Palaeobotanical Excursion . . .

to the Gaspé Peninsula, New Brunswick, and northwestern Nova Scotia

By
D. C. McGREGOR
with
J. TERASMAE
Geological Survey of Canada.

IX INTERNATIONAL BOTANICAL CONGRESS

PALAEOBOTANICAL EXCURSION

to

Eastern Canada

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Figure 1

Facsimile of pages from field notebook of Sir W. E. Logan, 1843, describing portions of section on north side of Gaspé Bay near Cap-aux-Os. The star-like sketches possibly represent *Annularia laxa* Dawson (1882, Pl. VI).

INTRODUCTION

The duration of Field Trip No. 23 (Palaeobotany) will be thirteen days, from September 2 to September 14, inclusive; the route covers approximately 2,500 miles (4,000 km.) in the provinces of Quebec, New Brunswick, and Nova Scotia.

Localities to be visited include those at which Lower and Upper Devonian, Pennsylvanian (Westphalian A, B, and C), and Pleistocene plants may be examined and collected. Many of the localities are those originally visited and first described by Sir W.E. Logan and Sir J.W. Dawson more than 100 years ago, when the geology of Canada was being first explored.

The contents of this Guide Book are designed to provide basic data for reference to the area traversed by the tour, and the plant localities visited. Literature containing fuller treatment of various aspects is made available, either as a library on each bus, or as donations to each registered member of the tour.

In view of the relatively great distances involved, the cooperation of each member in maintaining set schedules for arrival and departure will contribute greatly to the fullest enjoyment of the trip for everyone. The times of low tide are also critical for access to several of the sea-cliff sections.

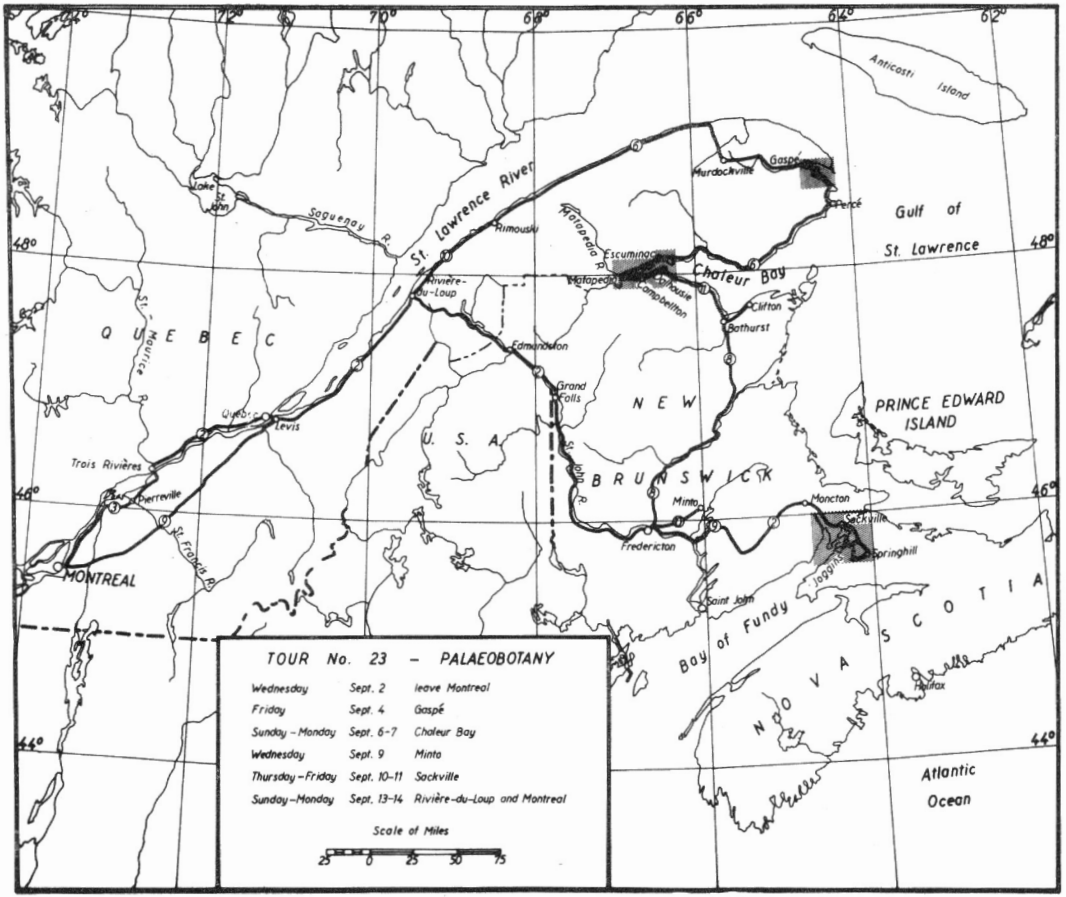
Numerous individuals and institutions have contributed generously toward the organization and implementation of the excursion. All are sincerely thanked, but space permits mention of only a few of them:

New Brunswick Mines Branch
Tourist Bureau, Province of Quebec
New Brunswick Travel Bureau
Shell Oil Limited
Imperial Oil Limited

Chambers of Commerce of several towns and cities in the provinces of Quebec and New Brunswick.

The Geological Survey of Canada, which assumed the cost of publication of the Guide Book, and also contributed generously in granting to the writer and other members of the continuing staff the time and opportunity for preparation of the tour and Guide Book.

Figure 2



Map of excursion route. Stippled portions indicate areas covered by Figure 3 (Gaspé Bay), Figure 6 (Escuminac-Campbellton), and Figure 8 (Joggins-Springhill).

The Quebec Department of Mines, which has been particularly generous in supplying literature and maps for free distribution, and in providing experienced guidance in the field.

The following individuals who are acting as leaders for the tour but whose contributions to its organization go far beyond this function:

Mr. Ronald Eydt
Prof. Norman W. Radforth
Dr. Glenn E. Rouse
Dr. Jaan Terasmae

The following literature is distributed to members of the tour, to supplement the information in the Guide Book:

Shell Route Map, Quebec and Maritime Provinces.
Geological Map, Gaspé Peninsula (Quebec Dept. of Mines, Map 1000).
Geological Map, Maritime Provinces (Geological Survey of Canada, Map 910A).
Geological Map, Chaleur Bay area (Geological Survey of Canada, Map 330A).
McGerrigle, H.W., 1950. La géologie de l'est de Gaspé. Quebec Dept. of Mines, Rapport géologique 35.
Physiographic divisions of the Appalachian Region of Canada (Figure 40, from Geological Survey of Canada, Econ. Geol. Ser. No. 1, 4th ed., 1957).
Tourist literature for Quebec and the Maritime Provinces.

THE ROUTE
(see Figure 2)

1. From Montreal the route follows Highway 9 across the Eastern Townships of Quebec to join Highway 3 south of Quebec City. From here it skirts the south shore of the St. Lawrence River via Highways 3, 2 and 10 and 6, entering the Gaspé Peninsula at Matane.

2. Approximately 100 miles (160 km.) east of Matane the route turns into the interior of the peninsula and proceeds via Murdochville to Gaspé village, on Gaspé Bay.

A day will be devoted to the Psilophyton flora of the Gaspé Sandstone, as exposed along the north and south sides of Gaspé Bay.

3. From Gaspé village, Highway 6 is followed south and west to Matapedia, Que., and Campbellton, N.B., at the southwestern corner of the Gaspé Peninsula. Outcrops of Devonian strata on both sides of the lower Restigouche River provide examples of the Psilophyton and Archaeopteris floras. Two days will be spent here.

4. Highway 11 is followed to Clifton, in northeastern New Brunswick, where Pennsylvanian (Westphalian C) plant-bearing beds outcrop on Chaleur Bay. These will be examined briefly.

5. The route then proceeds southerly through central New Brunswick via Highway 8 to Fredericton, and from here to the Minto coalfield, where one day will be spent on several sites.

6. A brief excursion extends eastward to other Pennsylvanian localities near Sackville, N.B. (Westphalian A) and Joggins, Nova Scotia (Westphalian B).

7. Returning via Fredericton, the tour follows Highway 2 west and north, up the St. John River valley to Edmundston, N.B., and northward into the province of Quebec. An extensive peat bog will be visited near Rivière du Loup.

8. From Rivière du Loup the route is retraced along the St. Lawrence River to Lévis, and a brief stop made at Quebec City.

9. The north shore of the St. Lawrence is followed to Trois Rivières, where the river is again crossed. After a brief visit to an interglacial site near Pierreville, the route proceeds to Montreal via Highway 3.

SUMMARY OF PHYSIOGRAPHY AND GEOLOGY

The excursion will traverse portions of the provinces of Quebec, New Brunswick, and Nova Scotia. Several physiographic regions will be entered (see accompanying map, Figure 40): the St. Lawrence Lowland, the Notre Dame Mountains (which are a continuation of the Appalachian chain), the Chaleur Uplands, the New Brunswick Highlands, and the Gulf of St. Lawrence Plain. The main topographic features in these regions trend northeasterly and thus reflect the trend of the underlying bedrock (see Geological Maps, Gaspé Peninsula and Maritime Provinces).

The St. Lawrence River separates the tour region from the vast Precambrian area of the Canadian Shield to the north. Precambrian rocks may be seen rising abruptly, north of the St. Lawrence and east of Quebec City. The area south of the St. Lawrence is underlain mainly by Palaeozoic strata, mostly sedimentary in origin. In certain areas the latter are covered by a mantle of glacial till and interglacial deposits, the major features of which are described briefly in the following pages.

The Palaeozoic sediments, particularly those which contain plant remains, will be described in more detail in succeeding chapters.

PLEISTOCENE GEOLOGY

by J. Terasmae

The bedrock in the St. Lawrence Lowland is overlain by Pleistocene deposits, and a composite, representative section would be composed of the following members, starting from the bedrock. The lower glacial till (the Becancour till) is overlain by some varved clay. The varved clay is overlain by the St. Pierre beds, consisting of sand, silt and peat layers (to be seen at Pierreville on the tour). The St. Pierre beds are overlain by varved clay and the upper glacial till of the region. The post-glacial deposits consist of marine clay of the Champlain Sea episode and the later lacustrine, fluvial and peat deposits.

At Quebec City the Lowlands narrow to the St. Lawrence River valley, and the Pleistocene deposits are present as remnants left after erosion by rivers. East of Quebec City the route follows the southern shore of the St. Lawrence River through the eastern Quebec Highlands and later along the northern fringe of the Shickshock Mountains which the tour crosses at Murdochville en route to Gaspé. Pleistocene deposits in this physiographic division of the Appalachian Region of Canada are restricted mostly to the valleys and only a thin cover of glacial till may be present on the hills.

