THE

PROCEEDINGS AND TRANSACTIONS

OF THE

Nova Scotian Institute of Science,

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SESSION OF 1904-1905.

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THE attention of members of the Institute is directed to the following recommendations of the British Association Committee on Zoological Bibliography and Publications :—

"That authors' separate copies should not be distributed privately before the paper has been published in the regular manner.

"That it is desirable to express the subject of one's paper in its title, while keeping the title as concise as possible.

"That new species should be properly diagnosed and figured when possible.

"That new names should not be proposed in irrelevant footnotes, or anonymous paragraphs.

"That references to previous publications should be made fully and correctly, if possible in accordance with one of the recognized sets of rules of quotations, such as that recently adopted by the French Zoological Society."

PROCEEDINGS

OF THE

Nova Scotian Institute of Science.

SESSION OF 1904-1905.

Annual Business Meeting.

Legislative Council Chamber, Halifax, 17th October, 1904.

The President, Dr. Henry S. Poole, in the chair.

Presidential Address: (1) Progress of the Institute, (2) Borings in Search of Coal. By Henry S. Poole, D. Sc., Assoc. Roy. Sc. Mines, F. G. S., F. R. S. C., Hon. M. I. M. E., &c.

The honor, I have had of being your chairman for a second term, gives me again the privilege of reporting the work of the past session, and an opportunity to lightly touch on the papers submitted.

Progress of the Institute.

Besides the regular monthly gatherings, a special meeting to hear papers by Mr. E. Stuart and Mr. R. H. Campbell, of Ottawa, on Forestry, illustrated by drawings enlarged on a screen, appealed to popular taste.

The subject matter of the papers at the ordinary meetings covered a wide range, as might be expected from a maritime people with diversified interests and familiarized by easy travel with the littoral of many lands. The consideration of time and its effects during periods that extended back into thousands of centuries, created no surprise; and geological questions, chiefly of local bearing, furnished subjects for one-third of the papers presented to the Institute.

Zoology found an exponent in Mr. Frank H. Reid who had many interesting things to say on the nidification of some of our birds.

Chemistry was not neglected. Mr. F. H. Mason gave notes on provincial hydraulic lime and cement, and Mr. W. H. Ross contributed the results of a study of solutions of hydroxylamine and its salts.

Botanical studies were shewn not yet to have been carried to exhaustion, for Capt. J. H. Barbour, A. M. C., on the local varieties of blue-eyed grass, suggested a new line of comparison. The value of combined observation conducted under experienced supervision by public school children was noted in the further additions to phenological records laboriously compiled by Dr. A. H. MacKay.

The veteran, Dr. H. Y. Hind, dwelt on the importance to miners of a knowledge of rock foldings; and the new science courses at Dalhousie College bore fruit in papers by two students, Mr. T. T Fulton writing on the Faults of Battery Point, Sydney, and Mr. L. A. DeWolfe on the cliff sections at North Sydney; papers indicating careful record of close observation. Dr. Woodman gave the bibliography and an exhaustive review of the gold-bearing rocks of Nova Scotia which he proposed should be designated "Meguma." The same gentleman recorded the earthquake shocks which were observed in parts of the Maritime Provinces in March of the present year. A criticism of the long received view that Louisbourg supplied evidence of very recent subsidence came from the pen of Mr. Kenneth McIntosh and met with general acceptance. To the writer was given an opportunity to ask for a review of the age of the conglomerate here and there capping the Cambrian rocks of the Atlantic coast. It was also given to him to speak of the "Sunken Land of Bus," where the cabled depths of mid-ocean recalled the ancients' story of the fabled Atlantis.

Mr. T. Vardy Hill referred to the creation and development of the foundation of the earth, and in this country was also heard an echo of the revived discussion of the relation of scientific studies to religious beliefs and something of the progress made among the foothills of knowledge by such seekers after truth as have met the outposts so long and strongly held by theological teachers. While by the bulk of our people the views of forty years ago are still

unchanged, by students of both classes mutual forbearance is practised and they are content to work side by side, although it is evident both could not agree were they to continue to an issue the deductions to which several of their teachings lead. We as a society cannot well engage in controversies of this character, for it is not to be expected that where individual convictions are involved that members as a body could maintain a judicial position and a tolerant spirit.

Note also was taken of the interest in scientific research by the Branch of the Institute established in King's County and the additional five papers that were discussed at Wolfville.

Borings in search of Coal.

In my address of a year ago I referred to certain theoretical deductions respecting the possible extension of workable coal seams lying concealed under newer measures on the north side of the Cobequid hills from the Bay of Fundy eastward to Merigomish.

The interest that had there been aroused took practical shape, and search in three localities was prosecuted. One borehole was put down at Spicers' Cove on the Bay of Fundy to a depth of 944 feet, but as it turned out, it was placed too close to the hill range, for after passing through a thick bed of conglomerate, largely composed of the debris of the old rocks it entered, at 893½ feet, igneous rocks in place. A site for another hole in this locality has been selected further from the hills, at Apple river.

The second locality is near Newville at Halfway River lake on the Springhill and Parrsborough railway, and a borehole there also met with conglomerate at the expected depths. Here it is found to be composed chiefly of clastic rocks of Lower Carboniferous age, and it has not yet been passed through by the borehole which has now reached a depth of over 2200 feet.*

The third persistent effort to get at the underlying strata was made at the mouth of Rear brook, below New Glasgow, on the East river. After the loss of the first hole at a depth of some 900 feet a second borehole was made alongside the first, and at 1900 feet it had failed to reach the bottom of the conglomerate bed when

* Subsequently, at 2350 feet from the surface coal was struck which is reported to be 9 feet in thickness, and the boring was stopped at a depth of 2359 feet.—*Ed.*

misfortune again met the borers and the hole was hopelessly lost. Another 100 feet would have got down to the underlying beds according to calculations based on surface outcrops.

The Treasurer's report was presented by Mr. McKerron, and having been audited and found correct, was received and adopted.

The Librarian's report was presented by Mr. Piers. During the year 1904, 2330 books and pamphlets had been received and catalogued The total accessions of the Science Library, with which that of the Institute is incorporated, were 3,115 for the year. The report was received and adopted, and a vote of thanks was presented to Mr. Piers for his services.

A report was read from the King's County Branch of the Institute, Wolfville, N. S., on the work done by the Branch during its fourth session (1903-04). The officers of the branch were as follows:

President,—Professor Ernest Haycock, M. A.
Vice-President,—Professor F. R. Haley, M. A.
Secretary-Treasurer,—Professor E. W. Sawyer, B. A.

The following papers, etc., were communicated to the branch:

1. Constitution of Matter. (General discussion.)
2. The Atomic Theory of Dalton.—By Professor E. Haycock, M. A.
3. The Divisibility of the Atom.—By Professor F. R. Haley, M. A.
4. Influence of Climate on Fruits.—By R. W. Starr.
5. The Black Knot of the Plum.—By Professor F. C. Sears.

The report was received and adopted.

It was resolved that the thanks of the Institute be conveyed to the Hon. M. H. Goudge, President of the Legislative Council, for his courtesy in granting the society the use of the Legislative Council Chamber as a place of meeting during the past session; and to the Secretary of the Smithsonian Institution for continuing to admit the Institute to the privileges of the Bureau of International Exchanges.

The following were elected officers for the ensuing year (1904-05):

President,—Henry Skeffington Poole, D. Sc., A. R. S. M., F. G. S., F. R S C., *ex officio*, F. R M. S

Vice-Presidents,—F. W. W. Doane, C E., and Professor Ebenezer MacKay, Ph D.

Treasurer,—William McKerron.

Corresponding Secretary,—A. H. MacKay, Ll. D., F R. S. C.

Recording Secretary,—Harry Piers.

Librarian,—Harry Piers

Councillors without Office,—Maynard Bowman, B A.; Watson L Bishop; Professor Stephen M. Dixon, B. A., B. A. I; Edwin Gilpin, Jr., Ll. D, F. R. S. C., I. S. O.; Alexander McKay; Professor J. Edmund Woodman, D. Sc.; J. B. McCarthy, M. A., B. Sc.

Auditors,—Roderick McColl, C. E.; and Professor F. H. Sexton.

Dr. MacKay took the chair while the President, Dr. H. S. Poole, read a paper on "Pre-Cambrian Volcanic Bombs from near Lake Ainslie, Inverness Co., N. S." (See Transactions, p. 339).

Dr. Woodman gave the result of a microscopic examination of some of these bombs.

First Ordinary Meeting.

Legislative Council Chamber, Halifax, 21st November, 1904.

The President, Dr. H. S. Poole, in the chair.

Professor Stephen M. Dixon, M. A., B. A. I., read a paper entitled, "A Determination of the Elements of Terrestrial Magnetism at Halifax, N. S., August, 1904." (See Transactions, p. 245). The subject was discussed by the President, and Dr. A. H. MacKay and Dr. Woodman, and a vote of thanks was presented to the lecturer.

Second Ordinary Meeting.

Legislative Council Chamber, Halifax, 23rd January, 1905.

The President, Dr. H. S. Poole, in the chair.

The Recording Secretary announced that the Rev. Brother Junian Peter of Fall River, Mass., U. S. A., a corresponding member, had presented to the Institute a collection of dried plants collected in his district. The Secretary was directed to convey to Brother Peter the thanks of the society.

Professor J. Edmund Woodman, D. Sc., gave a lecture on "The Volcanoes of the Hawaiian Islands," illustrated by coloured lantern-slides. A vote of thanks was presented to the lecturer.

Third Ordinary Meeting.

Provincial Science Library, Halifax, 13th March, 1905.

The President, Dr. Poole, in the chair.

It was announced that Captain E. B. Tinling, R. N., of the Marine and Fisheries Department, Halifax, had been elected an ordinary member.

The Recording Secretary reported that there had been received from the Royal Society of London, forty volumes of its earliest Proceedings (from vol. 1, 1800) so far as they were in print. It was directed that the thanks of the Institute be conveyed to the Royal Society for this valuable gift.

In the absence of the author, Dr. A H. MacKay read a paper by Walter H. Prest of North Brookfield, N. S., on "Edible Wild Plants of Nova Scotia." (See Transactions, p. 387). The subject was discussed by Drs. A. H. MacKay, Poole, Barbour, A. P. Reid, and Messrs. Piers, Bishop, Harris, and others. A vote of thanks was presented to Mr. Prest for his paper.

Dr. J. E Woodman read by title a paper entitled "Distribution of Bedded Leads in relation to Mining Policy." (See Transactions, p. 163).

Fourth Ordinary Meeting.

Assembly Room, Province Building, Halifax, 17th April, 1905.

The President, Dr. Poole, in the chair.

It was announced that L. C. Harlow, B. Sc., Provincial Normal School, Truro, N. S., had been elected an associate member.

The Recording Secretary announced that the Proceedings and Transactions of the Institute, vol. xi, part 1, had been published and part 2 was now in press.

In the absence of the author, Dr. Woodman read a paper by M. V. Grandin of Cheticamp, entitled, "Notes on the Ore Deposits of South Cheticamp, Cape Breton Island, N. S." (See Transactions, p. 347). The paper was discussed by the President, Dr. Woodman, and others; and a vote of thanks was presented to the author.

F. H. McLearn read a paper, entitled, "A Structural Analysis of the Goldenville Anticline, Guys. Co., N. S." The subject was discussed by J. Regan, H. Piers, Dr. Woodman, and Professor Haycock; and a vote of thanks was presented to Mr. McLearn.

Fifth Ordinary Meeting.

Assembly Room, Province Building, Halifax, 16th May, 1905.

Dr. A. H. MacKay, in the chair.

The Recording Secretary reported that the Council had appointed the Treasurer, Wm. McKerron, to represent the Institute at the forthcoming meeting of the Royal Society of Canada.

Professor J. E. Woodman, D. Sc, presented two papers: (1) "Note on Crystallized Gold"; (2) "Detection of Vanished Coastal Plains."

The following papers were read by title :—

"Phenological Observations in Nova Scotia and Canada, 1904," by A. H. MacKay, LL. D., F. R. S. C. (See Transactions, p. 373).

"Meteorological Notes," by F. W. W. Doane, C. E. (See Transactions, p. 361).

"Weathering of Building Stone in Halifax," by Professor J. E. Woodman, D. Sc.

Harry Piers,
Recording Secretary.

TRANSACTIONS

OF THE

Nova Scotian Institute of Science.

SESSION OF 1904-1905.

Pre-Cambrian Volcanic Bombs from near Lake Ainslie, Inverness Co., N. S.—By Henry S. Poole, D. Sc., Assoc. R. S. M., F. G. S., F. R. S. C.

(*Read 17th October, 1904.*)

Among the rocks of Cape Breton, N. S., classed in the Report of the Geological Survey of Canada of 1882-4 as pre-Cambrian, in a deposit on the east side of Lake Ainslie, are some globular balls associated with modified forms presenting marked features. They differ in so many respects from concretions ordinarily seen taking spherical shape in sandstones, plaster and shales, that these balls could not be grouped with them and thus dismissed. It may first be noted they are found with pyroclastic rocks, and next that such concretionary structure as they do present is in most cases merely superficial; they are associated in a bed which has cavities coated with matter that has flowed while in the condition of thick mud or paste and retained the forms then taken as ridges and layers of varied consistency. The balls have an indurated appearance with a smooth surface, and vary in size from that of a pin's head to a cricket ball. Rarely over three inches in diameter, the largest seen was a flattened oval of 7 in. by 5 in. by 3 in. that apparently had lost, through impact or pressure on contact with

others, an original shape more nearly spherical. The crushing it was subjected to, would appear to have taken place when the interior was still in a semi-plastic state and the crust alone was broken into irregularly shaped plates, the edges of which were more or less displaced. The distortion of form which the balls suffered on impact varied in degree with their size and plasticity. Some retained their form unaltered when they dropped to earth, others appear to have had an exterior sufficiently viscid at the moment of contact to coalesce, while yet others suffered deformation without cohesion, or had their crust fractured, while the displaced pieces were held together by the pasty condition of the interior. While I have said the external surface of the balls is smooth, this statement requires qualification, as parts have a rough or broken appearance where they have been in contact with others. A few show where a spherulitic structure with fibrous radiations has been developed, a form recognized as incipient of crystallization in igneous rocks of the more acid constituents. There was also to be seen on one or two specimens a faint trace of venation somewhat similar in character, and this feature has also been detected on the ridges of flow structure with the associated ash bed. Contact probably gave to the surface of the softer balls a cup-shaped depression, or flattened or simply depressed it, the ultimate form retained by the balls doubtless being determined by the relative hardness of the impinging bodies. Some of the forms found were oblong with rounded ends and somewhat constricted in the middle; they had a dumbell-like appearance fitting into the inequalities of one another with, in many cases, such slight adhesion that at a light tap of the hammer a group of them would fall apart.

Of the largest a fragment has been put in the Provincial Museum It presents a curiously pitted appearance all over its surface, giving to the plates, into which the crust is cracked, a likeness to the scutes of ganoid fishes; and taken alone it might be supposed to be part of a fossil.

The pitting is fairly uniform and about of the size and depth given to the depressions on the top of ladies' sewing thimbles. An appearance somewhat similar may be produced by stirring on a glass plate or other non-absorbent surface a thick mud of proper consistency, and allowing it to dry. When mud is rightly prepared and globules of air are incorporated in the mass, there is left on evaporation a coating having a pitted surface like that on this stone. To account then for this pitting phenomenon we may assume that the final concentric coating possessed such a consistency and the usual cementing qualities. I may add that Mr. M. V. Grandin, of Cheticamp, informs me he has seen the same external structure on fragments of lava on the slopes of Vesuvius.

On fracture these balls show an interior of irregular composition sometimes with cavities, parts being granular and easily pulverized and parts being like that of the outside coating, of a fine homogeneous material. The cavities were not found to contain crystals, but one was lightly bridged over by a crust not a 32nd of an inch thick. The concretionary exterior may be somewhat shelly, and shows that it has gathered additions splashed on in drops or patches. These are easily distinguishable by the slight irregularity of form thereby produced, which is often enhanced by a variation in col ring. That the accretions have been of varied degree of fluidity, is made evident by the extent to which they have spread out over the spherical surface, and their appearance would remind one who has visited a pottery establishment, of the action of 'slip' on the clay forms in the hands of the potter.

Besides the deformation due to impact or pressure, it will be seen they have suffered fracture under two distinct conditions, one in common with rocks in general from shrinkage in some ordinary form, and the other exceptional and attributable to sudden violence while in a non-homogeneous state such as is possessed by many articles of domestic confectionary like

chocolate drops and meringues. Pieces of the fractured crust of some of the smaller balls appear to have fallen out and been lost at the time.

