 there.

The igneous rocks of units 15 and 16 may not be the same age in different parts of the area.

Intimately folded Silurian and Devonian rocks (17) are neither sufficiently different lithologically nor well enough exposed to permit separation in the northwest part of the area.

Basic intrusive rocks (19) vary in texture and composition, particularly in the north half of the area. Additional unmapped bodies of gabbro occur north of the Nashwaak River among metamorphic rocks (Aa). Acidic intrusive rocks (20) are uniform, massive, and coarse grained. Locally some are foliated; others are closely fractured, faulted, and reddish in colour, such as the body on the lower part of Napadogan Brook. Syenite (20) is common in the hornblende-biotite granitic body north of Benton. Basic sills (21), mostly unaltered and with ophitic textures, are exceedingly common in the Ordovician rocks (1) in the central part of the area, but are much less common elsewhere. Others, as in the northeast, are considerably altered and carbonatized.

Metamorphic rocks containing biotite (A) occur along most borders of the dioritic and granitic bodies (19, 20). Along some borders, only white and green micas have been developed. Andalusite and cordierite are present in some zones; crystalline schists and gneisses are common in the northern part of the area and southwest of Middle Southampton. In the latter area, biotite is present beyond the area mapped as unit A.

All Carboniferous units (22-27), with the possible exception of unit 26, in different places unconformably overlie pre-Carboniferous rocks directly, that is each unit transgresses older Carboniferous units. The rocks are generally crossbedded. Pre-Carboniferous rocks for as much as a few tens of feet below the unconformity, and particularly below the red sediments (23), have developed red and green colours, some analogous to diffusion rings. Red hematitic ochre occurs locally. In the northeast, limestone nodules occur here and there throughout the formation (23) and with calcite veins in a few places at, and a few feet below, the unconformity. Basic volcanic flows (24) of local extent are found at and within the top 40 feet of the red sediments (23) and on the pre-Carboniferous rocks west of Green Hill and northeast of McGivney. A probable volcanic neck (24) cuts pre-Carboniferous rocks (9) about 1 mile south of Stanley. The quartzose beds (25) disconformably overlie rocks of unit 23; from Stanley towards Fredericton, they thicken from a few feet to over 120 feet. The beds of unit 26 are uniformly about 10 feet thick and may have been formed partly by Pennsylvanian weathering processes. In the northeast, the coal-bearing sediments (27) gradationally overlie the quartzose sediments (25), but, in one place farther northeast, fill channels in the intervening thin unit 26. In general, the distribution and inter-relationships of the various formations of the main body of Carboniferous rocks indicate that units 22-27 are now distributed much as they were at the end of the Pennsylvanian.

Almost everywhere the pre-Carboniferous rocks are cut by a well-developed cleavage. Generally they trend northwesterly, apparently occupying the core of an anticline. In general the axis of this anticline is horizontal but the southwestern part plunges gently southwest. In the central part of the area, however, the Ordovician rocks (1) appear to have been deformed into a gigantic drag-fold.

The major structures in the Silurian rocks in the northeast are folds but the stratigraphic relations of units 8, 9, and 10 are unknown. In the eastern belt the Ordovician quartzites (5) dip and face east, hence, unit 10 is the youngest of the Silurian units and the folds in them plunge northeasterly. On the other hand, some beds dip southwest, suggesting south-plunging folds and a normal fault along at least parts of the Ordovician-Silurian contact. Everywhere, a profusion of minor folds and some faults complicate the structural pattern and render its satisfactory solution impossible.

The Carboniferous rocks are undisturbed and flat-lying to gently dipping, but anomalously high dips north and southwest of Fredericton, near Upper Prince William, and near the Becaguimec River may indicate faults and/or folds.

Most of the base metal sulphide deposits occur in Ordovician rocks. The common ore minerals are chalcopyrite, sphalerite, and galena; these are generally associated with quartz veins, but in most of the occurrences there is some wall-rock replacement by sulphides. Exploratory work has been varied and in places intermittent throughout the last century. Many of the properties have shallow shafts and trenches, and in recent years some of the more promising deposits have been diamond drilled and surveyed by geophysical methods.