Along the north shore of Chaleur Bay the route passes through the Chaleur Uplands. At the west end of Chaleur Bay and along the south shore, marine clay and sand are encountered up to 200 feet above sea level (Alcock, 1935). This marine inundation occurred when the land was still depressed after retreat of the late-Wisconsin ice. During emergence numerous terraces were cut along the sides of river valleys.

The Pleistocene deposits near Fredericton and along the St. John River valley have been mapped and described by Lee (1955, 1957). From Fredericton to Rivière du Loup the tour follows the St. John River valley through the Miramichi and New England Highlands and then the Chaleur Uplands and the Notre Dame Mountains.

A palynological study of the bog at Rivière du Loup was made by Potzger (1953). The peat is used commercially; excavations which have exposed structural details of the upper few feet of peat will be examined during the tour.

On the return trip to Montreal late-Pleistocene buried peat will be seen at Pierreville.

The Pierreville Section

This exposure is in the east bank of the St. Francis River, about 2.1 miles (3.4 km.) southeast of Pierreville, Quebec.

Lithology	Thickness in feet
Till (grey)	3
Stratified silt	38
Stratified, massive and crossbedded sand with a 1-foot layer of peat in the top part of this layer	8
Varved clay	43
Stratified silty clay	10
Red silt	4
Till (red) - exposed in section nearby	
Bedrock	

This section and similar ones in the St. Lawrence Lowlands have been studied by the writer (Terasmae, 1958). The age of this peat is about 65,000 years, established by the radiocarbon method. Palynological studies by the writer indicate that subarctic and boreal forests covered the area at the time of peat accumulation and the climate in the area was colder than at present. Wood of black spruce (Picea mariana) and tamarack (Larix laricina) has been identified from this peat, and seeds and leaves of several species of bog and lake plants have been recorded.

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GASPÉ PENINSULA

Physiography and Geology

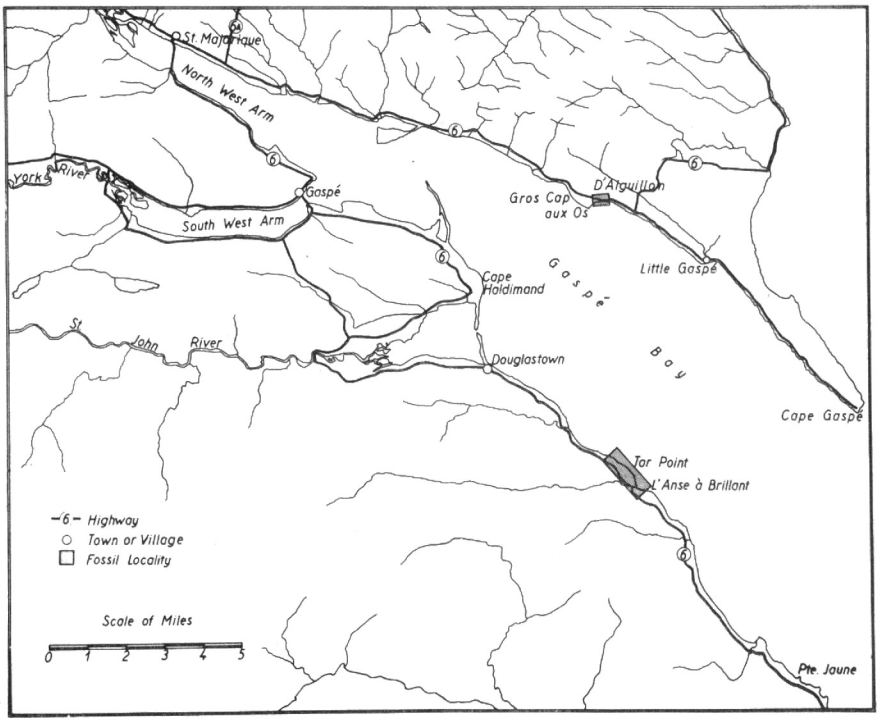
The Gaspé Peninsula comprises that part of the province of Quebec south of the Gulf of St. Lawrence, north of Chaleur Bay, and east of the Matapedia River. It is about 150 miles (240 km.) from east to west, and 85 miles (136 km.) from north to south.

The north-central part of the peninsula is occupied by the Shickshock Mountains, which form a belt 2 to 15 miles (3 to 25 km.) wide, 10 to 25 miles (16 to 40 km.) inland from the Gulf of St. Lawrence. The summits of the range form the remnants of a Cretaceous peneplain, and reach heights of from 3,000 to 4,160 feet (900 to 1,248 m.). This belt of mountains extends for about 60 miles (96 km.) in a northeasterly direction from Matane River to the Tabletop Mountains in central Gaspé.

This mountainous interior is surrounded by a plateau, about 2,000 feet (3,200 km.) lower in elevation, which forms steep cliffs on the northern and eastern coasts of the peninsula. The southern coastline, along Chaleur Bay, is much lower and shows an alternation of low cliffs, bays, bars and beaches.

The trend of the rock structure is in general a curved line paralleling the north shore of the peninsula. McGerrigle (1950) divides the rocks of Gaspé into four major east-west trending belts, (see Geological Map, Gaspé Peninsula). The northern one, north of the Shickshocks, is composed mainly of Ordovician rocks, with possibly some of Cambrian age. The north-central belt is that of the Shickshock Range, underlain mainly by pre-Ordovician basic volcanics, associated with granitic intrusions in the Tabletops. The central belt, averaging 40 miles (64 km.) wide, extends the full length of the peninsula and is underlain mainly by Devonian rocks, but includes some Ordovician and Silurian. Within this central belt the plant-bearing Gaspé Sandstones outcrop extensively in the eastern portion, and also in a somewhat basin-shaped area in the west-central portion. The southern belt borders on Chaleur Bay and the Gulf of St. Lawrence and is 25 to 30 miles (40 to 48 km.) wide. Underlying it are more or less folded Precambrian to Devonian rocks, and flat-lying or gently-dipping Carboniferous beds.

Figure 3



Map of Gaspé Bay region, showing Plant Locality 2 (Tar Point) and Plant Locality 3 (D'Aiguillon).

Within the central belt, the eastern area of outcrop of the Gaspé Sandstone, bordering Gaspé Bay and the lower parts of St. Jean, York, and Dartmouth Rivers, is the eastern end of a broad synclinorium containing two major downfolds, separated by the St. Jean River anticline, and with several subsidiary folds.

Plant Beds

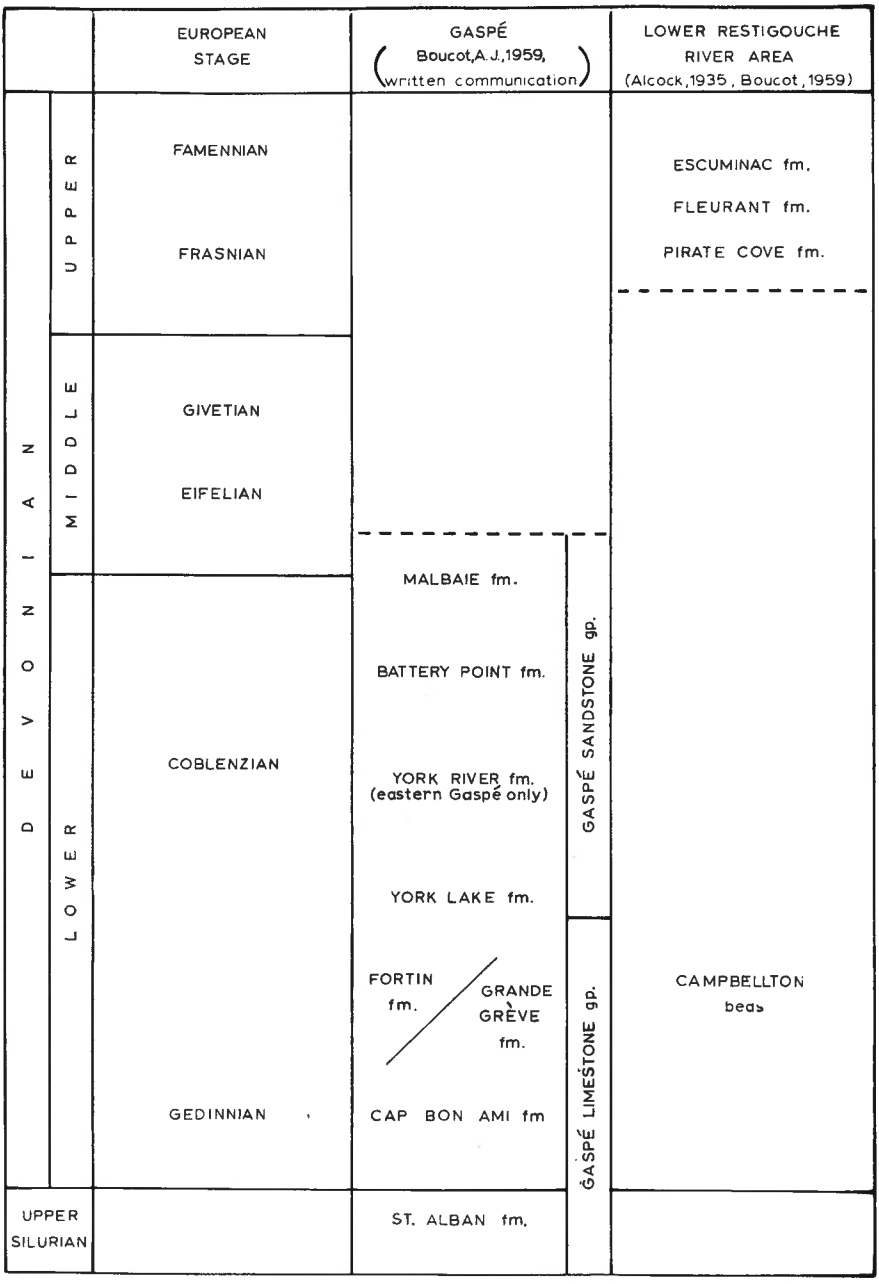
Plant-bearing strata outcrop in high cliffs on both the north and south sides of Gaspé Bay (Figure 3). The series was first described and measured by Sir W.E. Logan, of the Geological Survey of Canada (see Figure 1). It was Logan (1846) who first applied the name "Gaspé Sandstone" to these non-marine beds, which contain the Psilophyton flora. The 7,000-foot section which, according to Logan (1863, p. 394), "... may therefore, for the present, be assumed... to represent the whole group.", extends from Pointe Jaune to Tar Point on the south side of Gaspé Bay. This section (Figure 5) is now believed to represent the Battery Point formation (Figure 4, and McGerrigle 1950) which is only an upper part of the total thickness of the Gaspé Sandstone group.

The age of the Gaspé Sandstone flora is still under discussion, being regarded by some as Lower Devonian, and by others as Middle Devonian. According to the most recent opinions, the plant-bearing strata are believed to be Lower Devonian in age (Boucot and Cumming, 1953, and in press). This assignment is followed in the present account.