I have yet to speak of another feature, and that not of any lesser interest than the foregoing. Parallel to the major diameter of several of the balls, there is a more or less complete striation or grooving around the circumference. The grooves may be single or double, and have a width of as much as an eighth of an inch, while the striæ are more numerous and in a belt of fourteen or more on a scale of even less than thirty to the inch. In the specimen on the table this equatorial linear engraving can best be seen when light is made to fall parallel to the axis of rotation. It is further to be seen passing under the remains of an adhesion giving priority to its formation; but how this engraving was produced, or how the tool which made the lines was held, I am at a loss to suggest.

We may now consider how came these balls of matter, doubtless volcanic ashes, to acquire their present form, and under what conditions would it seem most probable they were produced? Whatever may be the ultimate concensus of opinion, it seems to me their formation can best be conceived by comparison with that of a modern volcanic bomb, and is due to swirling gases of an explosion giving a gyratory motion to the ejected particles of attrition and their aggregations.

Messrs. Chamberlain and Salisbury, in their recent work on geology,* write :—" The larger masses of lava ejected into the air are often caused to rotate by the unequal force of the projection, or by the unequal friction of the air, and to assume spheroidal forms. . . . These rounded projectiles are known as volcanic bombs." Of the ejected dust from Vesuvius they further say—" A finer variety [than lapilli] of the nature of sand, much used in making Portland cement, is locally known as puzzolana." This latter quotation is made as bearing on the rapid cementa-

*T. C. Chamberlain and R. D. Salisbury, *Geology*, 1904, vol. 1, p. 386.

tion which apparently took place in the crust of our Ainslie bombs under consideration. Another extract from the writings of an authority on volcanic rocks I make as apposite to the question at issue. Professor I. C. Russell, writing on the eruptions on Martinique in 1902, says—"In addition to the angular fragments of fresh lava, minor quantities of more or less spherical masses of similar material, which were projected into the air while yet moderately plastic, have also been observed. While the term volcanic bomb has been applied to much of the ejected material, it is evident that only the somewhat spherical masses referred to deserve to be so called, and even in such instances there is doubt as to the propriety of using the term. Typical volcanic bombs have a round or oval form with extended and spirally twisted projections at the ends of the longer axis, the spherical or more commonly oval form and the spirally twisted extremities being due to the rotation of the mass during its serial flight and while yet plastic. . . The nearest approach to a characteristic bomb are certain rudely spherical masses of lava with cracked surfaces and without protections to which have been given the name of Breadcrust volcanic bombs. Evidently these poorly shaped bombs are composed of fresh lava which was sufficiently hot to make it somewhat plastic at the time it was blown into the air, but was too rigid to acquire the typical shape frequently to be seen about certain basaltic craters. The absence of characteristic bombs on Martinique and St. Vincent is in keeping with the composition of the lava thrown out. The fresh lava is an andesite having in a general way the composition of refractory brick, and unless very highly heated would not be plastic. . . Not only are true volcanic bombs absent, but dots and splashes of plastic or fluid rocks such as are common about many volcanoes that have erupted easily fusible material are also lacking."

In the case of the Ainslie bombs, the composition is more acidic than andesite, and there is an entire absence of fusion in the mass, without any trace being observed of the spiral pro-

jections belonging to characteristic bombs. We have therefore to assume some marked change in the conditions to meet their peculiarities, for the special interest which these balls of undoubtedly igneous origin possess, lies not merely in their being volcanic bombs of very ancient geological horizon but in the presumption that they indicate phenomena of unusual type and a rapid cementation of volcanic ashes of a composition differing from those of ordinary modern volcanoes which, generally highly basic, make a mud which of itself does not possess the property of speedily setting as a cement.

The value of intimate grinding to an extreme fineness is well known in the manufacture of commerical cement, but conditions could not be reproduced which are effected during a volcanic explosion when the separation of impalpable dust is under the influence of the chemical agency of superheated steam and other gases, and which for the moment, it is here assumed, existed when these bombs were taking their natal flight. The late exhibition of vulcanism at Martinique and St. Vincent makes the contemplation of a rapid setting cem nt within reason, but requires that the composition of the powder be otherwise than that met with in the ejecta of the Lesser Antilles.

A complete comparison is not at present possible, as no ultimate analysis of the Lake Ainslie ash-bed has been made. That it materially differs from that of the dust from the Windward Islands is evident. Analysis showed the latter to be very basic, with an average of 55% of silica at St. Vincent, and 62% of silica at Martinique; while from the accompanying letter from Dr. Hoffmann of the Geological Survey it is clear the silica contents of the Lake Ainslie rock is very much higher.

OTTAWA, AUGUST 8TH, 1904.

My dear Mr. Poole.

I duly received your letter of the 30th ult., as likewise the specimens therein referred to. With regard to the "concretions of felsite." In so far as composition is concerned, they co sist essentially of silica, with a little alumina, etc., etc. The amount of alumina, in the specimen examined, was comparatively small

and would represent but a small proportion of felspar. Thin splinters of the material are with great difficulty fusible before the blowpipe, becoming in fact only just, and no more, rounded on the thinnest edges. This also would tend to show that the amount of felspar present is but small. There is not, so far as I am aware, any fixed ratio between the quartz and felspar in what are commonly designated felsites. Hence the material in question might by many, if not most, be referred to as felsite —and possibly permissively so. They exhibit an unmistakable concentric structure. I am disposed to refer to them as "slightly felspathic quartzose concretions." When next writing would you kindly mention locality of occurrence, and I will then place the same in our museum collection—duly crediting you with the presentation.

I remain,
Yours faithfully,
G. CHAS. HOFFMANN.

The locality where these bombs were found is on the Gairlock mountain road, half a mile from the east shore of Lake Ainslie, on the slope of the hillside within the loop which the road makes opposite the entrance to the ravine and within a stone's throw of the barite mine on the lands of Johnstone. The barite veins occur in a reddish volcanic ash or quartz-felsite and the bed of bombs appears to be at or about the contact of the ash bed with a band of basic volcanic rocks. The limits of the trap rocks are easily distinguished, as its beds are all dark in color while that of the quartz-felsite varies through light shades of yellow and pink to those of a reddish cast, weathering even to whiteness with minute crystals of sanidine (?) sparkling on the faces of fracture.

The deposit was very superficially exposed and where it had been long subject to surface influences. It seemingly was on edge, and apparently considerable excavation would be required to lay bare the bed where it had not been disturbed in order to establish the relation of the basic lava flows to the highly silicious tuff to which evidently belongs the special portion of the deposit containing the bombs, and a further

investigation of the relation of these very distinctive varieties of igneous rocks would be desirable.

The views respecting the formation of these bombs which I would offer for consideration are these, that during the propulsion upwards of the erupted dust and steam, there was a rapid growth of these spherical forms, augmented during flight, after partial cooling had taken place, by additions received from instrusions of fresher and hotter blasts meeting the descending bombs; that the agglomerates resulted from the clash of matter still in the formative stage and the process of cementation was very rapid and took place during the time of flight, the drying of the crust being completed in many cases even before the bombs fell back to earth.

Notes on the Ore Deposits of South Cheticamp, Cape Breton Island, N. S.—By M. V. Grandin, Cheticamp.

(Read 17th April, 1905.)

One of the most interesting and instructive mining districts of Nova Scotia, especially for the study of certain peculiar structural features of ore deposits, is that of Cheticamp.

PHYSICAL GEOGRAPHY.

The district lies in Inverness county, on the north-west side of the Island of Cape Breton, about 110 miles north-east of Pictou, from which place it may be reached by steamer during the season of open navigation. During the winter, however, the most direct route is by mail-coach from Inverness—the terminus of the Inverness railway—a distance of about forty miles.

It comprises a tract of country about 13 miles in breadth, extending along the Gulf of St. Lawrence in a north-easterly direction from Factory river to George's brook—a distance of 16 miles; its area being about 200 square miles. The most trenchant and conspicuous natural division of the district is into a narrow seaboard plain and a plateau lying to the east and north-east of the plain. But for the purpose of this description the great gorge of the Cheticamp river, which traverses the district from south-east to north-west is taken as the dividing line between North and South Cheticamp. The principal metalliferous deposits are located in the southern division which embraces almost the whole of the plain and more than half the plateau area included within the district. The barite and other deposits of the northern division have been made the subject of investigation by Dr. H. S. Poole, so they will not be described in this paper.*

* See bulletin to be shortly issued by Geological Survey of Canada.

The plain, which embraces the island of Cheticamp, covers but one-tenth of the area of the district. It stretches along the shore between Factory and Cheticamp rivers—a distance of nine miles, and rarely exceeds two miles in breadth. Its surface is traversed in a north-east and south-west direction by long low undulations, which towards the east and north, along the foot of the grand escarpment of the plateau, break up into hummocks and high ridges.

The harbor, which was originally a narrow strait running parallel to the undulations and severing the island from the mainland, but now silted up at the southern end, is about 3½ miles long and a little over a quarter of a mile wide. It is the only well sheltered harbor on the western coast of Cape Breton and requires but little dredging to keep it open. Ice, however, commences to form during the latter part of December and lasts from then until the latter part of April or early part of May, during which time navigation is entirely suspended. From this cause and the absence of railway communication with other parts of the province, the development of the resources of the district has been much retarded.

The plateau, with its almost severed stumps, comprises the remaining nine-tenths of the district. It is a portion of that great dismembered branch of the grand Appalachian group which embraces the larger part of northern Cape Breton. The front line of the tableland runs approximately parallel to the coast-line, except at a little south of the middle where it is broken by an embayment into which extends a tongue of the plain traversed by the Cheticamp river. North of Jerome brook, the plateau and its stumps rise precipitously out of the sea or from narrow level terraces; south of this brook it rises almost equally as abruptly from the plain. The average height of the plateau is about 1100 feet. Its surface, especially along the edge, is frequently deeply trenched by huge gorges and ravines cut by innumerable brooks and streams in their descent to the sea.

The drainage system of the district corresponds in its principal lines with the general slopes of the surface, which are from south-east to north-west. The main artery is the Cheticamp river, which enters it from the east a few miles north of the middle, runs south-westerly towards the centre for about 2½ miles and thence north-westerly for nine miles through a deep, dangerous and almost impassable canyon to its beautiful salmon pools where the gorge widens. From thence it continues approximately the same course for three miles, when after cutting through Black mountains it debouches on the Cheticamp plain and flows northerly to the Gulf of St. Lawrence. The river is, like mountain streams, rapid and shallow, and is nowhere navigable, except for small boats near its mouth, It receives many large brooks from the north and south. One of its most important southern tributaries is the L'Abîme brook, in the drainage basin of which the principal metalliferous deposits of the district are situated. This brook has its origin in some ponds and swamps about five miles in a south-easterly direction from its junction with the Cheticamp river. For 2½ miles from its source it flows quietly across the plateau, after which it descends wildly through a deep ravine for the remainder of its course. One of the principal feeders of the L'Abîme is the McLeod, which joins it from the west, a mile above its mouth. About three-quarters of a mile above its junction with the L'Abîme and shortly after commencing to deeply trench the plateau, the McLeod brook receives the Grandin brook from the south and then descends in a north-easterly direction in a series of cascades through a deep wide gorge. The Grandin brook is a very small stream and flows northerly through a narrow ravine.

The plain is mostly cleared and under-cultivation. The slopes of the gorges and ravines of the plateau are clothed with many kinds of woods, conspicuous among which are the birch, maple, beech, spruce and fir; but on the higher and more level surfaces of the tableland the prevailing vegetation is stunted

spruce and fruit-bearing bushes interspersed with the rank herbage which flourishes in the great wastes of marshland.

The district possesses a most remarkable diversity of scenery. Its most striking feature is the grand escarpment of the plateau, rising from sea and plain in lofty mural and castellated cliffs, majestic talus-slopes and precipitous and craggy acclivities. Its coast-line scalloped into long and grateful curves, presents, especially the northern part, a succession of bold headlands and picturesque bays and coves. Along its shores may be seen an endless array of strange, fantastic and beautiful forms carved by the sea out of its many-hued rocks. From the higher summits of the region, glorious panoramic views are unfolded of plain and plateau. Looking towards the former, spread out like a map at our feet, we see sparkling streams winding across it to the sea, and over its surface dark copses of fir alternating with bright green patches of cleared land. Turning towards the plateau, stretching as far as the eye can reach we see a great wilderness of pristine forest, moreland and rock. Here and there its surface is seen cut into labyrinths of gorges and chasms with foaming torrents, tumbling cascades and deep secluded salmon and trout pools.

GENERAL GEOLOGY.

The relationship of the rocks to the forms of the surface can only be briefly referred to in this paper.

The trend of the coast-line and that of the undulations of the plain, the course of the escarpment, the position, size and shape of the harbor and the island, have all been largely determined by the strike and the nature of the underlying rocks. The law of the survival of the strongest and fittest holds good in physiography as in biology. The softer rocks have suffered the most from erosive agents and left the harder as the salient features of the district. The granitic rocks which constitute the front of the plateau have acted as protecting barriers to the softer schists which lie beyond them, and have determined the trend and retarded the recession of the escarpment.

The courses of the principal streams appear to have been mainly determined by the original slopes of the surface; but those of the smaller brooks and torrents have been influenced chiefly by fault lines, the disposition and lie of the schists and the relative resistant power of the rocks.

Two great systems of rocks are represented in the district—the pre-Cambrian and the Carboniferous. The classification of the former into series has not yet, on account of the complexity of the problem, been attempted. The Carboniferous are divided into two series:—the Lower and the Middle. Broadly viewed, it may be said that the pre-Cambrian rocks occupy the plateau, and the Lower Carboniferous the fringe of hummocks and ridges along the foot of the escarpment, and the plain. The rocks of the Cheticamp Island are regarded by Mr. Hugh Fletcher as Middle Carboniferous.

The pre-Cambrian formation consists mainly of granites, syenites, felsites, gneisses and schists. Granitic rocks, cut by dikes of trap, predominate along the edge of the plateau. These give place towards the interior of the district to patches and belts of schistose rocks alternating with or surrounded by massive igneous rocks. The whole formation has been much plicated, sliced horizontally and vertically by shear and thrust planes, and in consequence of these mechanical movements and the chemical action thereby set up, most of its rocks have been converted into varieties of gneisses, schists and other foliated rocks.

The massive igneous rocks are frequently metalliferous, but it is the schists that have so far proved the principal ore-bearing rocks of the district and in them the important deposits have been located.

A powerful fault, traversing the district from north-east to south-west and following the course of the escarpment, separates the pre-Cambrian from the Carboniferous. The latter is represented by conglomerates, sandstones, shales, gypsum and lime-

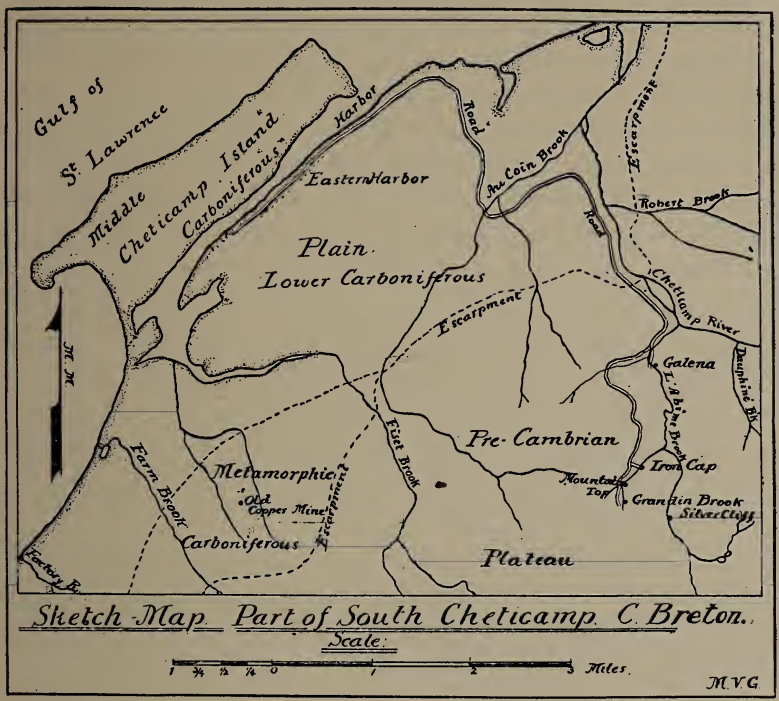
stones. Conglomerates and sandstones, more or less metamorphosed, form the high ridges which run parallel to the edge of the plateau. Along this boundary fault, these rocks are highly tilted, generally dipping seaward, but sometimes bent back upon themselves. They are also frequently faulted, crushed and cut by trap dikes. In places they give promise of workable deposits of copper, but elsewhere in the district the Carboniferous rocks are apparently barren. These metamorphosed sandstones are succeeded by thick beds of gypsum and limestone which form the hummocky land. The geological features of the plain and island are comparatively simple. The rocks of these tracts are principally sandstones and shales. Those flooring the plain, dip seaward, while those of the island have a general dip towards the mainland.

THE L'ABIME ORE-BEARING SCHISTS.

