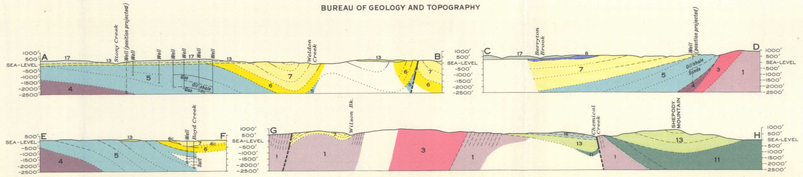
CANADA

DEPARTMENT OF MINES AND RESOURCES

MINES AND GEOLOGY BRANCH

BUREAU OF GEOLOGY AND TOPOGRAPHY



Structure sections along lines A-B, C-D, E-F, and G-H

LEGEND

CARBONIFEROUS

PENNSYLVANIAN

- 18 — *GRAND ANSE FORMATION: reddish-brown sandstone, in part with lenticular beds of arkose and pebble conglomerate, reddish-brown arenaceous shale*
- 16 — *BOSS POINT FORMATION: grey sandstone and shale, red sandstone and shale, some quartz-pebble conglomerate* — PETITCODIAC GROUP
- 17 — *Grey sandstone, quartz-pebble conglomerate, red shale and sandstone*
- 15 — *ENRAGÉ FORMATION: red shale, some sandstone, some conglomerate near base*
- 14 — *SHEPODY FORMATION: red shale and sandstone with interbeds of grey sandstone* — HOPEWELL GROUP
- 13 — *Conglomerate, red shale, sandstone, some argillaceous limestone*

MISSISSIPPIAN OR AND PENNSYLVANIAN

- 12 — *MARINGOUIN FORMATION: red shale and sandstone*

MISSISSIPPIAN

WINDSOR SERIES

- 10 — *Gypsum, anhydrite*
- 9 — *Red shale, gritty conglomerate*
- 8 — *Limestone*
- 7 — *HILLSBOROUGH FORMATION: red feldspathic grit and conglomerate*
- 6 — *WELDON FORMATION: red shale and sandstone; 6a, boulder conglomerate; 6b, red shale, sandstone, and conglomerate; 6c, ash bed* — MONCTON GROUP
- 5 — *ALBERT FORMATION: dark grey, in part bituminous, shale and sandstone; oil shale; some limestone and salt*
- 4 — *MEMRAMCOOK FORMATION: red sandstone and shale*

PALAEOZOIC

PRECAMBRIAN PALAEOZOIC

- 3 — *Albite granite (in part schistose), some quartz diorite, small bodies of volcanic rock*
- 2 — *Quartz diorite (in part schistose), some granite, small bodies of volcanic rock*

PRECAMBRIAN

- 1 — *Schistose, basaltic to rhyolitic, soda-rich lava and tuff; chlorite schist; some schistose sediments*

WINDSOR SERIES
11 — (not subdivided)

Blank areas represent areas where information regarding bedrock geology is not available

Tidal deposits
Rock outcrops (additional to those marked by bedding symbols)
Bedding (inclined, vertical, horizontal, overturned)
Fault (approximate, assumed)
Glacial striae
Fossil locality
Mineral occurrences (gypsum, manganese, zinc-copper-lead)
Wells drilled for gas and oil (dry, gas, oil)
Road and buildings
Road not well travelled
Bush road or trail
Church
School
Post Office
Cemetery
Quarry
Mine tunnel
Prospect
Wharf
Dyke
Lighthouse
Triangulation station
Bench-mark
County boundary
Parish boundary (position approximate)
Intermittent stream
Marsh
Spring
Contours (interval 50 feet)
Depression contour
Height in feet above Mean sea-level

Gyp, Mn, Zn

Geology by G.W.H. Norman, 1930, and 1931.

Base-map from Federal Government map published in 1931. Cartography by the Drafting and Reproducing Division, 1941.

Joins Map 646A, "Moncton"

Joins Map 648A, "Albert"

PUBLISHED, 1941.