The flora of the Gaspé Sandstone was first described by Sir J.W. Dawson--who himself twice visited the area--in several papers from 1856 to 1871. Dawson's species were collected on the north and south sides of Gaspé Bay, as well as inland on some of the streams entering the bay. Unfortunately, explicit descriptions of the localities are not available, but it is known that Dawson's list includes specimens from both the Battery Point and York River formations. Since the time of Dawson no major revision of the flora of this region has been undertaken.

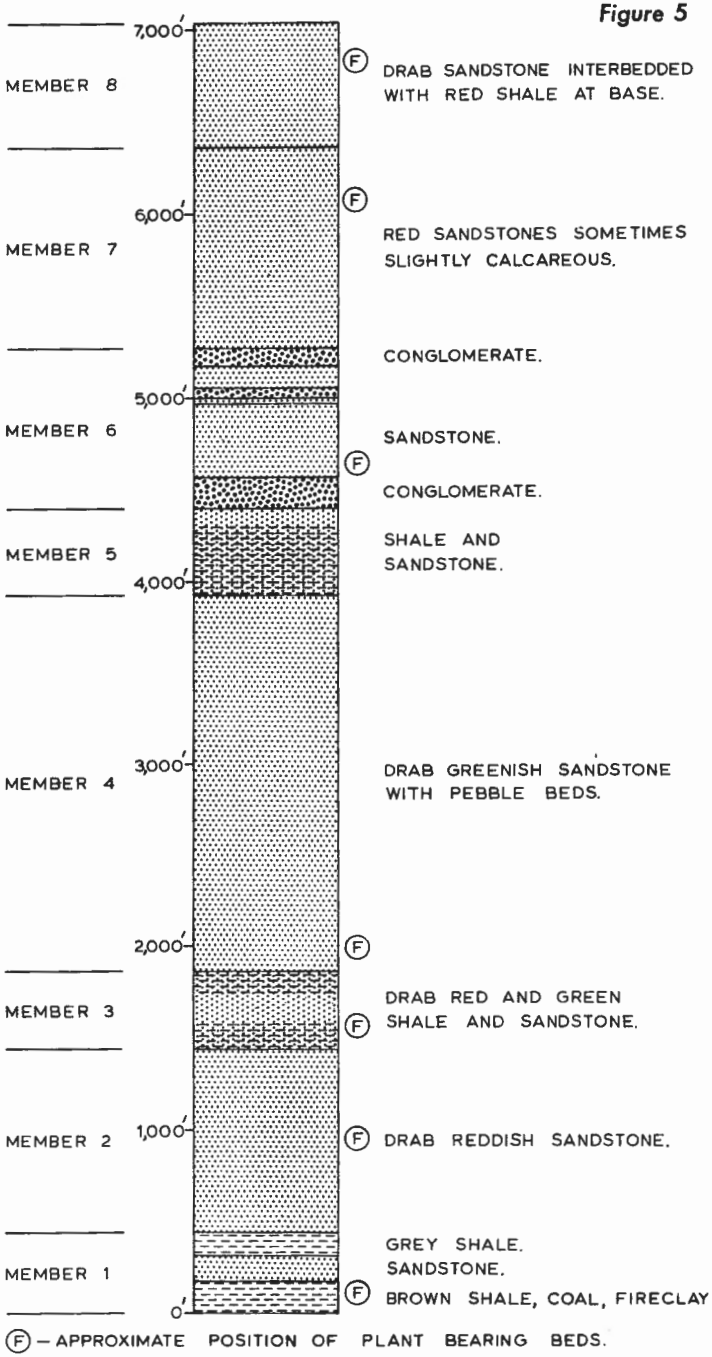
Small spores also occur in various levels of the sandstone; they have been found by the writer in abundance in the Battery Point formation from the vicinity of Gros Cap-aux-Os, and at Anse-à-Brillant (McGregor, D.C. 1957, and unpublished reports, Geol. Surv., Canada).

Figure 4



Correlation chart, Devonian, Gaspé Peninsula and northern New Brunswick.

Figure 5



Generalized stratigraphic section, Battery Point formation (see Figure 4). Plant Locality 2 is near base of section. Adapted from Logan 1846 (Appendix), Logan 1863, and Appalachian Discussion Group, Ottawa 1958.

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A thin seam of coal and carbonaceous shale (3 inches) is present at Tar Point, a few feet above the base of the section measured by Logan. It is associated with grey shale above and below, and with abundant plant remains (Figure 5).

Species Lists*

List 1: Vicinity of Anse-à-Brillant and Tar Point

(Logan 1863, Dawson 1871a)

Cordaites angustifolia Dawson
Cyclostigma densifolium Dawson (sic !)
Lepidodendron gaspianum Dawson
Poacites
Prototaxites Logani Dawson
Psilophyton princeps Dawson
P. robustius Dawson

List 2: Gaspé Bay area (including list 1).

(Dawson 1859, 1863, 1871a)

Annularia laxa Dawson
Arthrostigma gracile Dawson
Calamites inornatus Dawson
Chondrites
Cordaites angustifolia Dawson
Cyclostigma densifolium Dawson
Didymophyllum reniforme Dawson
Lepidodendron gaspianum Dawson
Lepidophloios antiquus Dawson
Leptophleum rhombicum Dawson
Poacites
Prototaxites (Nematoxylon) crassum Dawson
P. laxum Dawson

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* Retention of Dawson's nomenclature in these lists is deliberate. Revision is planned by the writer as part of a restudy of the early Devonian flora of the Gaspé and New Brunswick.

P. Logani Dawson
P. (Nematoxylon) tenue Dawson
Psilophyton princeps Dawson
P. princeps Var. ornatum Dawson
P. robustius Dawson
Stigmaria areolata Dawson
S. minutissima Dawson
cf. Parka decipiens Fleming

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Russell, L.S., 1947. A new locality for fossil fishes and eurypterids in the Middle Devonian of Gaspé, Quebec. Contrib. Roy. Ont. Mus. Palaeont., July, 6 pp.

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Extracts from Literature

Dawson, J.W. 1871.

p. 5 - "My attention was first directed to the special study of the Devonian Flora by the discovery on the part of Sir W.E. Logan, in 1843, of numerous fossil plants in the sandstones of Gaspé Bay, named by him the "Gaspé Sandstones;" but it was not till 1859 that I had opportunities to examine Sir William's collections, and to visit Gaspé with the view of studying the plants in situ. In that year I communicated to the Geological Society of London my paper on the "Fossil Plants of the Devonian Rocks of Canada," in

which I described the remarkable root-beds existing in the Gaspé Sandstones, and instituted the genera Prototaxites and Psilophyton for the reception of two of the more novel forms discovered."

p. 6 - "...I was desirous to have the opportunity of revisiting and more fully exploring the cliffs of Gaspé Bay, with the view more particularly of studying the type of plant which had proved to be, of all others, most characteristic of the Devonian Flora, viz., the genus Psilophyton, and which occurs more abundantly, and in better preservation, there than at any other known locality. This design I carried out in the summer of 1869, under favorable circumstances as to weather, and with the valuable aid of Mr. G.T. Kennedy, B.A., and Mr. G.M. Dawson, both good collectors. The more fully to do justice to the work of exploration, we took with us a large boat and two boatmen, so that we could secure abundant and large specimens, and could take time to work out the connections of the plants in the beds in which they lie, points of the utmost importance in the study of fossil plants."

p. 7 - "At one place, near the middle of the series, there is a bed of coal from one inch to three inches in thickness, associated with highly bituminous shales abounding in remains of plants, and also containing fragments of crustaceans and fishes (Pterygotus, Ctenacanthus ? & c). The beds connected with this coal are grey sandstones and grey and dark shales, much resembling those of the ordinary coal formation. The coal is shining and laminated, and both its roof and floor consist of laminated bituminous shale with fragments of Psilophyton. It has no true under-clay, and has been, I believe, a peaty mass of rhizomes of Psilophyton. It occurs near Tar Point, on the south side of Gaspé Bay, a place so named from the occurrence of a thick dyke of trap holding petroleum in its cavities. The coal is of considerable horizonal extent, as in its line of strike a similar bed has been discovered on the Douglas [St. Jean]River about four miles distant. It has not been recognized on the north side of the Bay, though we find there beds, probably of very nearly the same horizon, holding Psilophyton in situ."

The coal bed referred to by Dawson in the preceding paragraph, and plant remains in a portion of the Battery Point formation overlying the coal, may be seen at Plant Locality 2 (see Figures 3 and 5).

p. 16 - "... we found at Little Gaspé, near the junction of the Gaspé sandstone with the Upper Silurian limestone, two stumps of trees of this species [Prototaxites], with spreading roots. As they did not appear to be imbedded in an underclay, but in the ordinary sandstone, I suppose them to have been drifted stumps."

p. 19 - "That Prototaxites was essentially distinct from any other known tree of the Palaeozoic Period is obvious; but in the absence of all knowledge of its foliage and fructification, any attempt to divine its affinities must be merely conjectural. Its want of proper vascular tissue, along with its dense woody structure and regular exogenous growth, ally it to conifers; and among these its spirally marked fibres approach more nearly to those of the Taxineae than to any other tribe."

p. 31 - "ANNULARIA LAXA, S.N., - (Pl. VI, Figs. 64 to 69.) - M.D., Gaspé.
Stems slender, tortuous, with whorls of eight to twelve leaves at long intervals. Leaves long, linear, one-nerved, narrowing toward the point and united at the base by a broad membrane.

When Sir William Logan explored the Gaspé Cliffs in 1843, he observed on the surfaces of slabs of sandstone, singular stellar markings of unknown nature."

"...its affinities may still be regarded as doubtful. It consists of slender stems, straggling over the surfaces of the beds and usually very obscure. At intervals these are surrounded by a carbonaceous film from which radiate the leaves. These, when well preserved, have a distinct raised carbonaceous midrib, which must have been of a woody nature, though apparently flexible at the extremity. The margins of the leaves have not left very distinct impressions, and this with the quantity of carbon remaining, and the relief of the ribs, suggests the idea that they may have been thick and fleshy, or perhaps provided with air cells for floating. In some

specimens the ends of the leaves are curled in a circinate manner, which may indicate their mode of vernation, but on the other hand may be accidental."

The plant remains to which Russell (1947) refers are probably Annularia laxa, and are probably from the same beds from which Dawson's specimens were obtained.

p. 38 - "P. PRINCEPS, Var. ornatum. - (Pl. IX, Fig. 97 to 101.)
On my late visit to Gaspé, a bed of argillaceous shaly sandstone filled with specimens of Psilophyton in situ, was beautifully exposed on the north side of the bay, east of Great Cape Oiseau [Gros Cap-aux-Os]. Individual plants could be seen from two to three feet in length, and they appeared to have been overwhelmed when growing, all lying in one direction and being rooted in a dark shale, underlying the bed holding the stems. They presented the unusual feature of being leafy, so that fragments might have been referred to the genus Lycopodites. The leaves were, however, precisely of the same character with those of P. princeps, and their rigid spine-like nature was well shown by their projecting downward and upward into the stone from flattened stems."