The principal metalliferous deposits of the district are located in a belt of schists occupying the drainage basin of the L'Abîme brook. They are easily accessible from Eastern harbor by road. (See map.)

The belt consists mainly of serecite, chlorite and hornblende schists, which appear to have been produced by the metamorphism of an original stratified series—their plains of foliation being guided by the stratification of the original materials. A definite order of succession can be made out among them and their groups of serecite and other schists traced continuously over long distances.

The structure of this area is an extremely complicated one. In the uplifting of granitic masses to the east and west of it, the whole tract was subjected to enormous mechanical movements which not only threw its rocks into wave-like folds but dislocated them by reverse faults and cut them into slices by shear and thrust planes. The longitudinal axis of the folds strike approximately N. N. E. aud S. S. W. In the central part of the area they pitch S. S. W. or S., whereas in the


Gulf of St. Lawrence
Middle Cheticamp Island Carboniferous
Harbor
Eastern Harbor
Road
Au Coin Brook
Escarpment
Robert Brook
Road
Plain
Lower Carboniferous
Escarpment
Cheticamp River
Galena
Dauphine Bk.
M. N.
Pre-Cambrian
Iron Cap
Mountain Top
Granitin Brook
Silver Cliff
First Brook
Farm Brook
Metamorphic
Old Copper Mine
Escarpment
Carboniferous
Plateau
Sketch Map Part of South Cheticamp C. Breton.
Scale:
1 3/4 1/2 1/4 0 1 2 3 Miles.
M.V.G.

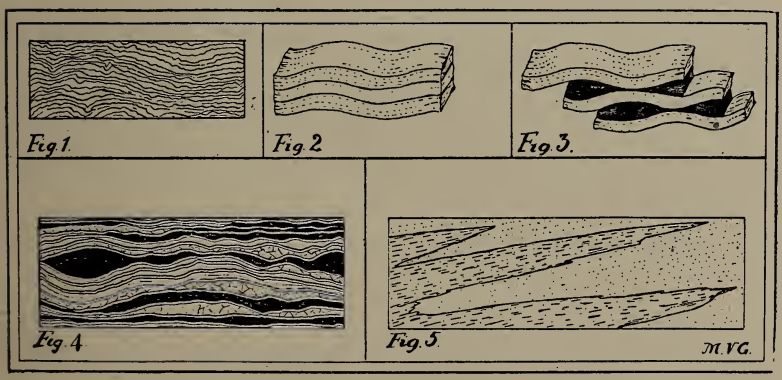


Fig. 1.
Fig. 2
Fig. 3.
Fig. 4
Fig. 5.
M.V.G.

northern part they are, when observed, inclined to the N. N. E. or N. This pitching of the axes may have been caused either by their being broken across the strike or by transverse east and west upheavals. The lines of movement run in certain definite directions and principally along lines of shearing and thrust planes. They may be grouped into two systems at least:—(1) Those running N. N. E. and S. S. W., and (2) those trending E. S. E. and W. N. W. or E. and W. and approximately at right angles to the first system. In a general way it may be said that the vertical lines of shearing or cleavage-foliation run parallel to the strike and the thrust planes coincide with the stratification-foliation planes of the schists.

To still more complicate the structure of this complicated belt of country, cross undulations and contortions have been developed on the flanks of the main folds which cause great irregularities in the lines of outcrop.

These movements appear to have developed considerable volcanic activity and the schists were cut by dikes of felsite and diorite which in places seem to have some genetic association with the ore deposits.

THE PRINCIPAL ORE DEPOSITS.

Grandin brook copper deposit.—The ore deposit in which development work is in the most advanced stage, is that of Grandin brook, which is situated on the edge of the plateau near the junction of the McLeod and Grandin brooks. The work consists of a slope at its most southerly outcrop, several lateral openings made at intervals for about 900 feet along the right bank of the Grandin brook ravine and the stripping of the vegetation and débris from the precipitous cliffs in which it outcrops in the McLeod brook gorge. It consists of several beds, aggregating probably not less than 250 feet in thickness, of serecite and chloritic schists impregerated with copper pyrites. These beds are locally known as the "copper schists," and rest on the schists which outcrop in the McLeod brook and which

are of considerable but undetermined thickness. The McLeod rocks possess somewhat similar lithological characteristics to those of Grandin brook and like the latter carry metallic sulphides disseminated through most of their beds. There is, however, as a rule, a marked difference in the nature of the sulphides carried by the two groups. Arsenopyrite, which is the dominant ore of the McLeod rocks, is conspicuous by its absence in the "copper schists." The nature of the rocks overlying the deposit has not yet been determined, as the hanging wall has not been reached; but the data so far collected indicates they possess characteristics similar to the underlying beds. The "copper schists" at their outcrop in the Grandin brook strike N. N. E. and S. S. W., with an average dip of 45° to the E. S. E.; but owing to the axis of the fold pitching S. S. W. at about an angle of 10°, the deposit is tilted up towards the north at its outcrop in the McLeod cliffs and then it has been ground down by detritive agencies to a thickness of about 40 or 50 feet. The characteristic cross-folds and contortions of the L'Aîbme schists are well illustrated at the deposit. Fig. 1 gives some idea of the tumultuous nature of the smaller contortions. The same pressure which produced the cross undulations, not only caused horizontal displacement of the beds, but caused the layers to slide over each other, by which movements cavities were developed. Many of these cavities have no doubt been modified in shape by the corrosive action of circulating fluids, but their original shape has generally been fairly well preserved. Figs. 2 and 3 represent the manner in which the lens-shapes were produced. Fig. 2 represents the corrugated beds before, and Fig. 3 after the sliding movements had taken place. This structure is characteristic of all the L'Abîme deposits; but is not so well illustrated at Grandin brook as at Iron Cap and Galena, as owing to the minuteness and the great abundance of the contortions of the "copper schists" the lenses are usually extremely small. Fig. 4 shows another structure, common to all the deposits, which has been

developed by forces pressing on the end lines of stratification. Both these forms of cavities were no doubt produced in most cases with but comparatively little horizontal displacement of the beds and layers. Below the zone of oxidation they are generally found filled with copper- and iron-pyrites or quartz, but at the outcrops where their metallic contents have been leached out they can usually be more easily studied. The copper-bearing solutions appear to have gained access to the cavities by travelling up and along the planes of jointing, shearing and foliation, as there divisional planes are frequently covered with thin sheets or films of ore. These thin sheets and minute lenses constitute the bulk of the ore at Grandin brook.

The surface characteristics and products of copper deposits may be seen at Grandin brook. At and near the surface, to a depth of from 5 to 15 feet, the metallic contents of the schists are often completely leached out leaving the rock in a cellular and porous condition. The schists at the surface are rarely stained, being, although normally of a greyish or greenish color, bleached nearly white. A few inches below the surface, however, they are generally discolored by limonite. This leached zone gradually passes into one in which green carbonates predominate, and this in turn into one containing a mixture of partly decomposed copper pyrites and carbonates which rapidly gives place to an unoxidized copper pyrite zone.

The outcrops of all the L'Abîme deposits are somewhat difficult to follow, as although admirable sections are occasionally laid bare in brooks and cliffs, they are usually covered with superficial deposits, forests, dense thickets, swamps and bays. The tendency of the ores to decompose and become leached out where the rocks are exposed to surface agencies, and the general resemblance of the rocks to each other, also add considerably to the difficulty. The course of the outcrop of the "copper schists," however, has been traced by means of "float" and a few exposed sections for a distance of nearly a mile.

The Grandin brook deposit is owned and is being developed by the Cheticamp Copper Company, Limited, Halifax.

As all the deposits of the L'Abîme area resemble one another very closely in the mode of occurrence of their ores only the peculiarities or exceptionally well developed structural features of the following deposits, will be described.

Mountain Top.—The Mountain Top deposit outcrops in the deep gorge of the McLeod brook near the mouth of the Grandin and immediately beneath the "copper schists." It consists of four distinct beds of schist which in descending order are as follows :—

1. Chlorite. Not explored. Thickness not determined.
2. Serecite, 4½ feet thick.
3. Chlorite, 25 " "
4. Serecite, about 50 " "

These rocks outcrop on or in close proximity to an anticlinal axis which pitches S. S. W. at about 10°. Along the crest and flanks of the fold, undulations have been developed with their axes parallel to the axis of the main fold. No. 1 is harder than normal varieties of chlorite schist and carries auriferous arsenopyrite associated with chalcopyrite in lenses and veins of the compression type (Fig. 4.) The lower chlorite No. 3 is very much softer than No. 1, and is remarkable for its crumpled and contorted folia. It carries arsenopyrite and pyrrhotite in lenses and veins similar to those of No. 1. In No. 2, the ore is also distributed in much the same way, and consists principally of auriferous arsenopyrite. No. 4 is a very hard serecite approaching quartzite in appearance and hardness. The planes of shearing which are here well developed are grooved and fluted in the most beautiful manner so that portions of the rock have some resemblance to prostrate Corinthian columns. Veins of the compression type predominate in this bed. The ore is more concentrated for about 10 feet below its junction with No. 3, and from this zone samples of arsenopyrite

have been taken carrying as high as $90 in gold per ton. But although these phenomenal values have been shown, the deposit is essentially a big low-grade proposition, as are the other deposits of the L'Abîme.

The outcrop has been traced over a large area, but work has as yet been confined to its outcrop in the McLeod gorge. This property is owned by the Richfield Mining Company, Limited, Halifax.

Iron Cap.—Next to the Grandin brook deposit, Iron Cap is in the most advanced stage of development. It outcrops 500 yards E. N. E. of Mountain Top in precipitous cliffs along the right bank of the McLeod brook which here flows easterly 600 feet below the general level of the plateau. The deposit consists of a bed of chlorite schist of undetermined thickness carrying auriferous arsenopyrite and pyrrhotite. The bed has been stripped along the brook for a distance of about 200 feet exposing a section of about 25 feet in thickness. The schists are here seen to be bent into an anticlinal fold and to dip east and west of its axis at low angles. A tunnel has been driven into the ore-body for about 100 feet at the end of which the schists make a sudden plunge to the south. The section exposed may be divided into two zones: (1) an upper zone in which pyrrhotite predominates and (2) a lower one in which arsenopyrite is the principal ore mineral. Large lenses which owe their shape to the sliding of corrugated masses of rock over one another and almost horizontal veins filling cavities produced by compression (Figs. 2, 3 and 4) are well developed here. The ore, although it has not shown the phenomenal high values of some of the Mountain Top ore is more abundant and more evenly distributed through the rock-mass. The series of chlorite schists, of which this deposit is a member, has been traced over a wide area and at all its outcrops it is found to contain metalliferous ores. It is owned by the Richfield Mining Company, Limited, Halifax.

Galena.—"Galena," from a structural point of view is one of the most interesting and instructive of the L'Abîme deposits. It is situated in the L'Abîme gorge about 900 feet below the general level of the plateau and a mile N. N. E. of Iron Cap. It consists of a bed of garnetiferous serecite schist (locally called the "grey schist") carrying galena associated with zinc blende and arsenopyrite and outcropping in cliffs on both sides of the L'Abîme brook which here flows north-easterly. The schists are at this deposit bent into a synclinal fold with characteristic longitudinal and transverse undulations well developed. Several openings have been made on the right bank of the brook which facilitate the study of the structural features of the deposit. At these openings the prevailing dip is approximately N. N. W. at about 28°. Overlying the "grey" at the most westerly opening (No. 1) is a hydromica schist of bluish color (locally called the "blue schist") which is seen at the next opening towards the east to impinge upon and intertongue with the "grey" as the outcrop of the latter ascends the bank of the brook. Higher up the bank, but stratigraphically lower than it appears at No. 1 opening, the "grey" is seen intertongueing with the "blue." Lower down the brook in the cliff on the left bank, fragments of the "grey" are seen intercalated among the "blue." This faulted condition of the schists could only have been caused by a lateral thrust which broke and drove the severed beds over their original continuation and forced their jagged ends together. (See fig. 5.)

The ore minerals are found in lenses and veins in the "grey" schist in much the same manner as they occur in the deposits already described; but at Galena they are also found deposited in sheet-like masses along the thrust plane at the contact of the "blue," and "grey" schists. They are also found occupying rents of a somewhat lenticular shape which cut through the planes of foliation and which appear to have been formed at the time the thrusting took place.

The "blue" schist contains very little ore. It is a more compact and close-grained rock than the "grey" and does not appear to have been as much disturbed as the latter and fewer cavities were therefore developed for the reception of ore.

The thickness of the "grey" has not yet been determined as its base is nowhere exposed either by natural sections or the development work. From measurements taken in the slope, however, it would appear to be not less than 25 feet. This deposit is owned by the Cheticamp Gold Mining Company of Halifax.

Silver Cliff.—The most interesting structural feature of Silver Cliff—an argentiferous galena deposit situated on the L'Abîme brook about 1½ miles south of "Galena"—is the development of incipient secondary foliation by shearing—the rock splitting into thin corrugated slabs along planes perpendicular to those of stratification-foliation. The ore-bearing schist is here a chloritic variety which has been violently disturbed and severely plicated. It rests upon a corrugated sheet of white quartz, below which is seen a dark hornblendic rock (probably a diorite) which shows shistose structure but imperfectly developed. This deposit is owned by the Inverness Mining Company, Limited, of Halifax.

From the foregoing facts relating to the mode of occurrence of the L'Abîme ores, there would appear to be no doubt that the deposition of the ores took place *after* the formation had been folded, faulted and sliced, and not prior to, as has been reported, and that the ores were deposited along the lines of movement rather than along the planes of foliation or stratification and, therefore, while the beds of schist are faulted, it by no means follows that the ore bodies have been dislocated to any great extent.

METEOROLOGICAL NOTES.—BY F. W. W. DOANE, M. CAN. SOC. C. E., City Engineer, Halifax, N. S.

(Read 16th May, 1905)

The last notes read before the Institute in connection with precipitation ("Rainfall Notes," *Trans. N. S. I. S.*, vol. x, p. 399) recorded observations to December 31st, 1900. Since that date several new "records" have been noted.

RAIN.

The rainfall at Halifax for the month of June, 1901, is given by the Dominion Government Meteorological Agent at 6.959 inches, of which 4.099 inches fell on the 24th in 13.7 hours. This is not the heaviest rainfall on record as a reference to our *Transactions*, vol. ix, p. 282, shows that on Oct. 19th, 1896, 4.394 inches fell in 14.3 hours. The rate of fall is about the same in each instance, viz: .3 inches per hour. The maximum rate during the storm cannot be ascertained as automatic gauges are not provided.

The storm on June 24th, 1901, extended over a large area. It was very heavy, not only throughout Nova Scotia, but in the United States. The rain began about six o'clock in the morning and continued until after one o'clock. At 9 a. m. the gauge showed .33 inches. The figures given convey no idea to the average reader of the severity of the storm. During the greater part of the storm thunder roared, lightning flashed, the streets were deluged and torrents swept down the steep hills destroying the roadways. The rush of water carried down stones as large as a man's head and heaped up earth and road metal in mounds and ridges two feet high on the street railway

tracks. The sewers on some streets became surcharged so that the water spurted from the manholes to a height of several feet. Seldom has a continuous downpour lasted for so many hours.

The Director of the Observatory at St. John, N. B., reports a record-breaking thunder shower on July 15th, 1901, at the close of one of the hottest days of the season. The fall was .58 inches, nearly the whole of which fell in about 10 minutes. The Director estimates that during the greater portion of that time the fall exceeded the rate of 3½ inches an hour. The measurements were made with an ordinary gauge as the observatory was not provided with an automatic register.

The total precipitation in Halifax in February, 1901, was .966 inches. The smallest fall previously recorded for that month was 1.61 in 1873. In May, 1903 only .676 inches fell the next smallest being 1.769 in May, 1894.

SNOW.

The winter of 1904-5 will long be remembered for its excessive snowfall. The first sleighs appeared on the streets of Halifax during the evening of December 13th and runners were in continuous service until March 27th.

Snowstorm followed snowstorm in rapid succession until streets, roads and railways were piled high, blockading traffic and paralyzing business. Each heavy storm was pronounced the worst by far for the past twenty to fifty years, yet each succeeding storm seemed worse than its predecessor.

In the city the street railway company managed to get their lines open after each storm, except in the western suburbs, the track from Coburg Road to Willow Park being snowed under on February 11th by a heavy gale and storm and remaining closed until April 5th. On portions of the main line the snow piled so high that the sweepers could not throw it clear and on some streets the track became walled in by four feet of packed

snow. Streets became impassable and teamsters were obliged to utilize the cleared sidewalks in order to reach their destination.