MAP 647A

HILLSBOROUGH

ALBERT AND WESTMORLAND COUNTIES

NEW BRUNSWICK

Scale, 2.500 or 1 Inch to 1 Mile

Miles

Approximate magnetic declination, 23°½' West.

DESCRIPTIVE NOTES

GEOLOGY

The volcanic and interbedded rocks (1) of Caledonia Mountains are similar to rocks underlying the Cambrian in the southwestern part of these mountains, near Saint John, and are believed to be of Precambrian age. They are mainly schistose and much altered to chlorite, epidote, uralite and white mica, but include some little deformed basaltic and rhyolitic lavas, whose feldspars are characteristically albite, and, in places, some intercalated sediments. Their stratigraphy and structure are imperfectly recognizable. A structure, that is apparently anticlinal, plunges westward across Crooked Creek 1½ miles north of Riverside. Phyllite, schistose sandstone, and some lavas occur in the central part of this structure with basic flows exposed in belts 2,000 to 3,500 feet wide on either side.

The bodies of quartz diorite (2) and albite granite (3) occurring on Caledonia Mountains are pre-Carboniferous and may be either of Precambrian or possibly Devonian age. In places the diorite grades into the granite but in other places granite dykes cut the diorite. Two types of granite are about equally prevalent. One type contains nearly 20 per cent biotite and hornblende, whereas the other is practically free from ferromagnesian minerals. The intrusive rocks are in part intensely sheared and schistose.

Dark augite andesite dykes cut other pre-Carboniferous rocks either parallel with, or at right angles to, their general northeast structural trend.

The Carboniferous strata are unaltered in contrast to the highly deformed and metamorphosed pre-Carboniferous crystalline rocks upon which they rest unconformably. The surface of the pre-Carboniferous rocks in early Carboniferous time was probably uneven, with broad ridges and depressions that were progressively buried under Mississippian rocks. Some of the ridges, for instance Caledonia Mountains, seem to have risen intermittently during Mississippian sedimentation, with consequent periodically renewed rapid erosion giving rise to interbedding of massive conglomerate in the pre-Windsor strata. There was, however, a gradual transgression and overlap of successive Mississippian formations onto Caledonia ridge, and when deposition of the marine Windsor beds commenced the surface probably had little relief for Windsor limestone rests directly in places on pre-Carboniferous rocks without intervening conglomerate.

The oldest Carboniferous strata in the area are best exposed at Memramcook, and are accordingly classed as the Memramcook formation (4). They consist there of interbedded red shales and sandstones (1500 + feet thick) which either overlie or grade into red strata with much interbedded arkose and conglomerate that rest on granite 3 miles north of Memramcook. Poorly preserved plant remains, identified as *Lepidodendron* of Mississippian age, occur in the lower part. A few fish scales occur in the uppermost beds of the formation at Memramcook West. The formation extends westward from Memramcook beneath the Albert formation and the overlapping Pennsylvanian strata at least as far as the north side of the Stony Creek Gas and Oil field. It was encountered there in the lower parts of wells that are located beside the Hillsborough-Moncton highway 4,700 feet south and 4,600 feet north of Stony Creek. It is concealed along the north side of Caledonia Mountains by overlapping strata except where poorly exposed near Prosser Brook and Coverdale River.

The Albert formation (5) (4000 ± feet thick) is apparently faulted against Memramcook strata near Memramcook. At Rosevale on the north side of Caledonia Mountains it overlaps onto pre-Carboniferous rocks. At Coverdale River the Memramcook and Albert formations are structurally conformable and are distinguished from one another arbitrarily by lithology. The Albert formation consists chiefly of dark grey shale with interbedded groups of fine to coarse-grained sandstone. The groups appear to be more persistent than the individual sandstone beds. The latter are lenticular and give place in part to conglomerate near ridges of pre-Carboniferous rocks. Interbedded particularly in the lower part of the formation are highly bituminous oil shales. A thick lens of salt present in the upper part was encountered in wells near Gautreau, on the east side and near the mouth of Weldon Creek on the west side of Petitcodiac River. A few thin limestone beds occur in the formation. The limestone at Prosser Brook, however, and which is shown on the map as a narrow band, may be of Windsor age.