"No fructification was observed, and the circinate termination of many of the branches indicated that the plants were immature."

The bed of shaly sandstone which yielded the original specimens of Psilophyton princeps Var. ornatum Dawson may be seen at Plant Locality 3 (Plate I, A; Figure 3).

LOWER RESTIGOUCHE RIVER REGION

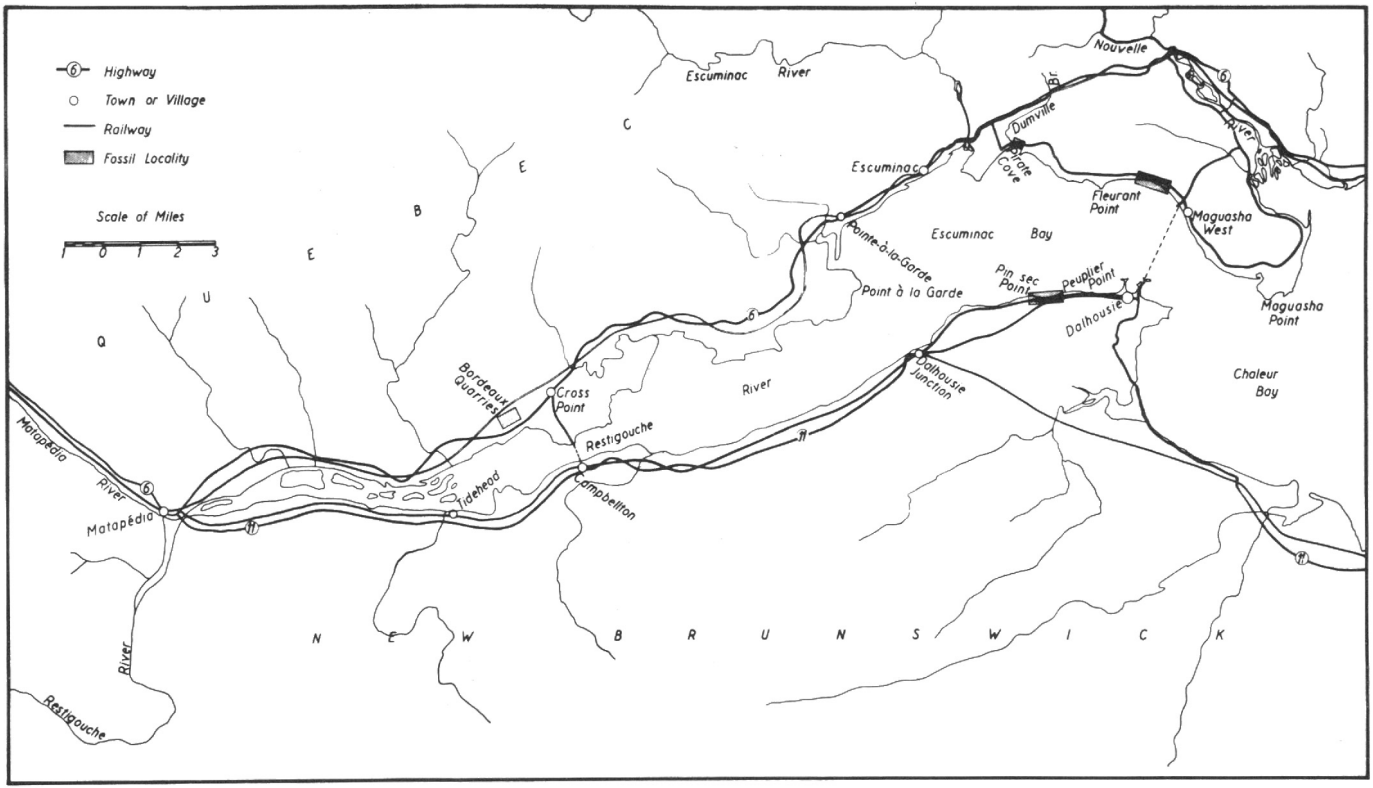
Physiography and Geology

Chaleur Bay and the lower part of the Restigouche River form the boundary between the province of New Brunswick on the south and the Gaspé Peninsula of Quebec on the north. The lower part of the Restigouche River (from the village of Matapedia eastward) is bordered on both sides by hills that rise steeply to about 900 feet (270 km.). Sugarloaf Mountain at Campbellton, a volcanic neck, has an elevation of 929 feet (279 m.). Both to the north and south of this bordering region is a plateau with an elevation of about 1,100 feet (335 m.), rising gently to the north on the Gaspé side. Further east, south of Chaleur Bay, the country is low, rising gently from the coast.

The bedrock of the western part of the Chaleur Bay region and the lower Restigouche River is of Palaeozoic age, ranging from Upper Ordovician to Pennsylvanian (see Geological Map 330A). Early Devonian non-marine sedimentary rocks (referred to as "Campbellton beds" in Figure 4) occur in a belt along the north side of the river, and in a narrow, more patchy zone on the south side, from just east of Tidehead to Dalhousie. They consist of poorly cemented sandstone and conglomerate, grey or greenish in colour, commonly showing lenticular structure with lenses of sandstone in conglomerate and of conglomerate in sandstone. Probably these deposits were supplied as a result of the uplift of the old land of Acadia, and deposited as deltas and flood-plains in the large depression which occupied the present site of Chaleur Bay and of the lower Restigouche River in the Devonian period. The thickness of the series is difficult to estimate, since much of the area has no outcrops. Alcock (1935) gives a tentative thickness of 3/4 to 1 mile.

The region was uplifted after deposition of the Upper Devonian Escuminac formation, and the Devonian strata were folded. Subsequently, the red sandstones and conglomerates of the Bonaventure formation, of early Pennsylvanian age, were deposited as marginal sedimentation, in a depression that had migrated to the south. The "Hugh Miller Cliffs", on the hills back of Escuminac Bay, are composed of the Bonaventure formation.

Figure 6



Map of lower Restigouche River, showing Plant Localities 4 (Bordeaux Quarries), 5 (Pirate Cove), 6 (east of Fleurant Point), 7 and 8 (Peuplier Point), and 9 (Pin Sec Point).

Economic geology of the region and a summary of early geological explorations are given by Alcock (1935). Recent geological work in part of the region has been done by Beland (1958).

Plant Beds (Figure 6)

Plant remains occur in the Lower Devonian beds on the Gaspé side of the Restigouche River at Bordeaux Quarries near Cross Point, on the shore below the quarries, near the Cross Point ferry landing, on the shore west of Pointe-à-la-Garde, and just east of the mouth of Dumville Brook in Pirate Cove. At the latter locality conglomerates are interbedded with argillaceous and sandy shales, and plant fragments occur in the shales in the intertidal zone. Kindle (1930) reported a 2 1/4-inch seam of coal here, which he believed to be approximately equivalent in age to the seam at Tar Point on Gaspé Bay.

On the south side of the Restigouche River, outcrops with plant remains occur on the shore west of Campbellton at Atholville*, and at several localities between Dalhousie Junction and Dalhousie.

Dawson (1882) collected from both sides of the river. He specified between those species found at Bordeaux Quarries and those from the vicinity of Campbellton, although many of the localities are not precisely known.

Upper Devonian clastic sediments containing Archaeopteris outcrop along the shore of Escuminac Bay, opposite Dalhousie. The section extends from Pirate Cove on the west to 3/4 mile (ca. 1,200 meters) east of Maguasha wharf, and includes a lower, predominantly conglomerate series and an upper plant- and fish-bearing sandstone series, the Escuminac formation (Alcock, 1935). The whole unit forms a broad syncline trending north of east, exposing the plant beds on the bay, between Maguasha wharf and Fleurant Point.

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*Recently covered by earth and logs. See Plate IVB.

Russell (1939) gives a good short account of the location of the fish-beds, and mentions the occurrence of well-preserved fossil plants. The plants, consisting predominantly of sterile and fertile fronds of Archaeopteris, occur at several spots, one of which is the site described by Arnold (1936).

Species Lists

List 3: Bordeaux Quarries.

(Dawson 1882, Penhallow and Dawson 1888)

Prototaxites Logani Dawson
Psilophyton princeps Dawson
Rhodea
Pachytheca

List 4: Campbellton and Dalhousie

(Dawson 1882)

Arthrostigma gracile Dawson
Cordaites angustifolia Dawson
Leptophleum rhombicum Dawson
Prototaxites Logani Dawson
Psilophyton princeps Dawson
P. robustius Dawson

List 5: Escuminac Bay.

(Dawson 1882, Arnold 1936)

Archaeopteris Gaspiensis Dawson
A. Jacksoni Dawson
A. obtusa Lesq. (Cyclopteris obtusa Dawson)
Caulopteris (?)
Knorria sp.
Lepidostrobus ("obscure" - Dawson)
Platyphyllum (Cyclopteris) Brownii Dawson
Sternbergia

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Penhallow, D.P. and Dawson, J.W., 1888. On Nematophyton and allied forms from the Devonian (Erian) of Gaspé and Baie des Chaleurs. Trans. Roy. Soc. Can., Sect. IV, 6: 27-47.

Russell, L.S., 1939. Notes on the occurrence of fossil fishes in the Upper Devonian of Maguasha, Quebec. Contr. Roy. Ont. Mus. Palaeont., note 2, Dec., 10 pp.

Extracts from Literature

Logan, W.E., 1844.

p. 62 - "A little below...[Pointe la Lime (near Dalhousie Junction)] ...there occurs, associated with the conglomerate, a thin seam of carbonaceous shale, with a bed of clay below it, which has induced hopes of coal in the minds of the inhabitants; but it does not appear to me to promise more than the thin seam which has been noticed on Gaspé Bay. The same seam is again seen at Pointe Pin Sec, where, resting on its subjacent argillaceous bed, it is covered by a roof of trap, the contact of which has altered its condition to a hard black stone. A conglomerate bed again occurs further on, from beneath which, between the spot where it is seen and Pointe Peuplier, there comes a red shale, altered to a condition, which the Indians find favorable for the manufacture of their calumets, which they carve from it with their knives."