In the country, blizzard after blizzard blocked the railways until not a wheel turned for days on any line in Nova Scotia except on the Yarmouth to Barrington line. Slight thaws following the great falls of snow caused the water to lodge along the rails the snow preventing it from running off. Then frost came suddenly, the thermometer falling below zero and miles of rails became incased in a solid mass of ice, which could be removed only by the thaws of spring or the pickaxes of hundreds of men. The smaller roads succumbed during the first week in February, the heavy storm of January 31st having stolen a march on the "weather man" whose prediction was "fair and cold" and tied them up as completely as if they had never been completed.

Then on top of a month of snowstorms which had partially paralyzed railway communication in Nova Scotia and practically put an end to all trade between the capital and provincial points, came another storm, the severest of them all (Feb. 15-17). The Intercolonial Railway flyers were buried on Folleigh Mountain and the line to Sydney completely closed, through traffic not being in good working order again until the 27th. The Dominion Atlantic Railway was unable to get a train through from Halifax to Yarmouth until March 9th.

In Halifax business of all kinds suffered. The raging, howling blizzards sent blinding drifts sweeping in every direction. The milk train was cancelled for the first time since it became known as such and the condensed article sold at a premium. In order to relieve the tightness in the meat market two cattle dealers were obliged to bring their droves through on foot from Annapolis County. Funerals had to be postponed until the roads could be made passable. Buildings suffered from the depth and weight of snow on roofs which strained

them and caused them to leak and in some cases to collapse. Men, women and children moved about the streets on snow shoes.

Outside the city the conditions became even more serious, and places depending on the railway obtained relief none too soon. Hundreds of cars of freight were stalled along the Intercolonial Railway, numbers of locomotives were isolated, coal hoppers innumerable were imbedded in deep snow drifts, water gave out in stalled engines and trains were without heat, causing passengers to suffer much inconvenience and discomfort.

Schools, churches, electric light stations, foundries, &c., had to close. because wood could not be hauled and coal supplies were exhausted. Meat, flour, oil, butter, milk, eggs and feed became scarce. Farmers were obliged to destroy cattle and horses because they could not obtain hay and had difficulty in getting water for their stock. Lumbermen were forced to abandon their work in the woods in consequence of the depth of the snow.

In Windsor the water supply became short. In Sydney several departments of the steel works were compelled to shut down, being handicapped by the scarcity of cars and the impossibility of moving out their product and by the lack of fuel and other supplies buried deep in the monster snow drifts.

The administration of justice was interfered with, the presiding judge being unable to reach Sydney for the regular sitting of the supreme criminal court. The aid of the legislature was required to straighten out the tangle caused in this instance, parliament being in session.

The mail service was completely demoralized. Steamers were pressed into service between St. John, Yarmouth, Halifax and Sydney, while nearer towns, Windsor, Lunenburg, Bridgewater, &c., were reached by team before the railways could be dug out.

The loss to the province was enormous; trade being temporarily paralyzed, and the prices for supply of fuel, food and other necessaries increased rapidly as the stores decreased.

In olden times when snow fell deeply (but, perhaps never so deeply), and communication was wanted the roads were used, but in these days in winter only main roads are kept open, and when the snow falls deeply people stay at home or go by rail. In but few districts are supplies put in to last the winter through. The railways are depended on to provide from day to day or week to week. A winter such as that of 1904-5 demonstrates the extent to which the whole economic system of the country now hinges on the railways and how with all our progress we are still merely the plaything of the elements.

A call from the pulpits of Wolfville and Kentville brought volunteers to attack the ice and snow fetters of the Dominion Atlantic Railway. Professors, teachers and students from King's and Acadia Colleges, Horton Academy and Acacia Villa rendered valuable assistance in clearing the line, while ladies helped on the work by ministering to the wants of the laborers. The first train to Kentville after the disastrous blockade got through on February 27th with four cars of coal. The line to Sydney was opened on the 22nd, but the railway to Yarmouth (Dom. Atlantic Ry.) defied the best efforts of man until March 9th. Even after the railroads were opened snow continued to fall and drift into the cuttings, walled in by perpendicular banks of snow level with the roof of the cars. One incident reported in connection with the snow blockade on the Folleigh Mountain is worthy of note: A farmer who was working his weary way along a country road with a pair of horses and load of hay was stopped at a railway crossing by a 12 to 14 feet cut in the snow which had been opened by an Intercolonial Railway train leaving the sides perpendicular. The crossing problem was solved by backing the snow plow into the cut and driving the team over the bridge thus temporarily provided.

It was feared that the snow which, without rain or soft weather, had piled so high, would be melted by a rain storm when great loss would have resulted. Rivers would flow through the streets and along car tracks and sidewalks, flooding cellars, as few gutters or catchpits had been kept open. Bridges would have been carried away and roads and railways washed out, making transportation dangerous to life. Fortunately the sun did the work gradually and practically unaided, until the danger was passed and the great snows of 1904–5 had disappeared.

A comparison with past meteorological history shows that the past winter has been the worst snow winter on record. While it takes second place in total depth of snowfall, it takes first place in minimum depth of rainfall. In the winter of 1881-2 the snowfall (the deepest on record) was 124.72 inches and the rainfall for December, January, February, March and April, 20.543. In 1904-5 the figures are 123.92 and 9.959. While the difference in depth of snow is a fraction of an inch only, the difference in rainfall is over 10 inches. The snow falling in 1904-5 came in severe storms, and from December to March there was almost no rain and practically no thaw. The result was that the snow piled up to a greater height with each storm, while in an ordinary winter rains and thaws dispose of the surplus snow.

The accompanying tables show in detail the snow records since the establishment of the Government Meteorological Station at Halifax. A study of these tables shows that during the 36 years the heaviest snowfalls have occurred every 10 to 12 years, viz.: in the winters 1871-2, 1881-2, 1893-4 and 1904-5, the fall in the last three being practically the same. It may also be noted that there were at least three years in succession above the maximum.

As there have been two heavy years only this time, there may be another due in the winter of 1905-6.

Comparison with the precipitation of other years would also seem to indicate the possibility of a dry year in 1905. The last heavy snowfall, 1893-4, one of the greatest on record, was followed by the smallest rainfall.

Year.	*Rainfall only.*	*Total precipitation.*
1872	42.270	54.060
1882	47.610	62.022
1894	34.567	45.808

Acknowledgement is due to the Dominion Government Meteorological Agent at Halifax from whom valuable assistance was obtained in the preparation of this paper.

PRECIPITATION AT

YEAR.	1869.		1870.		1871.		1872.		1873.	
MONTH	Rain.	Snow.	Rain.	Snow	Rain.	Snow.	Rain.	Snow	Rain.	Snow.
January	3 040	14 0	5 180	14 9	2 380	14 7	2 580	13 1	4 780	26.6
February	3 200	8.4	6 820	29.6	4 110	19.3	2.400	19.3	0 490	10.7
March	4 110	29 3	1.640	14 4	4 390	15.1	0.760	43 0	2 460	15.5
April	2 210	2 7	3 780	.8	3 420	13 4	2 770	.8	1.930	6.5
May	5.510	5	3.190	T.	2 590	T	4 440	T	1.580	7.4
June	3 920	.....	1 600	.....	2 960	.....	4.230	.....	2 960	.....
July	2 920	.....	3 2.0	.....	3.380	.....	2.880	.....	3.900	.....
August	2 580	.....	2 2.0	.....	3 690	.....	6 820	.....	4.450	.....
September	1.570	.....	3.330	.....	4.810	.....	1 410	.....	4.480	.....
October	7 030	2.3	6 750	8	4 490	.....	4 880	.....	8.630	.....
November	5 190	3.5	5.670	7.7	3.210	10 0	6 230	4.4	7 400	5 8
December	5.140	4.8	4.810	10 7	1 880	24 8	2.870	32.3	2.210	18.9
Totals	46.420	65.50	48.270	78.9	41 310	97 3	42 270	112.9	45 270	91.4
Total Precipitation	54 530		56 160		51.140		54.060		55 440	

YEAR.	1880.		1881.		1882.		1883.		1884.	
MONTH.	Rain.	Snow	Rain.	Snow	Rain.	Snow.	Rain	Snow	Rain.	Snow.
January	5.393	23.4	2.737	8 7	3 160	36.80	2 400	25 30	3.616	7.90
February	3.242	18 8	2.939	23 9	1.672	42.77	2.428	14 32	4.701	14.60
March	1.015	23.5	5.915	6.4	5.458	16.10	3 641	13.00	3.814	32 20
April	4.097	7.0	3.236	2.6	3.679	11.45	2 933	7.70	6.895	3.18
May	4.088	.....	2.460	.....	4.677	.....	8.613	.....	3.629	.....
June	1.343	.....	5 301	.....	5.507	.....	3.3.2	.....	3.773	.....
July	3 086	.....	3 177	.....	5 071	.....	3.510	.....	8.294	.....
August	3.920	.....	3.062	.....	3.925	.....	5.342	.....	2.771	.....
September	5 712	.....	3 105	.....	5.914	.....	3.864	.....	1 788	.....
October	4 590	.....	4.206	.....	7.403	.....	5.841	.....	3.083	0.10
November	4.344	3.6	3.120	13.0	0.832	5 60	2.628	8 50	5 652	3 40
December	3.213	11.8	6.574	4 6	1 312	21.40	4.008	26.70	7.416	17.03
Totals	44.043	88.1	45.832	59.2	47.610	134.12	48.560	95 5	55.432	78 46
Total Precipitation.	52.853		51.755		62 022		58.112		63.278	

YEAR.	1891.		1892.		1893.		1894		1895.	
MONTH.	Rain	Snow.	Rain	Snow.	Rain.	Snow	Rain.	Snow	Rain	Snow.
January	6.099	22.84	5 339	9 82	3.10	16.80	1.732	53.90	7.321	28.10
February	6.940	18.00	0.845	17.60	2.21	37.60	2 871	7.00	1.223	33 82
March	1.567	11.18	4 433	15.53	1.73	5.60	1.723	19.00	3 963	19.68
April	3.528	4.82	2.480	1.73	3.63	5.80	3.422	22.26	3 896	.60
May	4.195	.....	5.459	.....	5 05	.....	1.769	.....	4 089	.....
June	4.131	.....	3.638	.....	1.75	.....	3.803	.....	1 827	.....
July	4.003	.....	2.710	.....	4.75	.....	1.059	.....	3.924	.....
August	3.385	.....	6.809	.....	5.95	.....	3.993	.....	5.502	.....
September	3.052	.....	1.744	.....	4.39	.....	1.010	.....	2 491	.....
October	9.616	0 05	3 472	.....	5.64		3.863	.....	5.437	1.90
November	2.388	.....	9.240	.....	3.60	1.50	5.422	3.63	8.228	.....
December	3 984	0 92	2.352	7.01	8.15	20.10	3.900	6.62	5 549	2.97
Totals	52.888	57 81	48.521	51.69	49.98	87.60	31.567	112.41	53 445	87.07
Total Precipitation	58.669		53.690		58.74		45 808		62.152	

HALIFAX, N. S., 1869-1905.

1874.		1875.		1876.		1877.		1878.		1879.	
Rain.	Snow.	Rain.	Snow.	Rain.	Snow.	Rain.	Snow.	Rain.	Snow.	Rain.	Snow.
3.860	15.7	0.610	28.71	1 311	21.10	0.840	33.10	6.987	5 35	0.070	43 30
2 280	29.9	2.929	29 68	3 133	33.23	1 024	7.90	1 977	7.20	0.631	23.70
3.630	3 7	0 711	14.02	5.774	5 60	7.428	12.3	9.489	7.95	5.082	11.20
1 900	26.5	2.958	4.20	2 130	9.95	3.621	1.70	3.476	0.26	2.291	11.90
4.760	0.1	3.977	.....	4 574	0 90	4.024	.....	5 759	.....	4 687	.....
7 920	.....	4.067	.....	3.384	....	3.841	.....	4.477	.....	1.191	.....
2.290	.....	5.612	.....	3.914	.....	4 458	.....	1.483	.....	3.843	.....
3.370	.....	3 555	.....	1.909	.....	3.539	.....	3 127	.....	4.827	.....
5 040	....	2.060	.....	6.094	.....	3.164	.....	0.800	.....	2.596	.....
2.460	.....	9.976	....	4.067	0.01	6 623	0.90	5.061	.....	4.755	T
3.370	2.1	5.154	3.90	7.397	T	8.678	.....	6.853	0.56	2.997	18.26
4.420	11.0	0 884	7.30	0.618	25.58	3.027	14.40	4.281	8.38	2 179	18 50
45.240	89 0	42.493	87.81	44.335	96.37	50 277	70 30	53 770	29.70	35.149	126.86
54.180		51.274		53.972		57.540		56 740		47.835	

1885.		1886.		1887.		1888.		1889.		1890.	
Rain.	Snow.	Rain	Snow.	Rain.	Snow.	Rain.	Snow.	Rain.	Snow.	Rain,	Snow.
3 928	24.60	8.030	6.40	5.320	23 80	2.862	25.80	4.041	3.5	1.480	24.80
1 820	32.70	2.162	16.80	4.633	21.02	5.304	9.80	4.931	12 5	2.946	16.99
1.640	22.40	1.837	21 90	2 539	19.10	3.770	5.40	1.576	4.7	8 543	13.46
3 470	0.50	0.443	3.80	5.838	05.58	2.455	12.20	6 510	8.93	2.598	3.60
3.282	.....	8.819	.....	2.126	.....	2.857	.20	3.871	.....	3.970	.....
2 749	.....	2.708	.....	2 121	.....	4.939	.....	3.755	.....	3.440	.....
5 817	.....	6 525	.....	2.045	.....	5.001	.....	2.668	.....	2.141	.....
3.001	.....	4.526	.....	8 351	.....	7.000	.....	2 663	.....	7 042	.....
2.497	.....	4.459	.....	3.303	.....	5.331	.....	1.399	.....	4.534	.....
6.280	.....	2 105	0.30	3 058	.....	6.859	.....	4.179	.....	6.603	.....
5.383	0.40	5.204	0 80	6.718	T	6.772	.30	6.995	1.5	3.596	1.20
7.393	13.00	4.149	13.20	3.618	5 02	7.764	.10	2.708	2.8	6.082	11.20
47.269	93.60	50.967	63.20	49 681	74.52	60.914	53.80	45.266	33.93	52.978	71.25
56 629		57.287		57.133		66 294		48.659		60.103	

1896.		1897		1898.		1899.		1900.		1901.	
Rain	Snow	Rain.	Snow.	Rain.	Snow	Rain	Snow.	Rain.	Snow.	Rain.	Snow.
0.260	14.60	3.433	24.63	2.370	16 90	3.943	1[illegible].40	7.582	9.5	3.503	32.4
1.852	23.47	0.744	21 54	2 444	19.78	1.333	22.80	4.677	6.0	.060	9.0
7.238	15.48	3.852	16.18	2.718	13.50	5.445	17.33	5 345	5.7	3.043	5.3
1.108	3.05	5.443	7.68	6.752	5.94	2.908	3.70	3 289	5.3	6.235	.8
2.532	.....	4.591	0 22	2.366	.....	3.657	0.20	4.231	.....	5.556	.....
4.671	.....	6.070	.....	5.598	.....	3 875	.....	2.676	.....	6.959	.....
8.729	...	3.661	....	3.652	.....	5.747	.....	1.872	.....	1.585	.....
3.037	.....	5.185	.....	5.651	.....	1.542	.....	3.993	.....	3.656	.....
12 092	.....	1.169	.....	4.158	.....	3 201	.....	5.043	.....	6.872	.....
15.039	.....	0.746	.....	4.845	.....	6.191	.....	7.365	.....	4.884	.....
3.439	9 57	5.961	0.90	9.881	3.67	4 460	1.[illegible]0	6.370	4.1	2.558	.....
2.618	6.30	3.356	1.86	2.329	17.37	3.166	18.72	1.276	19.8	5.483	30.9
62.615	72 47	44.221	73.01	52.764	77.16	45.468	75.45	53.702	50.4	50 394	78.4
69.862		51.522		60.480		53.013		59.697		58.096	

PRECIPITATION AT HALIFAX, N. S., 1869-1905—*Continued.*

YEAR.	1902.		1903.		1904.		1905.	
MONTH	Rain.	Snow.	Rain.	Snow.	Rain.	Snow.	Rain.	Snow.
January	2.055	11.3	3.432	13 7	3 518	23 80	3.630	46.60
February	1.290	11 5	2.022	16.9	2 278	31.50	1.586	37 40
March	7.757	.....	6.474	6.1	4 602	9.60	1.644	11.60
April	2.487	5 8	5.403	.8	4.992	15.20	1.240	.02
May	3.725	.....	.676	.....	3.315	.....	.....	.....
June	4.908	.....	3.493	.....	2.668	.....	.....	.....
July	1.651	.....	4.313	.....	2.332	.....	.....	.....
August	4.767	.....	4.247	.....	6.520	.....	.....	.....
September	4.657	.....	4.237	.....	4.502	.....	.....	.....
October	4.252	.....	6 368	.....	5.031	.....	.....	.....
November	3.813	.....	9.228	3.7	5.007	1.00	.....	.....
December	4.853	21.3	3 210	13.8	1.859	27.30	.....	.....
Totals	46.215	49.9	53.103	55.0	46 654	108.40	.....	.....
Total Precipitation	51 916		59 125		57.494		.....	