The Weldon formation (6) varies up to 1500 ± feet thick, and consists characteristically of red shale and sandstone. Near Petitcodiac River, the Weldon red beds are separated from the Albert grey shales by a narrow zone of interbedded grey and red strata and the boundary between the two formations has been arbitrarily placed at the base of the lowest observed red bed. Along the edge of Caledonia Mountains, from Albert Mines to Rosevale, a thick boulder conglomerate that overlaps onto pre-Carboniferous rocks forms the base of the Weldon formation, and suggests that an upward movement of Caledonia ridge took place at the close of Albert time. A mottled red and greyish white volcanic ash bed (6c) lies 300 feet above the base of the Weldon formation on Boyd Creek. Fragments of the ash rock, probably not far removed from a consealed part of the bed, occur abundantly on the west side of the river 1,000 feet north of Weldon Creek and on the east side 2,000 feet south of Pré d'en haut. On Peek Creek typical Weldon red shales are separated from overlying Hillsborough conglomerate (7) by a narrow zone of interbedded shales and conglomerate, but on Boyd Creek erosion of Weldon strata occurred before deposition of Hillsborough beds which there contain ash fragments. In the west the Weldon strata are either overlapped by the Hillsborough strata or lose their distinctive lithological character west of the headwaters of Weldon Creek and grade imperceptibly into a conglomerate group that cannot be distinguished from the Hillsborough formation. Farther west on Sherman Brook some beds of red shales and sandstones occur with strata otherwise consisting of conglomerate and are included in the Hillsborough formation.

The Windsor strata (9-11) can be subdivided in part where gently folded. They contain fossiliferous marine limestones and are considered to be of Lower Windsor age. They rest conformably on Hillsborough strata north of Wilson Brook, although overlapping farther south onto pre-Carboniferous rocks.

In the Maringouin Peninsula the Windsor strata are conformably overlain by the Maringouin formation (12) consisting of red shale with thin, silty and arenaceous beds about 1,400 feet thick. The Maringouin beds are there conformably succeeded by the Shepody formation (14), 1,000 feet thick, consisting of red shale and sandstone with interbeds of grey, massive sandstone, the base of the Shepody being placed at the base of the lowest bed of grey sandstone. The Maringouin beds may be a non-fossiliferous, continental facies of Upper Windsor, Mississippian age or may be in part Pennsylvanian. The Shepody beds in Albert map-areas carry fine-ribbed *Calamites* and *Estheria* and *Leaia* occur sparingly and indicate that the strata are of Pennsylvanian age. The Shepody strata are succeeded conformably by the Enragé beds (15) and these, in turn, are conformable with overlying Boss Point strata (16) in which grey sandstone and grey shale predominate. The Boss Point measures hold a *Whittlesaya desideratа-Neuropteris schlehani* flora of early Westphalian and lower Pottsville age. They are succeeded unconformably by the Grand Anse (18) beds.

Shepody Mountain, west of Shepody Bay, is underlain by the Hopewell group (13) consisting mainly of conglomerate and possibly as much as 1,500 feet thick. The Hopewell beds apparently overlie the Windsor strata unconformably. Near the base of the section of Hopewell strata exposed along the shore of Shepody Bay near Hopewell Cape are two thin limestone beds which hold fossils indicating a late Windsor age. Strata correlated with the Hopewell group are extensively developed in the east half of Hillsborough map-area. North of Shepody Mountain they rapidly thin to 200 feet or less of red shale and sandstone with occasional argillaceous limestone interbeds and a basal conglomerate. These strata much resemble those of the Enragé formation and, apparently, are conformably overlain by typical Boss Point strata characterized by numerous beds of quartz-pebble conglomerate. Whereas in the Maringouin Peninsula sedimentation appears to have been continuous from Windsor into Boss Point time, this does not appear to have been the case to the north nor to the west closer to Caledonia Mountains. In these areas sedimentation appears to have been interrupted in Windsor time and to have recommenced at different times in different localities. To the various assemblages laid down after the interruption in Windsor time and before the commencement of the deposition of the characteristic Boss Point beds, the name Hopewell group has been applied.