Dawson, J.W., 1882.

p. 97 - "Farther up the Restigouche River, however, in the vicinity of Campbellton...agglomerate and lower shales contain abundant remains of fishes... . The shales and sandstones abound in remains of Psilophyton with which are Prototaxites, Arthrostigma and Leptophleum of the same species found in the Lower Devonian of Gaspé Bay. These beds near Campbellton dip to the Northward, and the Restigouche river here occupies a synclinal, for on the opposite side, at Bordeaux Quarry, there are thick beds of grey sandstone dipping to the southward, and containing large silicified trunks of Prototaxites, in addition to Psilophyton. These beds are all undoubtedly Lower Erian, but further to the eastward, on the north side of the River, there are newer and overlying strata. These are best seen at Scaumenac Bay, opposite Dalhousie, between C. Florissant and Maguacha Point .... In these beds numerous fossil fishes have been found .... With these are found somewhat plentifully four species of fossil ferns, all of Upper Erian types, of which one is peculiar to this locality; but the others are found in the Upper Erian of Perry in Maine, or in the Catskill Group of New York."

p. 106 - "(5) Cordaites angustifolia, Dawson." "Leaves referable to this species are common at Campbellton, and clearly distinct from any of the other plants there. They must have been very long and parallel-sided, as I have never seen a distinct termination of one of them. They can scarcely be said to have any venation, but present merely a delicate longitudinal striation, and when well preserved their surfaces are smooth and polished. Whether they really have any affinity with the true Cordaites it is impossible certainly to decide, as they have not been found attached to a stem or connected with any organs of fructification."

p. 107 - "(6) Prototaxites Logani, Dawson." "In the Bordeaux quarry, opposite Campbellton, I found in the summer of 1881 several silicified trunks of trees of this species, some of them in the debris of the quarry, but one of very large size still in situ. It was black in colour, with a distinct bark of coaly matter, and showed evident lines of growth on the weathered end. It was imbedded in stems and branches of Psilophyton, which must have drifted with it from the shore; but as the sandstone of this quarry is evidently a littoral deposit, and at no great distance from the old Silurian land, neither kind of plant need have come from any very remote locality. The tree in question was prostrate and slightly flattened, its horizontal diameter being 2 feet 6 inches, and its vertical diameter about 1 foot 4 inches. The bark on this and other large trunks showed a longitudinally ribbed or wrinkled appearance."

"Fragments of fossil wood in a carbonized state found in the shaly beds at the top of the Upper Silurian section at Cape Bon Ami also show the structure of Prototaxites, and prove that plants of this kind existed, along with Psilophyton, before the close of the Upper Silurian age... Dr. Hicks has recently described specimens from the Denbighshire grits of Corwen, N. Wales, in the base of the Upper Silurian."

p. 108 - "Besides the great age of Dr. Hicks's specimens, they are also interesting as being associated with well preserved specimens of the globular bodies found with the wood of Prototaxites in the Ludlow of England, and named by Hooker Pachytheca."

"Similar bodies with similar structure occur with fragments of Prototaxites at Cape Bon Ami, ... and round carbonaceous spots, possibly remains of similar bodies, are found in the sandstone of Bordeaux quarry. This constant association of Pachytheca with Prototaxites, along with its similarity of structure, certainly lends some probability to the view that they belong to the same plant. In this case the resemblance of Pachytheca to Aetheotesta, an acknowledged gymnospermous fruit, certainly adds confirmation to the view which I have maintained every since I first studied the structure of Prototaxites in 1856, that it is a prototypal gymnosperm, and not as some British botanists have supposed, contrary to the whole of the possibilities of its mode of occurrence and preservation, as well as to its structure, a gigantic alga to be relegated to a new genus "Nematophycus". Of all the algic fancies which have loaded the nomenclature of geology with imaginary fucoids, founded on all sorts of trails and impressions of animals, and on badly preserved specimens of land plants, this is one of the most baseless.

"Since however, so late as last year, this extravagant view has been sustained by men of so high reputation as Etheridge, Carruthers and Thistleton Dyer, in the discussion of Dr. Hicks's specimens, I think it desirable in the interest of scientific truth to reproduce here the substance of the reasons which I gave in 1873, and again in 1881, in favour of my original conclusion."

p. 109 "These considerations are dwelt on in my published descriptions of Prototaxites, but they naturally have more weight in the judgement of practical geologists than in that of botanists."

"... the affinities of the plant are to be sought with Taxineae, and especially with fossil Taxineae, rather than with ordinary pines."

p. 112 - "... Nematophycus may be allowed to take its place along with a multitude of obsolete fucoids which strew the path of palaeontology. As to Prototaxites, it is confessedly an obscure and mysterious form, whose affinities are to be discussed with caution ... ."

Dawson, J.W., 1859.

p. 485 - "With respect to the affinities of the genus [Prototaxites], I can only say that the markings on its wood-cells most nearly resemble those of the two genera of fossil Taxine trees above-mentioned [Taxites and Spiropitys], which are, however, found in much more modern geological formations. Among recent trees known to me by specimens or figures of their tissues, Taxus baccata and Torreya taxifolia most nearly resemble the Gaspé fossil. In the meantime, therefore, it may be included in the subfamily Taxineae."

Dawson, J.W. in Penhallow, D.P. and Dawson, J.W., 1888.

p. 28 - "I was also struck with the resemblance of the tissue [of Nematophyton] to that of certain Taxine woods when in a state of great disintegration. ... This resemblance caused me to propose for the new plant the name Prototaxites, a name, perhaps, somewhat unfortunate, for though in my descriptions, I disclaimed any intention to suggest a close affinity to coniferous trees, botanists have persisted in inferring that I regarded this wood as coniferous and allied to Taxus."

Penhallow, D.P. in Penhallow, D.P. and Dawson, J.W., 1888.

p. 44 - "The structure of Nematophyton is unique;... That it is an alga, admits of no doubt; and so far as the structure alone will permit a final decision, its affinity with the Laminariaceae, as first pointed out by Mr. Carruthers, who, therefore assigned it to the genus Nematophycus, appears to be highly probable.

Recently, Sir Wm. Dawson has modified his original views with regard to the nature of Prototaxites, and now assigns to it the name of Nematophyton, a name which we have retained in the present paper."

NEW BRUNSWICK LOWLAND AREA

Physiography and Geology

The New Brunswick Lowland occupies a triangular area with its base bordering on Chaleur Bay and the Gulf of St. Lawrence, and its sides enclosed by the New Brunswick Highland to the west and south (see accompanying map, Figure 40).

The plain is underlain almost exclusively by unfolded Pennsylvanian deposits (see Geological Map 910A) which have a slight regional dip to the east. The topography is a low, gently rolling, featureless plain, somewhat dissected near the coast, and standing about 400 feet (120 m.) above sea level. Outcrops in this area are poor except in sea cliffs.

Plant Beds

Pennsylvanian plant-bearing outcrops are readily accessible in two principal areas: along the southern coast of Chaleur Bay east of Bathurst, and in the Minto coalfield near Fredericton.

On Chaleur Bay, beds of the Clifton formation are exposed on cliffs about 120 feet (36 m.) high, between the villages of Clifton and Stonehaven. The formation here is mainly grey sandstone with a 6-inch coal seam 10 feet (5.4 m.) above the base and an eight-inch seam 150 feet (45 m.) stratigraphically above the base. The underlying Bathurst formation consists predominantly of red shales, sandstones and conglomerates, according to Alcock (1935, p. 95) and contains no plants.

Well-preserved compression remains occur associated with the coal of the Clifton formation. According to Bell (1944) this flora is of Pictou (Westphalian C) age, and perhaps slightly younger than the Minto flora. The species list (List 6) includes the revised list given by Bell in Alcock (1935) with some additions.

The other major area containing Pennsylvanian exposure, the Minto coalfield, comprises about 400 square miles and lies north of Grand Lake in the south-central part of New Brunswick. There is only one seam of mineable coal in the field; it is 18 to 24 inches thick, and occurs near the

surface in many areas. The coal is mined from both open pits and underground workings in the vicinities of the towns of Minto and Chipman. Geology and mining operations of the area have been discussed by Muller (1951). Plants occur abundantly in the slate-grey argillaceous shale of the roof of the coal seam.

Bell's list of Minto plants (see below) is taken from Muller (1951, pp. 18-19). Bell has also mentioned (in Dyer, 1926) that there were several new species present. The Minto flora has not been studied in detail, * but is considered to indicate a Pictou (Westphalian C) age, equivalent to part of the Linopteris obliqua zone of the Sydney coalfield of Cape Breton Island, Nova Scotia (Bell, in Muller 1951, p. 19).

Species Lists

List 6: Clifton.

(Alcock 1935, and unpublished reports, Geol. Survey of Canada).

Adiantites bondi Kidston
Alethopteris serli (Brong.)
Asterophyllites grandis? (Sternberg)
Annularia sphenophylloides (Zenker)
Calamites cisti? Brong.
Cordaites sp.
Lepidostrobophyllum triangulare (Zeiller) Bell
Mariopteris muricata (Schlot.)
M. nervosa (Brong.)
Neuropteris rarinervis Bunbury
Odontopteris sp.
Oligocarpia missouriensis White
Sphenophyllum cuneifolium (Sternberg)
S. emarginatum Brong.
Sphenopteris obtusiloba? Brong.

List 7: Minto

(Muller 1951)

Alethopteris serli (Brong.)

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* Description and stratigraphic evaluation of the Minto and Clifton floras is presently being done by W.A. Bell, Geological Survey of Canada.

Annularia radiata (Brong.)
A. sphenophylloides (Zenker)
A. stellata (Schlot.)
Asolanus camptotaenia Wood
Asterophyllites longifolia (Sternberg)
Asterotheca miltoni (Artis)
Calamites carinatus Sternberg
C. suckowi Brongniart
Cordaites principalis (Germar)
Cordaianthus rhabdocarpi (Dawson)
Corynepteris sternbergi (Ettingshausen)
Diplotmema furcatum (Brong.)
Lepidodendron cf. alternans Sauveur
L. cf. binerve Lindley and Hutton
L. dawsoni Bell
L. plicatum Dawson
Lepidostrobus squamosus Dawson
Mariopteris latifolia (Brong.)
M. muricata (Schlot.)
M. nervosa (Brong.)
Myriotheca desaillyi Zeiller
Neuropteris aff. flexuosa Sternberg
N. gigantea var. nov. (= N. aculeata Bell)
N. rarinervis Bunbury
N. scheuchzeri Hoffmann
N. scheuchzeri Hoffmann forma angustifolia D. White
Oligocarpia brongniarti Stur
O. gutbieri Goeppert
Pecopteris oreopteridia (Schlot.)
P. (Senftenbergia) plumosa forma dentata (Brong.)
Samaropsis bisectum (Dawson)
S. cornuta (Dawson)
Sigillaria tessellata Brong.
S. tessellata var. eminens Dawson
Sphenophyllum cuneifolium (Sternberg)
S. cuneifolium forma saxifragaefolium (Sternberg)
S. emarginatum Brong.
S. myriophyllum Crépin
Sphenopteris bella (Stur)
S. gracilis Brong.
S. laurenti Andrae
S. sp. cf. nummularia (Sternberg)
S. obtusiloba Brong.
Telangium? potieri (Zeiller) Kidston

References

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Gussow, W.C., 1953. Carboniferous stratigraphy and structural geology of New Brunswick, Canada. Bull. Am. Assoc. Petrol. Geol., 37 (7): 1713-1816.