NOTE.—In the preceding tables "T" indicates *Trace.*

SNOWFALL AT HALIFAX DURING EACH WINTER, 1869-1905.

WINTER OF	October.	November.	December.	January.	February.	March.	April.	May.	Total Snowfall.
1869-70	2.3	3.5	4 8	14.9	29.6	14.4	0.8	T	70 30
1870-71	0 8	7.7	10.7	14.7	19.3	15.1	13.4	T	81.70
1871-72	....	10 0	24 8	13.1	19.3	43.0	0.8	T	111.00
1872-73	...	4 4	32.3	26.6	10 7	15.5	6 5	7.4	103.40
1873-74	....	5 8	18 9	15.7	29.9	3.7	26.5	0.1	100.60
1874-75	....	2 1	11.0	28 71	29.68	14.02	4.2	....	89.71
1875-76	....	3.9	7 3	21.1	33 23	5.60	9.95	0.9	81.98
1876-77	0.01	T	25.58	33.10	7.90	12.30	1.70	....	80.59
1877-78	0.90	....	14.40	5.35	7.20	7.95	0.26	....	36.06
1878-79	....	0 56	8.38	43.30	23.70	11.20	11 90	....	99 04
1879-80	T	18.26	18 50	23.40	18 80	23 50	7.00	....	109.46
1880-81	...	3.60	11.80	8 70	23.90	6.40	2 60	....	57.00
1881-82	....	13.00	4 60	36 80	42.77	16.10	11.45	....	124.72
1882-83	....	5.60	21.40	25.30	14.32	13 00	7 70	....	87.32
1883-84	....	8 50	26 70	7 90	14.60	32 20	3.18	....	93.08
1884-85	0 10	3.40	17.08	24.60	32.70	22.40	0.50	....	100 78
1885-86	....	0.40	13.00	6.40	16.80	21.90	3 80	...	62.30
1886-87	0 30	0.80	13 20	23.80	21.02	19.10	5.58	...	83.80
1887-88	....	T	5 02	25.80	9 80	5.40	12.20	0.20	58.42
1888-89	....	0.30	0.10	3.50	12 50	4 70	8.93	....	30.03
1889-90	....	1.50	2 80	24.80	16.99	13 46	3 60	....	63.15
1890-91	....	1 20	11.20	22.84	18.00	11.18	4 82	....	69:24
1891-92	0.05	....	0.92	9.82	17.60	15 53	1.73	....	45.65
1892-93	....	...	7.01	16.80	37.60	5 60	5 80	....	72 81
1893-94	....	1.50	20.10	53.90	7 00	19 00	22 26	....	123.76
1894-95	....	3.63	6.62	28 10	33.82	19.68	0 60	....	92.45
1895-96	1.90	....	2.97	14.60	23.47	15.48	3.05	....	61.47
1896-97	....	9 57	6.30	24.63	21.54	16.18	7 68	0.22	86 12
1897-98	....	0.90	1.86	16.90	19.78	13.50	5.94	....	58.88
1898-99	....	3.67	17.37	11.40	22 80	17 33	3 70	0 20	76.47
1899-00	....	1 30	18.72	9 50	6.00	5.70	5 30	....	46.52
1900-01	....	4.10	19.80	32 40	9.00	5.30	0.80	....	71.40
1901 02	....	....	30.90	11.30	11.50	....	5.80	....	59.50
1902-03	....	....	21.30	13 70	16.90	6.10	0.80	....	58 80
1903-04	....	3.70	13.80	23 80	31.50	9.60	15.20	....	97 60
1904 05	...	1.00	27.30	46.60	37.40	11.60	0.02	.. .	123.92

Comparison of Snowfall at Halifax, N. S. (36 years).

Month.	Maximum.		Minimum.		Mean	1904-5.	Remarks.
	Inches.	Year.	Inches	Year.	Inches.		
October	2.30	1869	0.010	1876	0.18	.....	Fall in nine years only.
November	13 00	1881	0.300	1888	3.44	1 0	In 6 years no fall recorded.
December	32.30	1872	0.100	1888	13.85	27.3	
January	53.90	1894	3 500	1889	21.22	46.6	
February	42.77	1882	6 000	1900	20.80	37.4	
March	43.00	1872	3.700	1874	13 68	11.6	No fall in 1902.
April	26.50	1874	0.260	1878	6.28	0.02	Fall recorded in every year.
May	7.40	1873	0.100	1874	0.25	.....	Fall in nine years only.

Maximum snowfall in one year ..		134.12 in 1882.	
Minimum " "		29.70 in 1878.	
Mean " 36 years ..		78.53.	
Mean " one winter ..		79.70.	
Maximum " one winter ..	1881-2,	124.72—56%	above mean.
	19 4-5,	123.92—55%	"
	1893-4,	123.76—55%	"
	1871-2,	111 00—39%	"
Minimum " one winter .	1888-9,	30.03—38%	"
Maximum " two winters.	1903-5,	221.52 aver	110 76—39% above mean
	1893-5	216 21 "	108 11—36% "
	1871-3,	214.40 "	107.20 - 35% "
	1881-3,	212.04 "	106 02—35% "
Maximum " three winters.	1871-4,	315.00 "	105.00—32% "
	1881-4,	305.12 "	101 70—28% "
	1892-5,	289.02 "	96.34—26% "
	1902-5,	280.32 "	93.44—16% "

Rainfall (*only*) at Halifax, N. S., during Winters of Greatest Snowfall.

Winter	December.	January.	February.	March.	April.	Total for Dec , Jan., Feb., March, Apl.	Total for Jan., Feb., March, Apl.
1871-2..	1.88	2.58	2.4	0.76	2.77	10.39	8.51
1881-2...	6.574	3.16	1.672	5 458	3.679	20.543	13.969
1893-4...	8.15	1.732	2 871	1.723	3.4.2	17 898	9.748
1904-5...	1.859	3.63	1.586	1.644	1.24	9.959	8.100

Phenological Observations in Nova Scotia and Canada, 1904.—By A. H. MacKay, ll. d., f. r. s. c., Halifax.

(Read 16th May, 1905).

In Nova Scotia the public schools have been doing good work in phenology. Over three hundred accurate and full schedules of observations were sent in from as many school sections representing every county in the province. These were referred in groups to the following phenological staff for examination, selection, and compilation; and the criticisms on faulty observations were published in the *Journal of Education* for the benefit of observers in future years—from page 72 to 85 of the April issue, 1905.

Region	I.	(Yarmouth and Digby), A. W. Horner, Principal, Salem School, Yarmouth.
"	II.	(Shelburne Co.), C. Stanley Bruce, Principal, Academy, Shelburne.
"	II.	(Queens Co.), Miss M. C. Hewitt, Science Teacher, Academy, Lunenburg.
"	II.	(Lunenburg Co.), B. McKittrick, B. A., Principal, Academy, Lunenburg.
"	III.	(Annapolis and Kings), E. Robinson, Principal, Academy, Kentville.
"	IV.	(Hants Co.), Miss A. Forbes, B. A., Academy, Windsor.
"	V.	(Halifax Co.), G. R. Marshall, B. A., Principal, C. A. School, Halifax.
"	V.	(Guysboro Co.), J. B. McCarthy, B. Sc., Science Master, Academy, Halifax.
"	VI.	(Colchester and Cumberland), J. E. Barteaux, Science Master, Academy, Truro.

" VII. (N. Cumberland Co.), E. J. Lay, Principal, Academy, Amherst.

" VII. (Pictou Co.), W. P. Fraser, Science Master, Academy, Pictou.

" VII. (Antigonish Co.), F. G. Morehouse, Principal, Schools, Antigonish.

" VIII. (Richmond Co.), G. W. MacKenzie, B A., Principal, Public Schools, Sydney Mines.

" VIII., IX., X. (Cape Breton, Victoria and Inverness Co.), L. A. DeWolf, M. Sc., High School, North Sydney.

The phenochrons of each of these compilers were again averaged into the ten columns of phenochrons for each region of the province by Miss Jean Lindsay, B. A., of the Education Department, as they are given in the first table following.

The general phenochrons for Nova Scotia, and the observations reported by the following observers from stations within the other provinces of the Dominion are given in the last table:

New Brunswick: George U. Hay, D. Sc., Saint John.
Prince Edward Island: John MacSwain, Charlottetown.
Prince Edward Island: J. M. Duncan, Kensington.
Ontario: Cephas Guillet, Ph. D., Ottawa.
Ontario: Mrs. F. E. Webster, Creemore.
Ontario: A. B. Klugh, Guelph.
Saskatchewan: Rev. Charles W. Bryden, B. A., Shellbrook.
British Columbia: J. K. Henry, B. A., Vancouver.

These tables were published in the *Proceedings of the Royal Society of Canada;* and as two or three errors have since been detected in figures in the first table referring to Nova Scotia under Nos. 48 and 79b, they are corrected herein.

NOVA SCOTIA PHENOCHRONS, 1904.

FLOWERING AND OTHER PHENOCHRONS FOR EACH REGION OF THE PROVINCE OF NOVA SCOTIA, COMPILED FROM 300 PUBLIC SCHOOL OBSERVATION SCHEDULES.

[The Phenochrons for each region, (which are the averages of many observations), have the fractions omitted].

When First Seen. Region.												Year ended July, 1904, Nova Scotia.	When Becoming Common. Region.										
1. Yarmouth and Digby.	2. Shelburne, Queens, and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb and Col.)	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.	Average for Province.		Day of the year corresponding to the last day of each month.	Average for Province.	1. Yarmouth and Digby.	2. Shelburne, Queens, and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.)	7. North Cumb., Col. Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.
102	101	98	110	114	103	107	112	109	108	106 9	1	Alnus incana, Willd	113 2	108	108	103	115	121	114	112	119	114	113
115	112	109	119	129	120	115	119	119	125	118.	2	Populus tremuloides	124.3	127	118	117	128	131	125	121	124	123	127
92	98	99	103	113	1·5	113	115	117	121	109.1	3	Epigæa repens, L	118 4	107	109	108	116	119	124	121	123	123	127
125	127	132	126	134	133	128	132	121	125	128.8	4	Equisetum arvense	135.2	135	131	137	131	145	139	134	136	124	135
....	....	....	121	132	130	130		124	126	127.5	5	Sanguinaria Canadensis	130 8	126	....	....	128	138	130	132		128	133
120	121	125	125	126	126	127	130	129	129	126 3	6	Viola blanda	132.6	127	128	134	130	134	132	133	135	133	136
124	126	126	127	136	128	129	134	133	133	130.	7	Viola palmata, cucullata	135.3	130	131	133	133	138	134	136	139	136	139
...	126	113	129	...	123	118	124	....	....	122.3	8	Hepatica triloba, etc	127 5	....	137	120	134	..	123	120	130	....	....
127	127	124	126	131	127	127	132	128	136	128.8	9	Acer rubrum	133.1	131	132	131	132	127	131	132	138	132	140
122	124	123	123	130	127	129	133	132	131	127.7	10	Fragaria Virginiana	136.6	131	133	132	132	144	135	137	140	137	141
158	159	157	158	152	161	164	168	170	168	161.9	11	" " fruit ripe	173.3	172	169	169	169	175	172	175	177	179	176
125	127	127	128	133	133	132	136	134	137	131.6	12	Taraxacum officinale	138.	133	134	134	134	140	139	139	141	140	143
139	140	138	131	156	128	130	137	....	....	137.7	13	Erythronium Americanum	141.8	146	146	148	137	147	133	136	130	....	....
125	129	132	132	132	133	134	137	137	137	133 2	14	Coptis trifolia	139.	132	136	140	138	139	137	139	144	140	142
124	125	130	125	131	126	128	128	129	133	128 1	15	Claytonia Caroliniana	132.1	131	129	136	128	125	131	131	132	134	140
....	137	137	131	139	135	141	138	143	141	138.4	16	Nepeta Glechoma	143 6	141	142	145	136	143	142	149	141	146	146
137	136	135	136	142	135	136	144	146	141	137 1	17	Amelanchier Canadensis	144.8	141	144	143	141	148	140	141	150	149	146
....	198	180	....	240	216	195	185	203	182	200 1	18	" " fruit ripe	217.9	...	214	....	....	246	223	214	...	221	199

Day of the year corresponding to the last day of each month.			
Jan	31	July	212
Feb	59	Aug	243
March	90	Sept	273
April	120	Oct	304
May	151	Nov	334
June	181	Dec	365

For leap year add one to each except January.

NOVA SCOTIA PHENOCHRONS, 1904.—*(Continued).*

When First Seen. Regions.											Year ended July, 1904, Nova Scotia.	When Becoming Common. Regions.										
1. Yarmouth and Digby.	2. Shelburne, Queens, and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequ d Slope (S. Cumb. and Col)	7. North Cumb., Col., Pictou a d Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.	Average for Province.		Average for Province.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.)	7. North Cumb. Col., Pictou and Antig.	8. Richmond and Cape Breton.	9. Bras d' r Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.
											Day of the year corresponding to the last day of each month. Jan ..... 31 July ....212 Feb .. .. 59 Aug ..... 243 March ..... 90 Sept .....273 April .....120 Oct .....304 May .....151 Nov .....334 June.. .....181 Dec ....365 For leap year add one to each except January.											
138	141	141	142	151	138	141	151	151	149	144 5	19 Prunus Pennsylvanica	149.5	143	147	146	146	153	143	146	158	154	155
180	209	..		243	216	212	225	225	...	215.9	20 " " fruit ripe..	223.	190	216	...	...	247	221	220	236	230	....
131	134	136	139	143	140	142	148	149	151	141 7	21 Vaccinium Can. and Penn	148 7	139	142	143	145	152	146	148	156	153	159
178	189	191	194	232	223	205	....	222	231	207 6	22 " " fruit ripe..	222.7	204	217	216	203	240	224	218	236	227	240
139	144	140	143	149	144	146	154	155	158	147 5	23 Ranunculus acris....	155.5	148	150	151	151	157	154	155	160	159	165
147	151	152	150	168	150	159	162	163	163	156.9	24 R. repens	162.3	152	158	158	163	159	162	163	168	167	170
141	145	143	143	147	140	143	155	147	153	145.9	25 Trillium erythrocarpum	151.1	148	146	149	149	156	144	148	157	150	160
138	141	143	141	146	142	144	153	149	151	145 1	26 Rhododendron Rhodora	153.6	150	147	148	145	153	147	149	155	153	154
143	145	145	146	144	143	147	152	151	152	147.2	27 Cornus Canadensis..	150.5	150	151	153	153	153	149	152	157	156	157
182	201	205	247	220	216	205	. .	210	225	212 6	28 " " fruit ripe..	220.	204	217	210	253	202	224	219	..	215	231
146	144	144	146	148	149	147	153	154	149	148.5	29 Trientalis Americana	154.2	150	150	150	153	156	154	154	157	159	154
147	150	150	143	156	152	151	126	156	155	151.5	30 Clintonia borealis	157.5	153	168	156	151	165	156	157	157	162	158
159	150	162	147	159	159	159	161	....	168	158.5	31 Calla palustris	165.4	178	155	....	150	165	165	163	172	....	174
150	151	152	154	159	155	155	167	167	....	157.1	32 Cypripedium acaule	162.4	156	158	158	159	163	162	159	171	171	....
151	152	154	149	159	159	159	162	163	167	158	33 Sisyrinchium angustifolium.....	164.7	158	158	163	156	166	167	165	170	167	172
154	156	159	157	163	164	162	167	171	172	162 9	34 Linnæa borealis	168	161	163	166	164	167	167	169	170	176	174
148	148	148	146	154	145	149	155	156	157	151.1	35 Kalmia glauca	156.6	149	154	154	151	167	151	156	158	158	163
159	166	166	167	163	174	169	174	180	179	170.1	36 Kalmia angustifolia	174.3	166	174	173	176	162	176	174	179	186	...
158	155	157	155	163	170	157	170	....	170	162.	37 Cratægus oxyacantha	167.3	162	162	165	164	167	171	162	177	...	172
157	150	152	153	158	158	151	164	166	165	157 7	38 Cratægus coccinea, etc....	163.	165	159	158	154	163	165	159	167	169	168
158	157	162	160	167	161	163	170	170	173	164 6	39 Iris versicolor	170.3	164	163	170	164	173	167	170	176	174	177
159	158	159	160	169	161	161	172	171	172	164.8	40 Chrysanthemum Leucanthemum.	171.4	163	167	167	169	165	170	169	175	178	176