The Boss Point strata of Maringouin Peninsula were folded prior to the deposition of the Grande Anse beds which rest on them with a pronounced angular unconformity. To the north and west, however, the two formations do not appear to be separated by an angular unconformity and sufficient fossil evidence is not available to permit mapping the formations separately. In these localities the two formations are mapped together as constituting the Petitcodiac group (17).

STRUCTURE

The most pronounced folding and faulting north of the Caledonia ridge antedates the deposition of the Hopewell and succeeding Pennsylvanian strata and is of Mississippian age. South of the Caledonia ridge, however, pronounced folding and faulting took place in Pennsylvanian time prior to the deposition of the Grand Anse beds which are only gently disturbed and rest unconformably on older rocks.

The Mississippian rocks north of Caledonia Mountains lie in a westerly plunging syncline whose axis, disregarding minor folds, extends southwestward from Pré d'en haut to Berryton as indicated by the occurrences of Windsor limestone at Cat Creek and Berryton. West of Berryton the syncline is cut off by an uplaulted block of pre-Carboniferous, Memramcook and Albert rocks that are exposed on Prosser Brook. The northeastern extension of the fault bounding the south side of this block is concealed by Pennsylvanian strata. The structure of the north limb of the syncline is partly revealed by wells in and north of the Stony Creek Gas and Oil field. The wells show that beneath the overlapping Pennsylvanian the Mississippian strata abut against a ridge of pre-Carboniferous rocks whose southern limit is about 2.4 miles north of Stony Creek.

The Mississippian rocks northeast of Caledonia Mountains are disturbed by a gentle fold extending at a sharp angle to the regional structure and by faults. Although much deformed, an anticlinal fold seems to extend from Albert Mines to Upper Dorchester along which Albert and, at Upper Dorchester, Memramcook strata are exposed.

The thrust fault northwest of Shepody Mountain extends 22 miles southwestward from Shepody Bay to the vicinity of Alma in the adjoining map-area, and parallels the southeast side of Caledonia Mountains. Pennsylvanian strata east of this fault, except the Grand Anse beds, are steeply folded. The folds, though poorly displayed seem to trend eastward across Shepody Bay, and one that has been called the Minudie anticline farther east, continues eastward for at least 25 miles into Cumberland County, Nova Scotia. This anticline brings up Windsor strata in the southeast corner of the map-area and either dies out or breaks up into faults westward near the village of Albert.

MINERAL DEPOSITS

An irregular mineralized zone ranging from a few feet to thirty feet wide and about 600 feet long occurs in pre-Carboniferous chlorite and talcose schists at the Lumsden mine, on a branch of Crooked Creek, Caledonia Mountains. The zone strikes north 20 degrees east and dips steeply northwest. In it chalcopyrite, tenantite, sphalerite, galena, and pyrite occur in a gangue of carbonate and cherty quartz. The values are chiefly in zinc with a little copper, gold, and silver.

The Albert formation contains oil shale, gas and oil bearing sandstone, and salt. The oil shale occurs in beds seven feet or less thick interbedded with bituminous shale, barren shale, and sandstone in the lower part of the formation. It is well exposed at Albert Mines, Rosevale, and Taylor Village and occurs also at the upper part of Downing Creek and one mile southeast of Bellveau. Tests show that yields of 40 gallons of oil and 100 pounds of ammonium sulphate per ton can be obtained from the oil shales.