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Wilson, W.J., 1917. Notes on some fossil plants from New Brunswick. Geol. Surv., Canada, Summary Rept., 1917, Pt. F, pp. 15-17.

CUMBERLAND LOWLAND REGION

Physiography, Geology, and Plant-beds

The Cumberland basin of deposition extends northeastward from Chignecto Bay on the Bay of Fundy, across the northern peninsula of Nova Scotia, and includes most of Prince Edward Island. Within this basin, the excursion enters the western portion of the gently rolling Cumberland Lowland of Nova Scotia. The Lowland lies to the north of the Cobequid Mountains and extends to Northumberland Strait, and has an average elevation of about 200 feet (60 m.) above sea level.

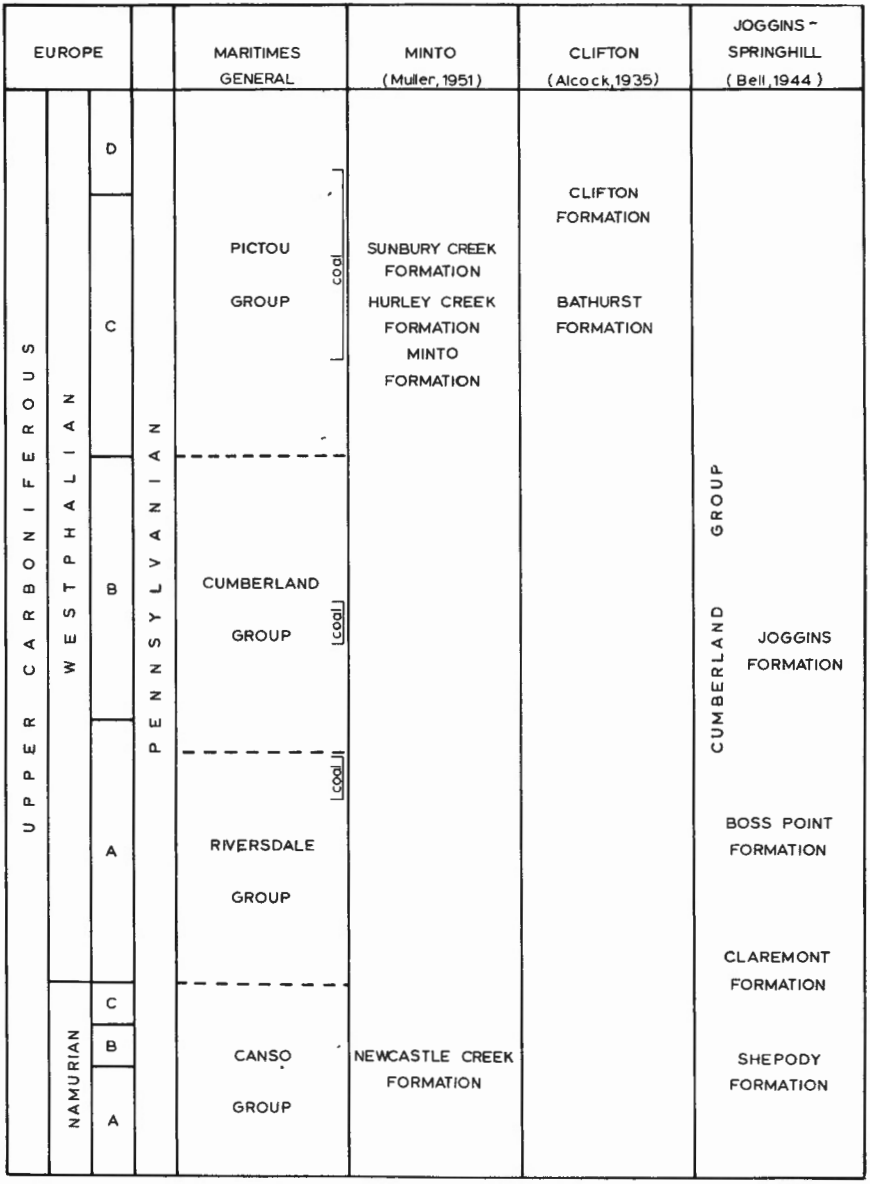
The route enters the two coal-producing areas of the Lowland, those of Joggins-River Hebert and Springhill, both within the Cumberland group of Pennsylvanian age. The Joggins-River Hebert coalfield, occurs in the Joggins formation (Figure 7), which is a local facies of the Cumberland group. This coal-bearing facies extends eastward from Chignecto Bay in a narrow belt about 20 miles (32 km.) long, and thins rapidly in this direction.

The best section of Cumberland strata, and the one that is visited by the tour, occurs in the Joggins-River Hebert coalfield. It is the famous section described by Logan (1845) in the Joggins sea-cliffs, in which he reported the abundance of Stigmaria, Sigillaria, and Calamites in situ. Most of the plant remains occur in Logan's Division 4, extending from near Joggins wharf for about 1 3/4 miles (2.8 km.) and stratigraphically downward along the shore in a northerly direction (Figure 8). The section consists of a cyclic repetition of beds of shale, thin sandstone, underclay, and coal in alternation with thick, massive sandstones. Thin shell-limestones are commonly associated with the coals. Limited mining operations are being carried on in underground workings in the Joggins area.

The Springhill coalfield is located east of Joggins in the vicinity of the town of Springhill, and occupies part of the southern flank of the Cumberland Basin. It is believed to be stratigraphically higher than the Joggins sequence, and contains several thick seams of mineable coal. Mining operations here ceased in 1958 following an accident in the No. 2 Colliery, which took the lives of 75 men. The route of the tour passes through Springhill.

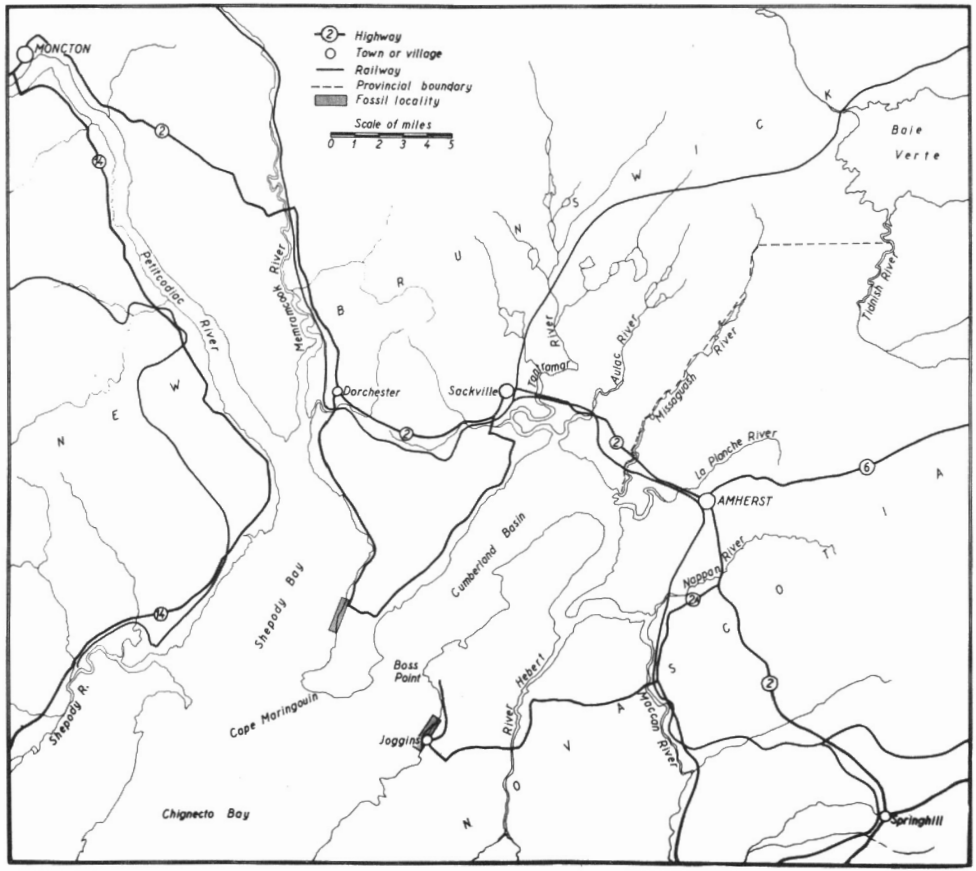
According to Bell (1944, p. 28) the Cumberland flora is "... not older than late Westphalian A or younger than early Westphalian B. An early Westphalian B age is considered more probable...".

Figure 7



Correlation chart, Pennsylvanian, New Brunswick and northwestern Nova Scotia. Coal occurs in the Clifton fm., the Minto fm., and the Joggins fm., in the areas covered by the excursion.

Figure 8



Map of part of the Cumberland Lowland, showing Plant Localities 12 (Shepody Bay) and 13 (Joggins).

Beds of the Boss Point formation, of the underlying Riversdale group, occur near Boss Point, about 3.5 miles (5.6 km.) north of Joggins wharf, where they locally contain remains of the characteristic Neuropteris smithsii Lesq. and Whittleseya desiderata White. Boss Point beds also outcrop further west, on the Maringouin Peninsula (Figure 8). The age of the Boss Point formation is regarded by Bell (1944) as Westphalian A.

Copeland (1956) states a possible correlation of the Riversdale with the lower and middle Westphalian A, on the basis of arthropods.

Species list

List 8: Joggins.

(Bell 1944)

Adiantites adiantoides (L. & H.)
Alethopteris decurrens (Artis)
A. lonchitica (Schlot.)
Annularia acicularis (Dawson) Matthew
A. aculeata Bell
A. asteris Bell
Artisia sp.
Calamites cisti Brong.
C. ramosus Artis
C. suckowi Brong.
C. of varians group
Cordaites principalis (Germar)
Lepidodendron aculeatum? Sternberg
L. lanceolatum Lesq.
L. rimosum Sternberg
Lepidophloios laricinus Sternberg
Lepidostrobophyllum lanceolatum (L. & H.)
L. majus (Brong)
Lepidostrobus variabilis? (L. & H.)
Mariopteris comata Bell
Mariopteris nervosa (Brong.)
M. sp.
Neuropteris schlehani Stur
Pecopteris pilosa (Dawson)
Polypterocarpus sp.
Samaropsis cornuta (Dawson)
Senftenbergia plumosa (Artis) Radforth forma crenata Kidston

Sigillaria elegans (Sternberg)
S. fundiensis Bell
Sphenopteris deltiformis Kidston
S. fletcheri Bell
S. obtusiloba Brong.
S. schatzlarensis (Stur)
S. valida (Dawson) Stopes
S. (Zeilleria) sp.
Zeilleria frenzli Stur

References

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_____ 1914. Joggins, Carboniferous section, Nova Scotia. Geol. Survey, Canada, Summary Rept. 1912, pp. 360-371.