161	159	163	157	166	165	163	169	170	170	164.9	41	Nuphar advena	170.5	170	165	170	165	170	172	170	174	173	173
156	155	158	150	161	156	163	160	169	167	160.6	42	Rubus strigosus	166.9	162	162	166	161	167	160	168	171	173	173
236	195	206	....	230	217	206		222	226	217.5	43	" " fruit ripe	227.1	220	219	216	225	236	227	238	..	227	234
164	172	170	171	175	....	173	173	175	179	172.7	44	Rhinanthus Crista-galli	175.9	172	176	180	177	180	153	181	176	180	181
162	165	162	159	165	159	167	172	171	175	166.	45	Rubus villosus	171.6	167	171	169	164	170	165	174	176	178	177
227	227	232	246	241	241	240	....	239	262	239.7	46	" "	249.2	236	253	239	252	247	252	249	....	244	268
165	161	151	168	176	169	169	174	177	..	168.1	47	Sarracenia purpurea	172.1	171	167	167	....	153	175	175	180	187	....
171	170	170	175	181	155	174	178	182	.	173 3	48	Brunella vulgaris	177.7	178	175	178	178	...	165	178	181	186	....
173	174	178	174	193	173	176	187	187	181	179.9	49	Rosa lucida	181.6	180	178	182	180	184	179	181	176	192	....
159	162	168	164	166	166	167	172	170	179	167.6	50	Leontodon autumnale	173.7	170	168	175	170	175	172	177	177	174	....
167	176	172	175	.. .	169	181	190	..	....	176.	51	Linaria vulgaris	178.6	167	182	179	179	....	176	174	191	...	
138	135	135	132	140	132	133	140	140	139	136.8	52	Trees appear green	146.	144	145	145	139	150	141	143	153	149	146
136	140	138	137	143	140	139	149	148	142	141.8	53	Ribes rubrum (cultivated)	147.2	141	146	146	143	150	144	144	152	153	148
181	179	....	....	230	205	194	....	208	226	203 4	54	" " (fruit ripe)	211.1	194	199	....	191	238	215	212		209	230
139	142	139	140	145	142	140	148	149	141	142.9	55	R. nigrum (cultivated)	148.1	143	147	145	146	151	146	147	154	151	147
190	199	....	....	219	214	201	....	213	228	209.4	56	" (fruit ripe)	214.9	195	205	....	....	210	223	214	....	218	239
138	144	138	142	160	146	146	152	155	148	147.4	57	Prunus Cerasus	156.9	145	151	145	149	163	150	151	157	160	155
221	199	..	200	....	212	205	218	214	....	210.	58	" " fruit ripe	210.3	228	206	150	220	....	219	214	225	220	....
141	147	142	144	157	147	147	156	160	156	151.1	59	Prunus domestica	155.8	145	152	147	150	169	150	152	163	164	162
143	146	143	144	155	147	147	161	159	155	150.5	60	Pyrus Malus	155.7	151	152	150	151	161	152	148	165	163	159
151	153	152	151	160	153	153	167	162	170	157.6	61	Syringa vulgaris	163.6	158	159	158	157	168	160	160	171	167	174
150	156	156	152	157	151	156	162	161	167	157.3	62	Trifolium repens	165.3	159	163	167	159	166	160	165	168	168	173
144	151	154	150	157	153	156	161	162	164	155.7	63	Trifolium pratense	164.6	154	159	163	160	166	162	166	168	171	172
173	169	171	173	171	164	167	184	196	..	157.2	64	Phleum pratense	180.6	180	173	178	180	180	175	177	180	199	..
175	181	184	205	....	197	190	....	199	181	176.8	65	Solanum tuberosum	198.7	189	189	196	222	...	208	201	184	204	193
104	114	115	124	118	124	126	120	125	119	119.3	66	Ploughing (first of season)	126.8	116	123	125	132	124	...	132	129	131	126
122	121	124	129	126	130	131	131	136	130	128.4	67	Sowing " "	135.9	130	129	135	138	132	....	138	137	143	137
119	118	123	129	125	131	132	125	129	131	126.6	68	Potato-planting (first of season)	134.4	125	129	144	141	128	....	138	132	134	136
143	129	117	136	127	138	135	129	123	114	129.6	69	Sheep-Shearing "	138 7	150	138	131	148	140	....	115	136	131	127
186	180	191	215	214	223	203	215	213	213	205.7	70	Hay-cutting "	211.	192	186	202	226	218	....	209	225	218	220
239	239	239	250	253	250	245	262	255	247	248.3	71	Grain-cutting "	256.4	252	247	249	258	253	...	257	271	264	254
248	263	254	270	273	264	272	269	276	269	266.2	72	Potato-digging "	272.2	256	276	270	276	257	...	278	281	274	278
81	81	80	80	92	94	91	91	91	100	88.5	73a	Opening of rivers	.....	...	...	..	...	...	..	...	..	...	....
93	96	97	102	112	112	105	119	119	113	107.1	73b	Opening of lakes	.....	...	...	..	...	...	..	...	...	...	....
111	111	111	115	111	114	110	109	112	114	112.2	74a	Last snow to whiten ground	.....	...	...	..	...	...	..	...	...	...	....
111	111	112	118	118	119	117	123	122	129	118.4	74b	" to fly in air	.....	...	..	...	...	...	..	...	...	...	....
134	135	141	133	132	155	139	145	134	137	138.9	75a	Last Spring frost—hard	.....		...	...	...	...	...	...	...		....
158	163	166	150	160	161	157	159	163	157	159.8	75b	" " hoar	.....	...	...	...	...	...	...	...	...	...	....
....	104	90	127	167	86	97	103	100	110	102.5	76a	Water in streams—high	.....	...	...	...	...	..	...	...	...	...	....
183	187	..	181	181	200	...	180	243	194	186.8	76b	" " low	.....	..	...	...	...	...	...	...	...	...	..
272	257	240	257	276	258	271	285	325	275	271.9	77a	First autumn frost—hoar	.....	..	...	...	...	...	...	...	...	...	....
297	292	277	294	297	289	295	300	314	304	296.3	77b	" " hard	.....	...	...	...	...	...	...	..	..	...	....
295	299	298	298	302	299	3 0	297	314	290	299.6	78a	First snow to fly in air	.....	...	..	...	...	...	...	...	...	...	....
305	311	304	310	320	299	305	310	316	299	308.3	78b	" to whiten ground	... ..	...	...	..	...	...	...	...	...	...	....
332	338	342	332	....	335	348	348	353	353	342.5	79a	Closing of lakes	.....	...	...	..	..	...	...	...	...	...	....
...	354	...	341	347	365	348	357	359	354	353.4	79b	" rivers	.....	...	...	..	...	...	...	...	...	...	....
....	86	86	80	84	96	89	90	91	90	88.3	80a	Wild Ducks migrating, N	... .	....	...	...	...	...	...	...	...	...	..

NOVA SCOTIA PHENOCHRONS, 1904—*(Continued).*

When First Seen. Regions.											Year ended July, 1904. Nova Scotia.	When Becoming Common. Regions.										
1 Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col).	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton	9. Bras d'Or Slope (Inv and Victoria	10. Inverness Slope to Gulf.	Average for Province.	Day of the year corresponding to the last day of each month. Jan 31, Feb 59, March 90, April 120, May 151, June 181, July 212, Aug 243, Sept 273, Oct 304, Nov 334, Dec 365. For leap year add one to each except January.	Average for Province.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.)	7. North Cumb., Col., Pictou and Antig.	8. Richmond and Cape Breton	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.
....	298	298	243	....	287	312	270	350	306	295.7	81b Wild Ducks migrating, S	....	....	....	....	....	....	....	....	....	....	....
84	85	84	78	82	85	81	82	86	85	83.9	82a Wild Geese migrating, N	....	....	....	....	....	....	....	....	....	....	....
317	283	336	324	.	337	315	283	303	....	312.5	82b " " S	....	....	....	....	....	....	....	....	....	....	....
85	83	88	87	88	97	92	93	96	98	91 2	83 Melospiza fasciata. North	....	....	....	....	....	....	....	....	....	....	....
82	84	83	85	85	87	90	90	90	99	88.1	84 Turdus migratorius "	....	....	....	....	....	....	....	....	....	....	....
70	88	81	89	86	94	91	85	92	94	87 3	85 Junco hiemalis "	....	....	....	....	....	....	....	....	....	....	....
....	108	132	124	121	130	134	138	131	125	127 4	86 Actitis macularia "	....	....	....	....	....	....	....	....	....	....	....
....	114	....	128	....	116	121	126	124	....	121.7	87 Sturnella magna "	....	....	....	....	....	....	....	....	....	....	....
129	122	126	125	117	127	123	125	126	125	124.9	88 Ceryle Alcyon "	....	....	....	....	....	....	....	....	....	....	....
29	141	....	128	135	140	136	130	..	134	134.5	89 Dendrœca coronata "	....	....	....	....	....	....	....	....	....	....	....
137	136	139	140	115	142	135	136	126	137	134.6	90 D. æstiva "	....	....	....	....	....	....	....	....	....	....	....
124	120	110	130	133	120	110	119	116	107	119 4	91 Zonotrichia alba "	....	....	....	....	....	....	....	....	....	....	....
151	147	143	141	150	143	143	149	142	143	145 6	92 Trochilus colubris "	....	....	....	....	....	....	....	....	....	....	....
138	138	136	136	139	136	138	151	141	144	140.1	93 Tyrannus Carolinensis, North	....	....	....	....	....	....	....	....	....	....	....
138	143	137	133	115	121	138	141	131	139	133.8	94 Dolychonyx oryzivorus "	....	....	....	....	....	....	....	....	....	....	....
148	144	143	139	142	150	146	146	132	..	143.7	95 Spinis tristis "	....	....	....	....	....	....	....	....	....	....	....
....	141	134	142	100	153	139	140	134	150	137.3	96 Setophaga ruticilla "	....	....	....	....	....	....	....	....	....	....	....
147	133	..	148	....	138	153	....	131	....	142.	97 Ampelis cedrorum "	....	....	....	....	....	....	....	....	....	....	....
102	132	128	125	124	139	129	117	..	105	122.5	98 Chordeiles Virginianus "	....	....	....	....	....	....	....	....	....	....	....
95	97	99	107	115	110	108	115	118	117	108.7	99 First piping of frogs	....	....	....	....	....	....	....	....	....	....	....
104	107	108	116	120	122	119	120	120	120	116.2	100 First appearance, snakes	....	....	....	....	....	....	....	....	....	....	....

THUNDERSTORMS—PHENOLOGICAL OBSERVATIONS, NOVA SCOTIA, 1903.

The indices indicate the number of stations from which the Thunderstorms were reported on the day of the year specified.

OBSERVATION STATIONS.

1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. S. Cobequid Slope (S. Cum & Col.)	7. North Cum., Col., Pictou & Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. & Victoria).	10. Inverness Slope to Gulf.	Province of Nova Scotia. YEAR 1903.
.....	183^{3}	.....	.....	183	183	183^{13}	.....	.....	.....	183^{18}
184	.....	.....	184	184^{2}	.....	184^{10}	.....	.....	184	184^{15}
.....	188	.....	.....	.....	.....	.....	188	.....	.....	188^{2}
.....	.....	.....	.....	.....	.....	189^{2}	.....	189	.....	189^{3}
.....	.....	.....	.....	.....	.....	190	.....	.....	.....	190
.....	191	.....	.....	.....	.....	.....	.....	191	.....	191^{2}
.....	.....	.....	.....	.....	.....	192^{2}	.....	.....	.....	192^{2}
.....	.....	.....	.....	.....	.....	.....	.....	193	.....	193
.....	.....	.....	.....	.....	.....	194	.....	.....	.....	194
.....	.....	.....	.....	197	.....	197	.....	.....	.....	197^{2}
.....	.....	.....	.....	199	.....	199^{2}	.....	.....	.....	199^{3}
.....	.....	.....	.....	.....	.....	200	.....	200	.....	202^{2}
203	.....	.....	.....	.....	.....	.....	.....	.....	.....	203
.....	.....	.....	.....	204	.....	204	.....	.....	.....	204^{2}
.....	.....	.....	.....	.....	.....	208	.....	.....	.....	208
.....	.....	.....	.....	.....	.....	215	.....	.....	.....	215
.....	223	.....	.....	.....	.....	.....	.....	.....	.....	223
.....	227^{4}	.....	.....	227	.....	227^{2}	.....	.....	.....	227^{7}
.....	228^{3}	.....	.....	228	.....	228^{15}	.....	228	.....	228^{20}
.....	229^{10}	.....	.....	229^{2}	229	229^{27}	.....	229	229	229^{42}
.....	230	230^{4}	230^{4}	.....	230^{6}	230^{11}	.....	.....	230	230^{27}
.....	.....	.....	231	.....	.....	231^{3}	.....	.....	.....	231^{4}
.....	232^{3}	.....	.....	.....	.....	232	.....	.....	.....	232^{4}
.....	233	.....	.....	.....	233^{12}	233^{2}	.....	.....	.....	233^{15}
.....	.....	234^{4}	234^{4}	234	234^{2}	234^{10}	234^{2}	.....	.....	235^{21}
.....	.....	235^{3}	235^{3}	.....	235^{3}	235^{7}	.....	.....	.....	235^{16}
.....	.....	.....	.....	.....	236^{3}	.....	.....	.....	.....	236^{3}
.....	.....	.....	.....	.....	.....	.....	237	.....	.....	237
.....	.....	.....	238	.....	.....	238	.....	.....	.....	238^{3}
.....	.....	.....	.....	239^{2}	.....	239^{10}	.....	.....	.....	239^{12}
.....	240	.....	240^{2}	.....	240	240^{4}	240	.....	.....	240^{9}
242^{2}	242	.....	.....	.....	.....	.....	.....	.....	.....	242^{3}
.....	243^{2}	.....	243^{4}	243^{10}	.....	243^{3}	243	243	.....	243^{21}
.....	244	.....	.....	244	.....	244^{3}	244	.....	.....	244^{6}
.....	.....	.....	.....	.....	.....	245	.....	.....	.....	245
.....	.....	.....	.....	.....	.....	246	.....	.....	246	246^{2}
.....	.....	.....	.....	.....	.....	.....	.....	.....	247	247
248^{2}	248^{12}	248^{7}	248^{7}	248^{15}	.....	248^{23}	248	248	248	248^{69}
249	249^{12}	249^{7}	249^{6}	.....	249^{3}	249^{21}	249	.....	.....	249^{51}

THUNDERSTORMS—PHENOLOGICAL OBSERVATIONS, N. S , 1903. —*Continued.*

The indices indicate the number of stations from which the Thunderstorms were reported on the day of the year specified.

OBSERVATION STATIONS.

1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. S. Cobequid Slope (S. Cum. & Col)	7. North Cum., Col., Pictou & Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. & Victoria).	10. Inverness Slope to Gulf.	Province of Nova Scotia. YEAR 1903.
.....	250^{2}	.....	250^{4}	.....	.....	250^{14}	.....	250	.....	250^{21}
251	251^{2}	.....	251^{4}	251^{2}	251^{2}	251^{15}	251	.....	.....	251^{17}
.....	.....	.....	252	.....	.....	252^{3}	.....	.....	.....	252^{4}
.....	.....	.....	.....	.....	.....	254	.....	.....	.....	254
.....	.....	.....	.....	.....	.....	.....	256	.....	.....	256
259	.....	.....	.....	.....	.....	259	.....	.....	259	259^{3}
.....	.....	.....	.....	.....	.....	260	.....	.....	.....	260
.....	.....	.....	.....	.....	.....	261	.....	.....	.....	261
.....	.....	.....	.....	.....	.....	.....	.....	.....	263	263
266	.....	.....	.....	.....	.....	.....	.....	.....	.....	266
267	.....	.....	267	.....	.....	.....	.....	.....	.....	267^{2}
270	.....	.....	.....	.....	.....	.....	.....	.....	.....	270
.....	.....	.....	.....	.....	.....	271^{6}	.....	.....	271	271^{7}
.....	.....	.....	.....	.....	.....	272	.....	.....	272	272^{2}
.....	.....	.....	.....	.....	.....	273	.....	.....	.....	273
.....	.....	.....	.....	278	.....	.....	.....	.....	.....	278
.....	.....	.....	.....	279	.....	.....	.....	.....	.....	279
.....	.....	.....	.....	280	.....	.....	.....	.....	.....	280
.....	.....	.....	.....	.....	.....	281	.....	.....	.....	281
.....	282	.....	.....	.....	.....	.....	.....	.....	.....	282
285^{3}	285^{4}	.....	.....	285^{2}	.....	.....	.....	.....	.....	285^{9}
289	289	.....	.....	.....	.....	.....	.....	.....	.....	289^{2}
290^{7}	290^{8}	290^{5}	290	.....	.....	290^{4}	.....	.....	.....	290^{25}
291^{5}	291^{2}	.....	.....	.....	291^{2}	291^{5}	.....	.....	.....	291^{14}
.....	299	.....	299^{2}	299^{4}	.....	.....	.....	.....	.....	299^{7}
.....	.....	.....	.....	.....	.....	304	.....	.....	.....	304
.....	.....	.....	.....	306	.....	.....	.....	.....	.....	306
310	310^{2}	.....	.....	.....	.....	.....	.....	.....	.....	310^{3}
.....	.....	.....	311^{2}	311^{9}	.....	311^{8}	311	311	311	311^{22}
.....	.....	.....	.....	312	.....	312^{4}	312^{2}	312	312	312^{9}
.....	.....	.....	.....	.....	.....	318	.....	.....	.....	318
.....	.....	.....	.....	.....	.....	321	321^{2}	.....	.....	321^{3}
.....	.....	.....	.....	322^{4}	.....	322^{9}	322	322	322	322^{16}
.....	.....	.....	.....	.....	.....	323	.....	.....	.....	323
.....	.....	.....	.....	.....	.....	324	.....	.....	.....	324
.....	.....	.....	.....	.....	.....	328	.....	.....	.....	328
.....	.....	.....	.....	.....	.....	341^{2}	.....	.....	.....	341^{2}
.....	.....	.....	.....	.....	.....	.....	.....	.....	360	360

THUNDERSTORMS—PHENOLOGICAL OBSERVATIONS, NOVA SCOTIA, 1904.