Chalcopyrite, chalcocite, and iron sulphides occur as stringers and lenses in basic volcanic rocks (15) and coarse-grained intrusive rocks (19) west of Becaguimec Lake. Sphalerite, galena, chalcopyrite, and iron sulphides occur as a replacement of sedimentary and volcanic rocks (2, 2a) near Sisson Brook, a tributary of Napadogan Brook.

Iron and manganese rich sediments occur in both Ordovician and Silurian strata. The Ordovician occurrences are low grade and have not been given more than a cursory examination. The Silurian iron and manganese deposits are relatively larger and richer and some have been mined for over 100 years. The most advanced economic project in the area is the current development program of Strategic Manganese Corporation, Limited, to treat manganiferous iron formation (12) west of Woodstock and produce ferro-manganese.

Stibnite appears to be confined to Silurian strata. Near Lake George, stibnite-bearing quartz veins were mined as early as the mid-1800's. Similar veins are present near Coldstream. Barite with a little galena was found in 1958 by H.A. Lee east of Woodstock (See, Geol. Surv., Canada, Information Circular No. 2, 1958). Disseminated molybdenite occurs with tourmaline and beryl in quartz monzonite (20) west of Zealand Station. In the last century, argentiferous galena was mined near Woodstock and occurrences of gold were reported near Oak Mountain and Knowlesville. Gold and silver have also been reported in assays of the various base metal showings.

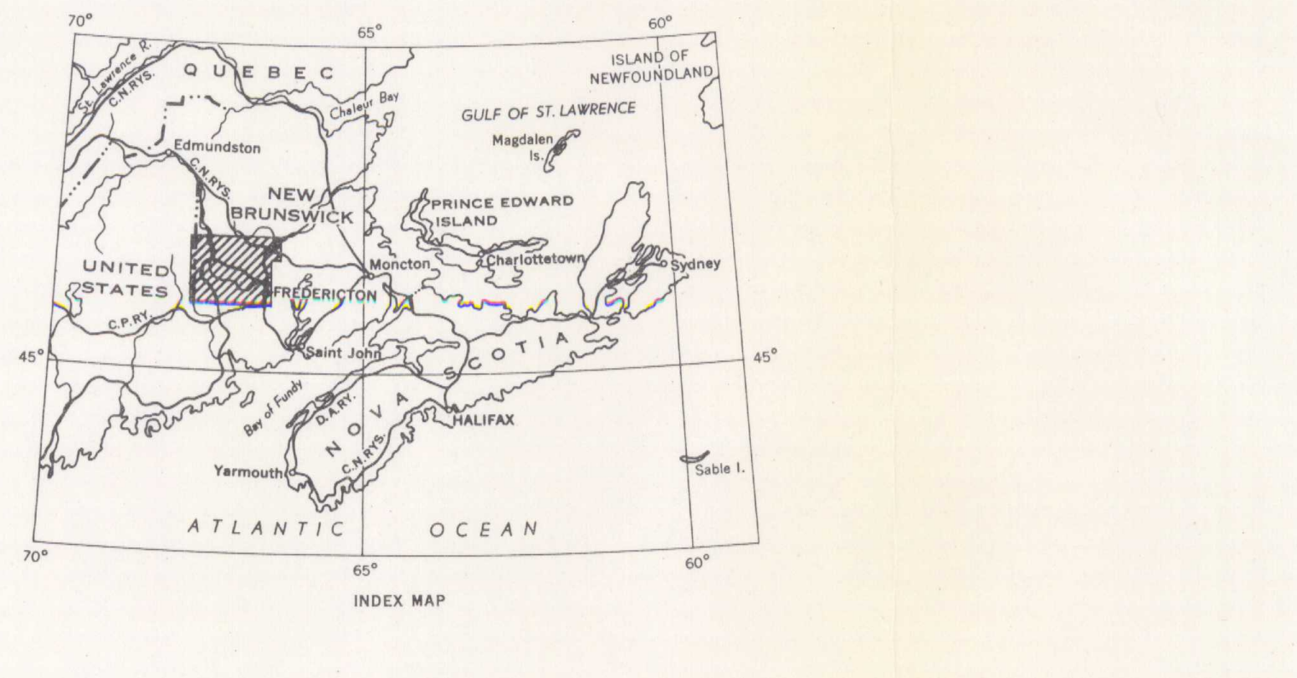
Coal, although widespread in the youngest Pennsylvanian strata (27), has not been found in commercial quantities. All coal prospects marked on the map have been known for several years. The Cross Creek prospect has the thickest seam, but it pinches from 14 to 7 inches in 15 feet.