_____ 1944. Carboniferous rocks and fossil floras of northern Nova Scotia. Geol. Survey, Canada, Memoir 238.

Copeland, M.J., 1957. The arthropod fauna of the Upper Carboniferous rocks of the Maritime Provinces. Geol. Survey, Canada, Memoir 286.

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Logan, W.E. and Fletcher, H., 1908. A section of the Carboniferous rocks in Cumberland County, Nova Scotia, Proc. Trans. Nova Scotian Institute of Science, XI (3): 417-550.

Wilson, L.R., 1952. The plant microfossils of the Joggins Section: a progress report. Second Conf. on the Origin and Constit. of Coal, N.S. Dept. Mines and N.S. Res. Found.: 208-218.

Extracts from Literature

Bell, W.A. 1913.

p. 329 - "The Joggins section early attracted the attention of geologists by the reported occurrences of many fossilized trees still standing erect in the sandstone. In 1842 Sir Charles Lyell made his first visit to this locality and was impressed by the abundance of erect trees to be seen, as stated in one of his letters:

"Whither I went to see a forest of fossil coal-trees--the most wonderful phenomenon perhaps that I have seen, so upright do the trees stand, or so perpendicular to the strata...trees twenty-five feet high, and some have been seen of forty feet, piercing the beds of sandstone and terminating downwards in the same beds, usually coal. This subterranean forest exceeds in extent and quality of timber, all that have been discovered in Europe put together."

Unfortunately the present stand of the fossil timber is not so striking, owing in some measure to the destructive tendencies of fossil hunters."

TRIP LOG

First day - Wednesday, September 2

Mi.	Km.		
		Lv. Montreal, Congress headquarters. Via Victoria Bridge across the St. Lawrence River to St. Lambert. Route 9 is followed eastward over the St. Lawrence Lowland Plain. The Monteregian Hills rise up to more than 1,000 feet (300 m.) above the plain between Montreal and St. Hyacinthe.	8.00 a.m. (Eastern Time)
146	234	Ar. St. Nicholas Station (10 mi. west of Lévis). Lunch: Auberge de la Colline	11.30
		Lv. St. Nicholas Station, via Routes 2 and 3. One and one half miles (2.4 km.) east of Lévis, Montmorency Falls is visible across the St. Lawrence, beyond the tip of l'Ile d'Orleans. East of Lévis the route passes from the St. Lawrence Lowland into the northwestern border of the folded and hilly Appalachian Region.	12.30 p.m.
233	373	Rivière Ouelle - Peat bog to right of highway.	
273	437	Rivière du Loup. Rest stop, 20 min.	
		Lv. Rivière du Loup, via Route 10	4.00 (Atlantic Time)
337	539	Ar. Rimouski	6.30
		Dinner: Hotel St. Louis	7.30

Second day - Thursday, September 3

		Breakfast: Hotel St. Louis	7.30 a.m.
		Lv. Rimouski Via Route 10 to Route 6 at Ste. Flavie, and continuing eastward to Matane.	9.00

58	93	Rest stop, 20 minutes	
		Lv. Matane	
115	184	Ar. Ste. Anne-des-Monts	12.00
		Lunch	noon
		Lv. Ste. Anne-des-Monts	1.30
158	253	Continue on Route 6 to Anse-Pleureuse. Here the route turn southerly, toward the interior of the Gaspé Peninsula.	p.m.
183	293	Murdochville, site of Gaspé Copper Mines. Proceeding eastward from Murdochville, the route crosses several areas underlain by rocks of the Gaspé Sandstone series.	
210	336	Ar. Plant Locality 1: road cut in York River formation, north side of road, a few hundred yards beyond Keg Brook, ca. 26.5 miles (42.4 km.) from Murdochville. (York River formation, Lower Devonian.) Stop, 1 hour	4.00
		Lv. Plant Locality 1	5.00
239	380	Ar. Gaspé village	6.00
		Dinner: Baker Hotel	
		Third day - Friday, September 4	
		Breakfast: Baker Hotel	7.30 a.m.
		Lv. Gaspé village (traffic light) Cross Bassin du Sud-Ouest (South West Arm) and proceed southeasterly to l'Anse-à-Brillant, on the south shore of Gaspé Bay.	8.30
16	26	Plant Locality 2: Battery Point formation, Lower Devonian. (Figure 3). Low tide: 9.44 a.m. High tide: 3.50 p.m.	9.00

Plant-bearing beds of the Battery Point formation outcrop in cliffs along the beach northward from Rivière de l'Anse-à-Brillant to Tar Point, a distance of about 1 mile (1.6 km.).

This section includes the 3-inch seam of coal and carbonaceous shale reported by Logan (1863, p. 394) from the base of his 7,036-foot section of the Gaspé Sandstone.

Plants identified from the vicinity of Tar Point and l'Anse-à-Brillant by Dawson: See Species list 1, p. 14.

Dawson rarely quoted exact localities for his species. For a complete list of those he reported from the Gaspé Bay area, including those of list 1, see Species list 2, p. 14.

There has been no comprehensive study of the fossil plants of this area since that of Dawson.

	Lv. Plant Locality 2	12.00 noon
	Ar. Gaspé village	12.30
	Lunch: Baker Hotel	p.m.
	Lv. Gaspé village (traffic light) Northerly on Route 6 via St. Majorique to D'Aiguillon. About 600 yards (540 m.) east of D'Aiguillon post office, plant-bearing beds occur on the beach.	1.30
19.4 31 (from Gaspé)	Plant Locality 3: Battery Point formation, Lower Devonian (Figure 3 and Plate I A). High tide: 3.50 p.m. This is the locality from which Dawson collected his Psilophyton princeps, Var. ornatum (1871, p. 39).	2.00
	Lv. Plant Locality 3	5.00
	Ar. Gaspé village	5.30
	Dinner: Baker Hotel	6.30

Fourth day - Saturday, September 5

		Breakfast: Baker Hotel	7.30 a.m.
		Lv. Gaspé village Follow route 6 southward along the eastern shore of the Gaspé Peninsula.	8.30
46	74	Viewpoint overlooking Baie de Malbaie to north. Rest stop, 30 minutes	9.45
47.2	76	View of Percé village, Percé Rock and Bonaventure Island as the route crosses the summit of the hills above Percé. Stop, 15 minutes.	10.20
126	202	Ar. Bonaventure Lunch	12.30 p.m.
		Lv. Bonaventure The route skirts Chaleur Bay and the lower Restigouche River to Matapedia, passing close to the plant-bearing Devonian deposits of Escuminac Bay and Bordeaux Quarries, which will be visited next day.	2.00
219	350	Ar. Matapedia Forty members will be accommodated at the Hotel Restigouche in Matapedia; the remainder will proceed by bus to the 40-Winks Motel at Campbellton, New Brunswick, 12.1 miles (20 km.) east of Matapedia. Dinner: Hotel Restigouche, Matapedia.	4.30 6.30

Fifth day - Sunday, September 6

		Breakfast: Hotel Restigouche; 40-Winks Motel.	7.30 a.m.
		Lv. Matapedia, Hotel Restigouche Retrace the route along the north shore of the Restigouche River to Bordeaux Quarries. The entry road is on the north side of Route 6 on the farm of Wm. Busteed.	8.30

11.4	18	Plant Locality 4: Lower Devonian, (Figure 6 and Plate I B). Dawson (1882) recorded Psilophyton princeps and Prototaxites Logani from this locality. (Species list 3, p. 23.)	8.50
		Lv. Bordeaux Quarries, one bus, for Protestant Church services in Campbellton.	10.00
		Lv. Bordeaux Quarries, one bus, for Roman Catholic Church at Cross Point. Lunch: prepared box lunch, on bus.	10.30
		Lv. Bordeaux Quarries Continue eastward on Route 6 for 17.0 miles (27 km.); turn south on the road to Escuminac Flats and proceed for 1.3 miles (2 km.) to Dumville Brook. Immediately east of the mouth of Dumville Brook, steeply dipping early Devonian beds outcrop on the beach in the intertidal zone. Plant fragments occur in the shales, and Kindle (1930) reported a 2 1/4-inch coal seam which he believed was approximately equivalent to that at Tar Point on Gaspé Bay.	1.00 p.m.
29.7	47.5	Plant Locality 5: Lower Devonian, (Figure 6 and Plate II A).	1.20
		Lv. Plant Locality 5 Follow the coast road eastward for 5.4 miles (8.6 km.) to Maguasha Landing.	2.00
35.1	56	Plant remains, including Archaeopteris spp., occur at various localities in the cliffs for more than a mile westward from the ferry landing. The best known locality is about 100 feet (30 m.) above the beach and 2,000 yards (1,800 m.) west of the ferry landing (Arnold, 1936). Plant Locality 6: (Figure 6 and Plate II B). High tide: 5.54 p.m. See Species list 5, p. 23.	

Lv. Maguasha Landing 5.30

Ar. Matapedia, Hotel Restigouche (via St. Jean l'Évangéliste) 6.15
Dinner: Hotel Restigouche 7.00

Sixth day - Monday, September 7

Breakfast: Hotel Restigouche, 40-Winks Motel 7.30 a.m.

Lv. 40-Winks Motel 9.00
Via Route 11 eastward on the south shore of Restigouche River for 15.7 miles (25 km.). Access road to the beach leaves Route 11 on the east slope of a hill just west of Dalhousie.
Plant Locality 7: on beach, 300 yards (270 m.) west of intersection of access road and beach; Peuplier Point, Lower Devonian (Figure 6 and Plate III A). 9.30
Plant Locality 8: on beach, 75 yards (67.5 m.) west of Locality 7. (Figure 6 and Plate III B).
Lunch: on beach, prepared box lunch.
Plant fossils occur at several places westward from Locality 8 for about a mile to Pin Sec Point. At Pin Sec Point, sandstone with fragments of Psilophyton and Hostimella occurs in the cliff at the base of a thick conglomerate, and also on the beach in the intertidal zone.
Plant Locality 9: (Figure 6 and Plate IV A).
Low tide: 12:13 p.m.
Species list 4 (p. 23) comprises plants from the vicinity of Campbellton and Dalhousie. Some, including Arthrostigma gracile Dawson (Drepanophycus spinaeformis Goeppert) were probably collected from beds that are now covered, on the beach near Atholville (0.3 miles west of the 40-Winks Motel) (Plate IV B).