The indices indicate the number of stations from which the Thunderstorms were reported on the day of the year specified.

OBSERVATION STATIONS

1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. S. Cobequid Slope (S. Cum. & Col.)	7. North Cum., Col., Pictou & Antig	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. & Victoria).	10. Inverness Slope to Gulf.	Province of Nova Scotia. YEAR 1904.
									4	4
				32		32				32^{2}
38										38
						54				54
						56				56
				60		60				60^{2}
	61^{2}									61^{2}
	62^{48}		62^{3}	62^{18}		62^{4}				62^{73}
63^{16}	63^{10}	63^{10}	63^{19}	63^{6}	63^{19}	63^{58}	63^{2}		63	63^{141}
64			64	64		64^{6}	64	64		64^{11}
						66				66
			67							67
			68^{3}							68^{3}
	70									70
71				71		71				71^{3}
				72						72
73										73
				74						74
77						77				77^{2}
					81		81			81^{2}
83^{6}	82^{19}			82						82^{20}
	83			83^{6}						83^{13}
						88^{2}				88^{2}
						91				91
					92					92
		93^{9}								93^{9}
						94				94
								95		95
97^{2}										97^{2}
	101^{17}	101^{4}	101			101^{2}		101	101	101^{26}
102^{2}	102^{6}	102^{15}	102		102^{13}	102^{27}				102^{64}
103^{14}	103			103		103^{2}		103	103	103^{20}
104										104
						109	109^{6}	109		109^{8}
					110^{2}					110^{2}
	111									111
						112				112
			114							114

THUNDERSTORMS—PHENOLOGICAL OBSERVATIONS, N. S., 1904.—*Continued.*

The indices indicate the number of stations from which the Thunderstorms were reported on the day of the year specified.

OBSERVATION STATIONS.

1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. S. Cobequid Slope (S. Cum. & Col.)	7. North Cum., Col., Pictou & Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. & Victoria).	10. Inverness Slope to Gulf.	Province of Nova Scotia. YEAR 1904.
									117	117
						119				119
			120	120		120^{9}	120	120^{3}	120^{3}	120^{18}
		121^{7}	121^{12}		121^{12}	121^{48}				121^{79}
				122		122^{3}				122^{4}
						123				123
					124	124^{12}				124^{13}
						125				125
			126			126				126^{2}
						128^{2}		128		128^{3}
									129	129
				130		130				130^{2}
			137			137^{2}	137			137^{4}
			138	138						138^{2}
						140				140
			141			141^{15}				141^{16}
								144^{3}	144^{4}	144^{7}
145^{6}	145^{3}		145^{4}	145		145			145	145^{16}
146	146			146^{7}		146	146			146^{11}
	147^{2}	147^{2}		147^{7}		147^{4}	147^{8}	147^{3}		147^{26}
	148^{5}				148^{2}	148^{5}	148^{12}		148^{5}	148^{29}
							149^{3}	149		149^{4}
	150									150
						151^{2}		151	151	151^{4}
				154	154					154^{2}
			155			155	155^{2}			155^{4}
156	156		156							156^{3}
157	157^{4}						157			157^{6}
158						158				158^{2}
161										161
						162				162
				163		163^{2}				163^{3}
					164					164
			165						165^{2}	165^{3}
	166									166
	167^{3}		167^{2}	167^{4}		167			167	167^{11}
168	168^{3}		168^{9}	168^{4}	168^{4}	168^{39}		168	168	168^{62}
169	169	169^{8}	169^{2}			169			169	169^{14}

THUNDERSTORMS—PHENOLOGICAL OBSERVATIONS, N. S., 1904.—*Continued.*

The indices indicate the number of stations from which the Thunderstorms were reported on the day of the year specified.

OBSERVATION STATIONS.

1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. S Cobequid Slope (S. Cum. & Col.)	7. North Cum., Col., Pictou & Antig.	8. Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. & Victoria).	10. Inverness Slope to Gulf.	Province of Nova Scotia. YEAR. 1904.
170	....	170^{5}	170^{12}	....	170^{9}	170^{30}	170^{2}	170	176^{4}	170^{64}
171	.....	.....	171^{2}	.....	.....	171^{4}	.....	.....	....	171^{7}
.....	172	.....	.....	.....	172	172^{8}	.....	....	.....	172^{10}
173^{5}	173^{11}	.....	173^{12}	173^{5}	173^{9}	173^{22}	.....	173	.....	173^{65}
174^{3}	174	174^{6}	174^{7}	174^{2}	174^{2}	174^{13}	.....	174	....	174^{35}
175	175^{9}	.....	.....	.....	.....	175^{4}	.....	.....	.....	175^{14}
176^{6}	176^{4}	.....	176	176	.....	....	.....	....	.....	176^{12}
177^{2}	177	.....	177^{3}	....	177	177^{3}	.....	....	.....	177^{10}
.....	.....	.....	178	178	178^{2}	.....	.....	.....	.....	178^{4}
179	.....	.....	.....	.....	....	.....	.....	.....	.....	179
181	.....	.....	181	.....	.....	.....	.....	.....	.....	181^{2}
.....	.....	.....	182	.....	.....	.....	.....	....	.....	182

PHENOLOGICAL OBSERVATIONS, CANADA, 1904.

"When First Seen."

Observation Stations.

Number.	Day of the year corresponding to the last day of each month. Jan ..... 31 July .... 212 Feb. .... 59 Aug..... 242 March . 90 Sept .....273 April ....120 Oct.....304 May .... .151 Nov .....334 June ... .181 Dec. ... 365 For leap year add one to each except January.	Average dates for Nova Scotia	*St. John, N B.	Charlottetown, P. E. I.	Kensington, P. E. I.	Ottawa, Ont.	†Creemore, Ont.	Guelph, Ont.	Shellbrook, Sask.	Vancouver, B. C,
*1	Alnus incana, Wild	106 9	118	120	....	114	....	117	....	75a
2	Populus tremuloides	118.	125	132	....	118	126	123	....	....
3	Epigæa repens, L.....	109.1	125	120	116	118	....	....	....	....
4	Equisetum arvense	128.8	....	....	131	†124	....	127	....	102
5	Sanguinaria Canadensis	127.5	....	...	....	124	.. .	117	....	....
6	Viola blanda	126.3	131	....	127	†127	142	129	....	....
7	Viola palmata, *cucullata*, etc.	130.	130	....	134	130	134	132	...	....
8	Hepatica triloba, etc	122.3	125	....	....	107	126	123	....	....
9	Acer rubrum....	128.8	125	132	136	....	....	125	....	100b
*10	Fragaria Virginiana.	127.7	131	146	136	127	....	132	....	...
11	" " (fruit ripe).	161.9	162	....	....	...	...	....	....	....
12	Taraxacum officinale	131.6	139	135	139	127	130	112	...	....
13	Erythronium Americanum....	137.7	125	....	....	122	126	117	....	....
14	Coptis trifolia	133.2	....	...	137	†133	....	144	...	....
15	Claytonia Caroliniana.....	128.1	...	....	....	115	...	117	....	....
16	Nepeta Glechoma.....	138.4	....	....	...	†133	....	....	...	108
17	Amelanchier Canadensis.... .	137.1	139	....	139	133	....	132	. ..	....
18	" " (fruit ripe)	200.1	....	....	....	....	...	....	....	....
19	Prunus Pennsylvanica	144.5	149	....	139	122	142	....	....	114c
20	" " (fruit ripe)	215.9	....	....	....	....	....	....	....	....
21	Vaccinium Can. and Penn...	141.7	146	....	148	135	..	135	....	80
22	" " (fruit ripe)	207.6	....	....	....	....	....	...	...	....
23	Ranunculus acris	147.5	...	...	156	....	...	151	....	134
24	R. repens	156.9	...	...	170	....	....	....	....	128
25	Trillium erythrocarpum.....	145.9	139	. .	141	127	....	....	....	....
26	Rhododendron Rhodora	145.1	139	....	151	....	....	....	...	...
27	Cornus Canadensis.....	147 2	....	....	147	152	....	163	....	133
28	" " (fruit ripe)	212.6	..	....	....	....	....	....	....	....
29	Trientalis Americana	148.5	146	....	159	138	....	..	148	....
30	Clintonia borealis	151.5	149	...	160	138	....	148	....	....
31	Calla palustris.	158.5	....	....	131	....	....	163	....	....
32	Cypripedium acaule.....	157.1	162	....	162	....	....	156	..	....
33	Sisyrinchium angustifolium...	158.	....	....	172	145	..	..	....	....
34	Linnæa borealis	162.9	....	....	168	...	...	163	....	....
35	Kalmia glauca	151.1	....	....	....	....	....	143	....	....
36	Kalmia angustifolia.	170.1	....	....	172	...	....	....	....	....

a. Alnus rubrum; b. Acer macrophyllum; c. Prunus emarginata.
*When becoming common, except 1 and 11.
†When becoming common.

PHENOLOGICAL OBSERVATIONS, CANADA, 1904.

"When First Seen."

Observation Stations.

Day of the year corresponding to the last day of each month.

Jan	31	July	212
Feb	59	Aug.	242
March	90	Sept.	273
April	120	Oct.	304
May	151	Nov.	334
June	181	Dec.	365

For leap year add one to each except January.

Number.		Average dates for Nova Scotia.	*St. John, N. B.	Charlottetown, P. E. I.	Kensington, P. E. I.	Ottawa, Ont.	†Creemore, Ont.	Guelph, Ont.	Shellbrooke, Sask.	Vancouver, B. C.
37	Cratægus Oxyacantha	162.	149	....	....	142	....	....	....	....
38	Cratægus coccinea, etc	157.7	....	161	....	....	....	148	....	....
39	Iris versicolor	164.6	162	....	175	....	....	188	....	....
40	Chrysanthemum Leucan	164.8	....	....	167	....	....	169	....	....
41	Nuphar advena	164.9	....	....	....	151	....	162	....	....
42	Rubus strigosus	160.6	....	....	170	151	....	155	....	74d
43	" " (fruit ripe)	217 5	....	....	....	....	....	....	....	152
44	Rhinanthus Crista-galli	172.7	....	....	....	....	....	....	....	....
45	Rubus villosus	166.	....	....	....	....	....	160	....	....
46	" " (fruit ripe)	239.7	....	....	....	....	....	....	....	....
47	Sarracenia purpurea	168.1	....	....	....	....	....	158	....	....
48	Brunella vulgaris	173.3	....	....	179	....	....	178	....	....
49	Rosa lucida	179.9	....	....	....	....	....	197	....	....
50	Leontodon autumnale	167.6	....	....	161	....	....	....	....	....
51	Linaria vulgaris	176.	....	....	....	....	....	....	....	....
52	Trees appear green	136.8	....	....	....	127b	146	....	....	100
53	Ribes rubrum (cultivated)	141.8	....	....	....	....	....	....	....	....
54	" " (fruit ripe)	203.4	....	....	....	....	....	....	....	....
55	R. nigrum (cultivated)	142.9	....	....	148	....	....	....	....	....
56	" (fruit ripe)	209.4	....	....	....	....	....	....	....	....
57	Prunus Cerasus	147.4	....	149	150	....	....	....	....	104
58	" " (fruit ripe)	210.	....	....	....	....	....	....	....	....
59	Prunus domestica	151.1	....	....	146	129	....	....	....	103
60	Pyrus malus	150.5	....	149	146	....	....	....	....	112
61	Syringa vulgaris	157.6	....	161	158	....	....	....	....	125
62	Trifolium repens	157.3	....	....	158	....	....	....	....	127
63	Trifolium pratense	155.7	....	....	159	†128	....	....	....	140
64	Phleum pratense	157 2	....	....	....	....	....	....	....	....
65	Solanum tuberosum	176.8	....	....	....	....	188	....	....	....
66	Ploughing (first of season)	119.3	....	....	124	....	....	....	....	....
67	Sowing "	128.4	....	....	127	....	....	....	....	....
68	Potato-planting "	126.6	....	....	....	....	145	....	131	....
69	Sheep-shearing "	129.6	....	....	....	....	144	....	....	....
70	Hay-cutting "	205.7	....	....	....	....	194	....	196	....
71	Grain-cutting "	248.3	....	....	....	....	202	....	....	....
72	Potato-digging "	266 2	....	....	276	....	....	....	....	....

d. Rubus spectabilis.
*When becoming common.
†When becoming common.

PHENOLOGICAL OBSERVATIONS, CANADA, 1904

"When First Seen."

Observation Stations.

Number.	Day of the year corresponding to the last day of each month Jan ..... 31 July.....212 Feb ..... 59 Aug.....242 March.. . 90 Sept... .273 April.. ..120 Oct ..... 304 May.....151 Nov. .. 334 June... ..181 Dec... ..365 For leap year add one to each except January.	Average dates for Nova Scotia.	St. John, N. B.	Charlottetown, P. E. I.	Kensington, P. E. I.	Ottawa, Ont	Creemore, Ont.	Guelph, Ont	Shellbrooke, Sask.	Vancouver, B C.
73a	Opening of rivers (1st of season)	88.5	....	103	....	....	....	....	..	....
73b	Opening of lakes "	107.1	..	....	....	....	....	...	....	....
74a	Last snow to whiten ground .	112.2	....	....	....	...	....	....	..	82
74b	" to fly in air	118 4	..	....	117	....	....	...	...	82
75a	Last spring frost—hard	138.9	....	....	97	....	...	...	...	....
75b	" " hoar	159 8	163	126	124	....	....	...	.	....
76a	Water in streams—high. . .	102.5	...	...	...	....	107	..	..	....
76b	" " low	186 8	....	..	...	....	....	....	. .	....
77a	First autumn frost - hoar	271.9	....	252	252	....	227	....	..	....
77b	" " hard	296 3	281	....	280	....	. ..	....	...	....
78a	First snow to fly in air	299.6	....	262	301	...	....	...	..	....
78b	" whiten ground .	308.3	. ..	..	306	...	....	..	..	....
79a	Closing of Lakes	342.5	....	...	....	....	...	....	. .	....
79b	" Rivers	340.9	. .	344	....	....	....	. .	. .	....
81a	Wild ducks migrating, N ..	88.3	....	....	....	....	124	123	..	. .
81b	" " S ...	295.7	...	....	...	...	....	..	...	. .
82a	Wild geese " N	83.9	....	69	....	....	....	...	94	....
82b	" " S	312 5	....	260	....	....	....	...	..	....
83	Melospiza fasciata, North . .	91.2	..	88	92	85	86	83	...	....
84	Turdus migratorius, "	88 1	....	90	92	84	85	83	111	....
85	Junco hiemalis, "	87.3	...	90	92	93	....	Res	...	....
86	Actitis macularia, "	127.4	...	....	...	....	....	120	..	....
87	Sturnella magna, " ...	121.7	...	....	....	93	.. .	83	112	...
88	Ceryle Alcyon, "	124.9	....	....	....	114	...	97	.	....
89	Dendrœca coronata, "	134.5	....	....	..	....	....	120	. .	....
90	D. æstiva, " . .	134.6	....	....	....	128	....	126	. .	...
91	Zonotrichia alba, " ..	119 4	...	....	....	....	....	146	..	...
92	Trochilus colubris, "	145.6	....	....	....	....	....	141	..	...
93	Tyrannus Carolinensis" ...	140.1	....	....	....	....	...	126	...	....
94	Dolychonyx oryzivorus"	133.8	....	....	....	....	....	124	..	....
95	Spinis tristis, " .. .	143.7	....	....	....	...	151	Res.	...	....
96	Setophaga ruticilla. "	137.3	....	....	....	128	....	140	..	....
97	Ampelis cedrorum. " ...	142.	....	....	...	....	....	147	.	....
98	Chordeiles Virginianus ' . ..	122.5	...	149	....	....	....	155	.	....
99	First piping of frogs	108.7	....	114	123	108	112	....	113	....
100	First appearance of snakes. . .	116.2	...	....	168	....	93	....	111	....