Gas and oil are produced from the Albert formation at the Stony Creek field which lies on the west side of Petitcodiac River between Stony and Weldon Creeks. The Albert formation in this field dips south beneath unconformably overlapping Pennsylvanian strata that dip gently north. The producing sands are apparently lenticular and occur in groups separated by shale, at depths ranging from 1,200 to 3,000 feet. Meadow Brook divides the field into two parts. The oil producing part of the field lies east of the brook and gives place northward to a gas producing area. The strata west of the brook produce gas only and are structurally higher than those to the east. The Stony Creek field lies on the north limb of the main Mississippian syncline in the map-area. Perhaps oil and gas has accumulated in the south limb also. It is impossible, however, to predict whether drilling for oil in this limb would or would not be successful, or what type of oil structures to expect.

Four wells, two near Gautreau on the east side and two near the mouth of Weldon Creek on the west side of Petitcodiac River show that, there at least, a thick bed of salt occurs 150 to 500 feet beneath the top of the Albert formation in the centre of the basin north of Caledonia Mountains. The top of the salt in the wells east of the river is 1,225 feet below sea-level and in the western wells slightly more. The greatest drilling thickness of salt, though perhaps not the true thickness, is 1,012 feet in a well at the mouth of Weldon Creek. The salt contains a little shale and in some layers a little glauberite. Most of the glauberite occurs in a bed 100 feet thick at the top of the salt and in parts of this bed it is the chief constituent.

Gypsum and anhydrite occur in the Windsor series of this area. The principal deposits lie between Hillsborough and Wilson Brook in two shallow basins that are separated on the surface by younger rocks. The gypsum in the northern basin and the outlying mass at Edgett's Landing extend southward under Hopewell and Boss Point strata, but are probably cut off in this direction by faults that are exposed at Surrey. The gypsum-anhydrite beds at Wilson Brook may extend eastward for a considerable distance beneath the Hopewell and overlying strata. Gypsum beds southeast of the Riverside fault occur in steeply dipping narrow belts that are largely concealed by drift. The gypsum bed on the southeast side of Shepody Bay at Cape Maringouin is about 90 feet thick and dips steeply south. It is probably paralleled by another bed 1,000 feet farther north that is poorly exposed on the road beside the shore. Sink holes suggest that a belt of gypsum lies along the southeast side of the Riverside fault from Cape Station on the railway to the main road south of Hopewell Cape Village although gypsum is exposed at only one place 2,000 feet west of the main road. A narrow gypsum belt, indicated by sink holes and a few outcrops, extends for 3,000 feet along the north side of Chemical Creek.

Small deposits of manganese occur near the contact of Pennsylvanian strata with older rocks at Berryton and at Dawson Settlement. At Berryton the deposit is an irregular replacement in flat lying Windsor limestone. It pinches and swells from a few inches to a few feet in thickness and extends for a few hundred feet along Berryton Brook. At Dawson Settlement bogs formed by manganese bearing springs cover about 10 acres. The crude ore from the bogs has a high moisture content and contains powdery manganese dioxide and limonite intimately mixed and in separate bands. A deposit formerly mined on the north side of Shepody Mountain consisted, according to report, of nodules and small lenses of pyrolusite and in red clay immediately underlying the Hopewell conglomerate and overlying blue clay and limestone that rest on pre-Carboniferous schists. Small pockets of manganese minerals occur locally along the south side of Caledonia Mountains in Hopewell and Pennsylvanian strata.

Quartz-pebble conglomerate that forms the lower part of the Boss Point and Petitcodiac group strata breaks down at the surface to a loose gravel extensively used for surfacing roads in the district. Deposits of this material in the map-area are located near the contact of this strata with older rocks.

Grindstones, building, and pulp stones have been quarried out of massive brown to grey sandstone that occurs in the upper part of the Boss Point formation immediately north of the Riverside fault. The principal quarries occur in the point of land to the east of Beaumont north of the juncture of Petitcodiac and Memramcook Rivers, and at Curryville. Massive sandstone beds probably occur between Curryville and Beaumont in the southern half of the ridge west of Hopewell Cape.

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