		Lv. Plant Locality 9	4.30 p.m.
		Ar. Campbellton, 40-Winks Motel Dinner: Matepedia, Hotel Restigouche.	5.00

Seventh day - Tuesday, September 8

		Breakfast: Hotel Restigouche, 40-Winks Motel.	7.30 a.m.
		Lv. 40-Winks Motel Via Route 11 to Bathurst, and for 14.3 miles (22.9 km.) east from the junction of Routes 8 and 11 to a point just east of the village of Clifton. Here a quarry road leads to the cliffs at the shore of Chaleur Bay, where well-preserved Pennsylvanian (Westphalian C) plants occur associated with two thin seams of coal (6 inches and 8 inches).	8.45
85	136	Plant Locality 10 Species list 6, p. 30 .	11.00
		Lv. Plant Locality 10	12.30 p.m.
99	159	Ar. Bathurst Lunch	1.00
		Lv. Bathurst Via Route 8 southward, across the New Brunswick Lowland. Rest Stop, The Enclosure, near Newcastle. Afternoon tea as guests of the Province of New Brunswick.	2.15
250	400	Ar. Fredericton, University of New Brunswick. Dinner: University of New Brunswick	6.30 7.30

Eighth day - Wednesday, September 9

		Breakfast: University of New Brunswick.	7.30 a.m.

		Lv. Fredericton	8.45
35	56	Via Route 10 to Minto	9.30
		A single coal seam averaging 18 to 24 inches in thickness is mined in the Minto area, from open pits and underground workings. Plants occur in the roof-shales of the coal. Plant Locality 11. Several sites will be visited. The coal is considered by Bell (1944) to be of Pictou (Westphalian C) age, and perhaps slightly older than the plant-bearing beds at Clifton. Species list 7, p. 30 . Lunch: prepared box lunch	
		Lv. Minto	5.00 p.m.
70	112	Ar. Fredericton, University of New Brunswick.	5.45
		Dinner: University of New Brunswick.	6.30
		Entertainment for the evening is being provided through the courtesy of the Province of New Brunswick.	

Ninth day - Thursday, September 10

		Breakfast: University of New Brunswick	7.30 a.m.
		Lv. Fredericton	8.30
		Cross the St. John River and follow Routes 9 and 2. Rest stop, Chapman Picnic Site, 2 miles east of Salisbury (near Moncton).	
155	248	Ar. Sackville, Mount Allison University	12.30 p.m.
		Lunch	
		Lv. Sackville	1.30
		Via Route 2 southwesterly for 1.8 miles (2.9 km.); leave Route 2 and continue south, on the east side of the Maringouin Peninsula for 15 miles (24 km.); turn west at Upper	

Rockport and cross the peninsula. An access road at this point leads

174 278 to the beach on Shepody Bay 2.00

Near the intersection of the road and the beach, plant-bearing sandstones and shales of the Boss Point formation, of Riversdale (Westphalian A) age (Bell, 1944; Copeland 1957), are in faulted contact with younger Pennsylvanian sandstone, shale and conglomerate. The Boss Point strata outcrop in cliffs on the beach for almost a mile in a southerly direction.

A list of plants known from the Riversdale group, including those from the Boss Point formation, is given in Bell 1944.

Plant Locality 12. (Figure 8)
Low tide: 11.25 a.m.
High tide: 5.50 p.m.

Lv. Plant Locality 12 5.00

194 310 Ar. Sackville (via Dorchester). 5.45
Dinner: Mount Allison University 7.00

Tenth day - Friday, September 11

Breakfast: Mount Allison University 7.30 a.m.

Lv. Sackville 8.30

Follow Route 2 eastward into the province of Nova Scotia.

Between Sackville and Amherst the route passes Fort Beauséjour and the Tantramar Marshes.

Proceed via Amherst to Route 2A, Nappan, and Maccan to Joggins.

26 41.6 Ar. Joggins wharf 9.15

Extending southwesterly and northeasterly from the wharf for about 35 miles (56 km.) is the shore section of Mississippian and Pennsylvanian strata measured by Logan (1845).

The most productive plant beds of this famous section belong to the Cumberland group (Westphalian B), and occur within about 1 mile, extending northeastward and stratigraphically downward from the Joggins wharf. These constitute part of Logan's division 4, which contained the thick forest of Sigillaria, Calamites, and Stigmaria in situ, reported by him (ibid. p. 108). Plant Locality 13.

Since the time of Logan the cliffs have been eroded rapidly, and only a very few examples of the original forest now exist. Compression remains are also rather rare for a coal-bearing region.

Species list 8, p. 36 . A complete species list for the Cumberland group is given in Bell (1944).

Lunch: Joggins wharf 12.00 noon

Lv. Joggins wharf 1.00 p.m.

The route is retraced to Maccan, and Route 2A followed south to Southampton. From here Route 2 is taken via Springhill and Sackville, thence to Route 9 and to Fredericton.

60 96 At Springhill, mining operations ceased following the disaster in the No. 2 colliery in October, 1958. The coal-bearing facies at Springhill is part of the Cumberland group, as is the coal sequence at Joggins, but is believed to be slightly younger than the latter (Bell, 1944, p. 19)

126 202 Ar. Chapman's Picnic Site, near Salisbury 3.00
Rest stop, 30 minutes

Lv. Picnic site 3.30

237 379 Ar. Fredericton 6.30

Dinner: University of New Brunswick 7.30

Eleventh day - Saturday, September 12

		Breakfast: University of New Brunswick	7.30 a.m.
		Lv. Fredericton Via the south side of the St. John River to Woodstock (Route 2).	9.00
96	154	Rest stop, 30 minutes, Island Park Picnic Site.	11.15
		Lv. Woodstock At Hartland a 1282-foot covered bridge spans the St. John River. Now on the east side of the river, the route continues northward through the New England Uplands. The Beechwood hydro-electric power development is on the left, 22 miles (35 km.) north of Hartland.	11.45
133	213	Ar. Andover Lunch, York's Restaurant	1.00 p.m.
		Lv. Andover Continue on Route 2 via Grand Falls	2.30
157	251	Rest stop, Grand Falls, 15 minutes	
200	360	Ar. Edmundston Dinner: Rita's Motel	4.30 6.00

Twelfth day - Sunday, September 13

		Breakfast: Rita's Motel	7.00 a.m.
		Church services, Edmundston	8.00
		Lv. Edmundston Route 2 is followed northward, crossing the low Notre Dame Mountains to Rivière du Loup.	10.00
75	120	Ar. Rivière du Loup Lunch	11.45
		Lv. Rivière du Loup The route is retraced to the property of Premier Peat Moss Ltd.,	1.00 p.m.

1 mile southeast of Rivière du Loup. This is the site of a 7,000-acre deposit of moss peat. Terrain and production methods will be observed.

Lv. Peat bog 2.30
Again proceed via Route 2, to Rivière du Loup and thence westward along the St. Lawrence River to St. Nicholas Station, south of Quebec City.

205 328 Ar. St. Nicholas Station 5.30 (Eastern Time)

Dinner: Auberge de la Colline 6.30

Thirteenth day - Monday, September 14

Breakfast: Auberge de la Colline 7.30 a.m.

Lv. St. Nicholas Station 8.30
To Quebec City via the Quebec Bridge,
914.4 Route 9 and Grande-Allee
Quebec City, the only fortified city in America, was established in 1608 at the site of the Indian village of Stadacona. This city of unusual historic, architectural and geographic interest, is now the capital of the province of Quebec.

Lv. Quebec City 10.00
Via the north shore of the St. Lawrence River to Trois Rivières.

91 146 Ar. Trois Rivières 12.30 p.m.
Lunch

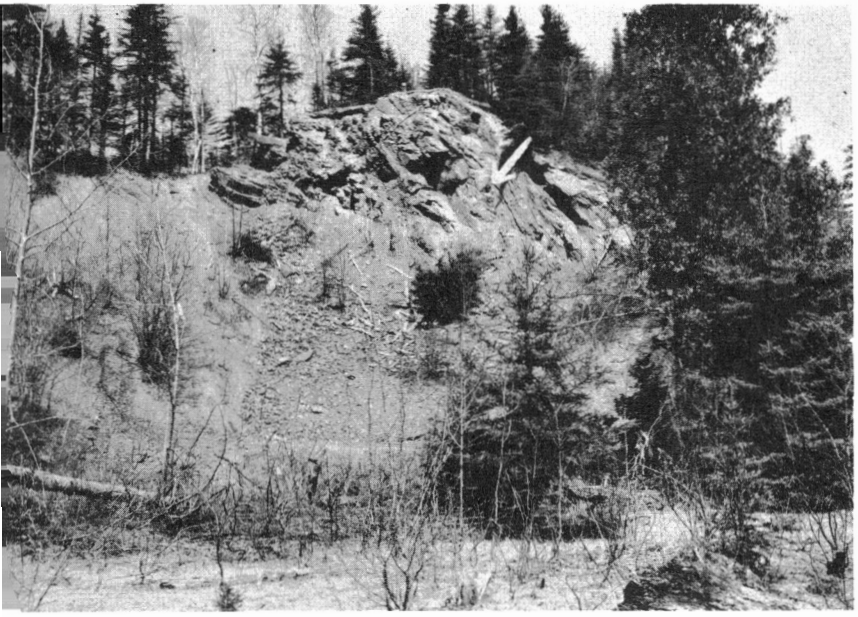
Lv. Trois Rivières 2.00
Cross the St. Lawrence by ferry to St. Angèle-de-Laval; proceed via
121 194 Route 3 to Pierreville; turn left in Pierreville at Hotel Traverse, continue for 2.1 miles (3.4 km.) to a site to the right of the road, where gully erosion has exposed late-Pleistocene buried peat and clay deposits.
123.1 197.4 (See p.7 for description of section). 2.45

		Stop, 45 minutes	3.30
		Lv. Pleistocene site Return via Pierreville to Route 3, Proceed via Sorel to Montreal.	3.30
194	304	Ar. Montreal, Congress Headquarters	6.00

A. Plant Locality 3, north side of Gaspé Bay near D'Aiguillon (see Figure 3), looking eastward. Stratum with *Psilophyton princips* var. *ornatum* Dawson shown by dashed line (DCM 2-6-58)

Plate I

B. Plant Locality 4, westernmost Bordeaux quarry (see Figure 6). *Prototaxites* in situ at arrow. (DCM 7-2-58)



A. Plant Locality 5, Pirate cove (*see* Figure 6). Lower Devonian plant-bearing rocks outcrop in intertidal zone in centre of photo. (DCM 6-1-58)

Plate II

B. Plant Locality 6, Escuminac Bay, looking westward from point $\frac{1}{2}$ mi. west of ferry landing. (*see* Figure 6). Beds with *Archaeopteris* in foreground and at arrow. (DCM 2-5-58)

A. Plant Locality 7, west of Dalhousie, N.B., near Peuplier Point (see Figure 6), looking eastward. Lower Devonian. (DCM 6-7-58)

Plate III

B. Plant Locality 8, 75 yards west of Locality 7. Lower Devonian. (DCM 6-8-58)

A. Plant Locality 9, west of Dalhousie, near Pin Sec Point (see Figure 6). Lower Devonian plant-bearing sandstone in contact with conglomerate at arrow. (DCM 6-6-58)

Plate IV

B. Debris covering Lower Devonian plant beds at Atholville, west of Campbellton, N.B. (DCM 6-6-58)