Radioactive minerals were recently found in rhyolitic rocks of Carboniferous age south of the map-area (See, Gross, G.A.: Uranium Deposits in Gaspe, New Brunswick, and Nova Scotia; Geol. Surv., Canada, Paper 57-2, 1957).

Aeromagnetic maps are available for most of the district. The magnetic background ranges from 3,100 gammas in the southeast to about 3,300 gammas in the northwest. The sedimentary rocks, including the iron formation (12), are magnetically weak and the magnetic maps are of little use in resolving structure or identifying strata. Many of the igneous and metamorphic rocks contain enough magnetite to cause magnetic anomalies. High magnetic anomalies in the north central part of the map-area have been attributed to a gabbroic mass and rocks metamorphosed by a granitic intrusion; the anomalies roughly parallel granitic contacts. In the central part of the area, southeasterly trending isogams are abruptly bent into a northeasterly direction. The northeasterly trending anomaly is interpreted as a fault that cuts sedimentary rocks and parallels the border of a granitic batholith (20) lying a few miles to the southeast. There, the anomalies are probably caused by swarms of diabase sills and dykes. Part of the weak linear anomaly trending northeast in the northeast part of the area is apparently caused by a volcanic rock (6), but, to the southeast, the anomaly crosses sedimentary rocks (5, 7, 8) and a granitic body (20) for no apparent reason.

References

Anderson, F.D.: Millville Map-area, New Brunswick; Geol. Surv., Canada, Paper 53-32, 1954.
Anderson, F.D.: Woodstock Map-area, New Brunswick; Geol. Surv., Canada, Paper 53-33, 1954.
Anderson, F.D.: Coldstream Map-area, New Brunswick; Geol. Surv., Canada, Paper 55-59, 1956.
Caley, J.F.: Geology of the Woodstock Area, New Brunswick; Geol. Surv., Canada, Mem. 198, 1936.
Freeze, A.C.: Geology of the Fredericton Sheet, New Brunswick; M.Sc. Thesis, Univ. of New Brunswick, 1936.
Lee, H.A.: Surficial Geology of Fredericton, New Brunswick, Geol. Surv., Canada, Paper 56-2, 1957.
Patterson, J.M.: Geology of the Canterbury Map-area, West Half, M.Sc. Thesis, Univ. of New Brunswick, 1958.
Patterson, J.M.: Canterbury Map-area, West Half, New Brunswick Dept. of Lands and Mines, 1957.
Patterson, J.M.: Canterbury Map-area, East Half, New Brunswick Dept. of Lands and Mines, 1958.
Poole, W.H.: Burtts Corner Map-area, West Half, New Brunswick; Geol. Surv., Canada, Map 7-1957, 1957.
Poole, W.H.: Napadogan Map-area, New Brunswick; Geol. Surv., Canada, Map 11-1958, 1958.
Tupper, W.M.: Fosterville Map-area, New Brunswick; New Brunswick Dept. of Lands and Mines, 1957.
Geol. Surv., Canada: Geophysics Papers 135, 139, 140, 141, 143, 145, 147, 1953.



MAP 37-1959
GEOLOGY
WOODSTOCK-FREDERICTON
YORK, CARLETON, SUNBURY AND
NORTHUMBERLAND COUNTIES
NEW BRUNSWICK

Scale: One Inch to Two Miles = $\frac{1}{126,720}$

Miles
2 1 0 2 4 6

LEGEND

Main highway. . . . . ⑥
Other roads. . . . .
Railway. . . . .
Post Office. . . . . P
International boundary . . . .
County boundary. . . . .
Parish boundary. . . . .
Indian Reserve boundary. . . . .
Intermittent stream. . . . .
Falls and rapids. . . . . R. F.
Marsh. . . . .
Sand and gravel. . . . .
Height in feet above mean sea-level. 412

MAP 37-1959
WOODSTOCK-FREDERICTON
NEW BRUNSWICK