80 No Thunderstorms:
Charlottetown. P. E. I. :—63, 121, 141, 148, 202, 210. 231, 262.
Kensington. P. E. I. :—63, 121, 148, 170. 182, 202, 230, 242, 262.
Creemore, Ontario :—129, 194, 202, 246, 255, 273.

Edible Wild Plants of Nova Scotia.—By Walter H. Prest, Bedford, N. S.

(Read 13th March, 1905.)

These notes on the edible wild plants of Nova Scotia are the result of my early experience in the backwoods, and are offered with the hope that they may prove of benefit to those whom business or accident may lead temporarily beyond the reach of the resources of civilization. While some of the wild fruits here mentioned, such as the blueberry and cranberry, are of commercial value, others are included because they may assist in sustaining life at a critical time. While lost in the forest, persons have perished through a want of knowledge of the resources which nature has bounteously provided in many sections at certain seasons of the year. As these resources are more animal than vegetable, the latter class has been much neglected. Therefore, the result to a lost man, unprovided with weapons or the means of snaring, trapping or catching game or fish, might be perhaps serious. I propose, therefore, to tabulate these edible plants, so far as known to me, and describe as freely and popularly as possible, all that have come under my personal notice. To Dr. A. H. MacKay I am indebted for several of the more difficult scientific identifications. As, however, the best scientific description, especially during the fruiting season, would be almost useless to the average man, we will be forced to largely fall back on nature's testing apparatus, the eyes, nose and mouth.

The nuts and seeds, with few exceptions, do not repay the labor and time spent in gathering, except in extreme cases; therefore an astute backwoodsman searches the hillsides for the stores of food buried by ground squirrels for winter use. These

industrious little animals dig burrows usually in the side of a small knoll (or cradle-hill as it is often called). The entrance is about 1 in. wide, and descends about 1 ft. at an angle of 40° to 50°, though often nearly vertically. After a tortuous and somewhat horizontal course of 2 ft. to 5 ft., a chamber nearly 1 ft. in diameter is made. In this is the nest, packed round with nuts and seeds of various kinds. Several branch burrows also contain the same kind of food, often to the amount of three or four gallons.

A knowledge of the appearance, location, and edible qualities of the plants described herein, though not always ensuring a bounteous meal, will, without doubt, keep off the pangs of hunger so frequently dwelt on in tales headed "Lost in the woods." To a backwoodsman of ordinary intelligence such stories sound like gross exaggerations. A pocket knife, a tin kettle, and a few matches, provide means of existing in a forest which would be totally inadequate in a city. The addition of a little sugar and salt would place him beyond need, and if he has any skill as a trapper the animal world would also be largely at his mercy.

Note.—The descriptions in this paper are intended to be given, as far as possible, in plain, untechnical language, so as to be easily understood by those for whom the paper is primarily intended, namely, persons with little or no botanical knowledge. The writer does not wish to be considered as at all attempting to present technically accurate descriptions, which may be found in various systematic works. The nomenclature is mainly that of Gray's *Manual of Botany.*

FRUITS AND BERRIES.

1. Vaccinium Canadense Kalm., and *Vaccinium Pennsylvanicum* Lam. Canadian, and Dwarf Blueberry.

Two species much alike; but the former has downy leaves with entire edges, the latter little or no down and finely-toothed

edges. 5 in. to 24 in. high, many branched, brownish-grey main stalks with green leaf stalks. Leaves, oblong and pointed, $\frac{3}{4}$ in. to $1\frac{1}{4}$ in. long, $\frac{1}{4}$ in. to $\frac{1}{2}$ in. wide, thin, light green. Berries blue to blueish-black, with thin skin, purple juicy pulp and many small seeds. Sweet to slightly acid, globular, $\frac{3}{10}$ in. to $\frac{4}{10}$ in. thick. A wholesome and valuable article of food. Eaten raw or easily prepared. Sometimes the delicious sweetish fruit is in heavy clusters.

Grows on open barrens and dry partly wooded land, sometimes covering large districts with its abundant growth. Forms a large item in the exports of Yarmouth county. Ripens in July and August.

2. *Vaccinium uliginosum* L. Great Bilberry.

Bush 4 in. to 10 in. high. Branches spreading and tufted, but not so thickly branched as blueberry. Leaves oblong, narrowed at the base, $\frac{1}{2}$ in. to 1 in. long, pale beneath. Berries purple to black, juicy pulp with small seeds, sweetish taste, slightly oblong and pear-shaped with thick end next stalk, $\frac{4}{10}$ in. long. Pleasant and wholesome food. Does not grow in clusters as do blueberries.

Found on barrens with blueberries, very rarely in swampy land. Not plentiful. Grows chiefly in the western and northern counties. Too rare to be considered an important article of food in this country.

3. *Vaccinium macrocarpon* Aiton. Large Cranberry.

A creeping vine, 6 in. to 30 in. long, from which the fruitstalk ascends 3 in. to 6 in. Leaves oblong, $\frac{3}{10}$ in. to $\frac{5}{10}$ in. long, evergreen, dark-brownish green above and pale beneath, with turned-back edges, thick and somewhat ridged, attached directly or almost so to the vine, two bracts on fruit stalk. Berries, 1 to 3 on each fruit stalk, red when ripe, round to slightly oblong, $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long, ripens late and remains in

good condition until next May. Very acid, but one of the most digestible of our sour berries.

Easily domesticated in fields or prepared bogs. Sometimes very abundant in meadows and along stillwater brooks; but often found in dry fields and on sandy hills and flats. Generally distributed in Nova Scotia.

4. *Vaccinium Oxycoccus* L. Small Cranberry, "Bog-berry."

A creeping vine, 4 in. to 10 in. long, very slender, with thread-like fruit stalks, Leaves ovate or egg-shaped, few and irregularly disposed, $\frac{2}{10}$ in. long, with curved margins. Berries round, $\frac{3}{10}$ in. thick, with a few small seeds, generally one berry on each fruit stalk, which seldom stands erect, very sour, changes from white with greyish-brown spots to red when ripe, ripens late like the large cranberry, but remains good until the next May. Very palatable, but requires much sugar.

Found on moderately wet open bogs, only on a certain green or reddish-green moss, but never on dry soil or water-covered meadows, as the large cranberry. Either too much or too little moisture is fatal to its growth. Generally distributed, but rarely very plentiful.

5. *Vaccinium Vitis-Idæa* L. Foxberry, Mountain Cranberry, "Cowberry," locally "Partridge-berry."

Vine 6 in. to 10 in. long, tufted creeping stems, with erect ends 1 in. to 3 in. high. Leaves alternate and closely set on stems $\frac{1}{3}$ in. long, wide oval, not pointed, slightly notched at ends, dark green, thick and hard with turned-back edges, smooth and shining above, light green, smooth, with very small black spots below. Berries round, $\frac{1}{3}'$ thick, dark red, acid and very slightly bitter, mealy, juicy after becoming ripe, seeds few and small. Berries in bunches of from 2 to 5, very productive. Important as an article of food, but requiring much sugar.

On bare headlands, barrens or other exposed situations, usually near or on the sea coast, seldom found on wet soil or

far inland. Widely distributed and plentiful in the eastern and northern counties, scarcer in the western counties. Ripe in September; remains late, but does not keep as well as the large cranberry.

6. *Gaylussacia resinosa* T. & G. Huckleberry.

Bush 1 ft. to 10 ft. high, many branched, thin limbed. Leaves oblong, $\frac{3}{4}$ in. to $1\frac{1}{4}$ in. long, light green above and below, thinner and larger than blueberry leaves, often spotted with red. Berries round, black, $\frac{3}{10}$ in. to $\frac{4}{10}$ in. thick, more seedy than the blueberry, but more juicy, sweeter, and better flavored, one of the most palatable and agreeable of Nova Scotian wild fruits. Bushes well laden, but fruit distributed more evenly and on longer fruit stalks than the blueberry.

Associated on barrens and partly wooded land with blueberry, but unlike the latter often capable of growing in more shady places. A valuable food, but will not keep long. Widely distributed and plentiful everywhere throughout Nova Scotia. Ripens in August, after the blueberry.

7. *Viburnum lantanoides* Mx. Hobble-bush, locally "Moose-bush."

A shrub 6 ft. to 9 ft. high, with spreading branches, growing in pairs from main stalk and larger branches, the pairs alternating at right angles to each other. Bark, brown to brownish-grey on all branches except the growths of the present year, which are covered with a light green velvety bark, continuous to the ends of the leaf ribs. The old bark is spotted with minute white warts. Leaves in pairs opposite each other on leaf stalks, 2 in. long, 3 in. to 6 in. diameter, round, but curved inward at junction with leaf stalk, thick, soft, smooth above, scurfy to downy beneath, somewhat wrinkled, leaf-ribs large, leaves toothed irregularly and slightly pointed. Berries in widely spreading flat topped bunches, 3 in. to 5 in. across, no berries on outer row of flower stalks. Changing from red to

black when ripe, $\frac{8}{10}$ in. to $\frac{4}{10}$ in. thick, somewhat flat, and containing a single hard flat seed about half the size of the fruit, thin skinned, with moist soft black pulp, very sweet and easily digested, decays soon, unless eaten by birds and squirrels. Ripens in August.

Grows in deep shady woods, in moderately dry soil. Widely distributed, but not very abundant.

8. *Viburnum Opulus* L. Cranberry-tree, Bush Cranberry.

Shrub 5 ft. to 12 ft. high, with many branches. Bark light grey. Leaves 3 to 5 ribbed, strongly lobed, lobes pointed, base of leaf wide, sides notched. Berries $\frac{3}{10}$ in. long, round, bright red, very sour but pleasant, with a single thin flat smooth seed. Smooth skinned, juicy, remains uninjured until spring.

In low or moist rocky lands, or beside streams, but not in swamps, meadows or pine timber land. Preserve made of the berries is sometimes to be had in the Halifax country market. Plentiful only in a few districts of the northern and western counties.

9. *Viburnum cassinoides* L. Withe-rod.

Bush 5 ft. to 8 ft. high, thin, tough, wiry, branches few, which ascend at slight angle with main stem; much used for basket making. Bark light brown. Leaves 2 in. to 3 in. long, oval, pointed, wavy margin notched into rounded teeth, dark green, not shining nor very thin. Berries slightly flattened, $\frac{2}{10}$ in. to $\frac{3}{10}$ in. long, with a bluish bloom, smooth black skin and pulp, with a flattened stone, sweet, but pleasant tasting, agreeable and easily digested, and of considerable value as an article of food. Their dark color makes them objectionable to some whose fastidiousness exceeds their common sense.

In nearly all meadows, swamps, wet barrens and low open lands, often in great abundance. Widely distributed.

10. Cornus Canadensis L. Dwarf Cornel, Bunch-berry, locally "Pigeon-berry."

Slender green red-ribbed stalk $2\frac{1}{2}$ in. to $4\frac{1}{2}$ in. high, rising from long tangled creeping roots, evergreen. Four large white petal-like bracts surround the cluster or bunch of small inconspicuous flowers. Leaves 4 to 6, ovate, pointed at both ends, $1\frac{1}{4}$ in. to 2 in. long, arranged in a whorl at foot of fruit stalk, light green, smooth, grooved above and ribbed below, two scale like leaves clasp the stem lower down. Leaf stalk very short. Berries in a bunch, round, red, $\frac{2}{10}$ in. to $\frac{3}{10}$ in. thick, smooth skinned, fleshy white or pinkish pulp of sweetish taste, containing a single large, hard, round, white seed, which is hard to separate. Its value as a food is therefore slight in spite of its abundance. The seed, however, is easily crushed between the teeth.

Grows in mixed woods in moderately dry soil where ground is not too thickly covered by leaves. Ripens in August and September. Very plentiful and widely distributed.

11. Chiogenes hispidula T. & G. Creeping Snowberry, locally "Maidenhair," "Capillaire."

Slender creeping vines, often grows in thick and matted masses. Leaves evergreen, oval, $\frac{3}{10}$ in. long, not notched, margins curved, light green, smooth above, bristly below, leaf stalks extremely short, has the aromatic taste of the birch or tea berry. Berry white, $\frac{3}{10}$ in. long, slightly oblong, with many minute seeds, dry and mellow with a sweetish spicy flavor, without visible fruit stalks. Nova Scotia's most delicious berry; either eaten uncooked or as a preserve. Ripens in July and August.

Grows in mossy woods or shady bogs where not too wet. Generally distributed and fairly abundant, though their small size makes them unimportant as an article of food. Make very delicious preserve.

12. Gaultheria procumbens L. Creeping Wintergreen, Checkerberry, locally "Tea-berry," "Deer-berry," "Partridge-berry."

Stalks 2 in. to 4 in. high, connected beneath the surface. Leaves in a crown of 2 to 4, smooth and dark green, ovate, slightly pointed and minutely notched, $\frac{3}{4}$ in. to $1\frac{1}{4}$ in. long, edges curved, hard, thick, light green below, strongly aromatic odor and taste, containing a volatile oil known as wintergreen, used as a flavor or perfume. Flowers small pinkish-white and cup-shaped, in bunch of 2 to 3 beneath leaves, which are nearly edible. The juice of the chewed leaves is very invigorating. Berries bright red, round, end indented and containing dark-colored bristle in centre, $\frac{3}{10}$ in. to $\frac{4}{10}$ in. thick, pulp dry and spicy. Does not complete its growth in one season, remains on stalk over winter, and increases in size and ripeness next spring.

Dry barrens, open or burnt woods, and old pastures. Widely distributed and abundant, available at all times except July to September.

13. Prunus Pennsylvanica L. Wild Red Cherry, Bird Cherry.

Small tree 7 ft. to 20 ft. high, with many straight thin branches. Bark smooth, light reddish-brown; outside thin and paper-like, but tearing easily in strips around the trunk, inside green and intensely bitter. Leaves very oblong and sharply pointed, notched, thin, shining light green and smooth on both sides, on leaf stalks 1 in. long. Berries not in a long cluster, round, $\frac{2}{10}$ in. to $\frac{3}{10}$ in. thick, smooth skinned, red, juicy, very sour, somewhat clustered, but on fruit stalks 1 in. to $1\frac{1}{2}$ in. long; contains a single round hard seed with bitter kernel, which is more or less unsafe to eat. Ripens in July.

On the driest and rockiest soil, on barrens and burnt or open woods, never in swamps. Widely distributed, and often extremely plentiful. Much eaten by birds.

14. Prunus serotina Ehrh. Wild Black Cherry.

A large tree, 15 ft. to 50 ft. high, often used for cabinet work. Bark rough and dark grey on trunk, with reddish-brown branches, thin outside bark, and very bitter inner bark. Leaves very oblong, tapering to a point, a little larger and thicker than the leaves of the wild red cherry, dark green and shining above, a little lighter and duller below, on leaf stalks nearly 2 in. long. Berries in a long cluster, round, $\frac{4}{10}$ in. thick, purplish black, pulpy, juicy, sour to slightly bitter but pleasant and digestible, contains a single slightly oval hard seed. Ripens in August.

Found chiefly on rich intervales, Musquodoboit, Shubenacadie, and other valleys. Not very plentiful, though widely distributed.

15. Prunus Virginiana L. Choke-cherry.

A shrub 5 ft. to 10 ft. high, consisting chiefly of separate stems from the same root. Leaves oblong, abruptly pointed, 3 in. to 4 in. long, dark green, sharply notched. Bark rough, greyish-brown. Berries in a long cluster, crimson-brown or nearly black, round, $\frac{3}{10}$ in. to $\frac{4}{10}$ in. thick, moderately sour, juicy, astringent, pleasant, digestible, with single slightly oval hard seed; arranged thickly and regularly to the number of 10 to 16 on long fruit stalk. Ripens in August.

Grows around the edges of cultivated land, roads, intervales, seldom found in uninhabited districts. Widely distributed, and plentiful in the western counties; scarce in the east except in the older settlements and towns.

16. Pyrus arbutifolia L. Choke-berry.

A bush $1\frac{1}{2}$ in. to 7 in. high, branching tough stalk. Bark brownish-grey. Leaves oblong, pointed, finely notched, thick, dark green to brownish-green, smooth above and slightly downy beneath. Berries deep reddish-purple or nearly black, with

lighter colored juice, the stains of which are very difficult to efface, nearly round or slightly egg-shaped, $\frac{3}{10}$ in. to $\frac{4}{10}$ in. thick, smooth skinned, juicy, sweetish-sour, astringent; in heavy bunches, though each berry has a separate long fruit stalk. Pleasant and digestible. Contains several small seeds.

In meadows, wet intervales, or moist places in open woods and barren land. Widely distributed and abundant, especially in the southern counties.

17. Pyrus Americana D. C. American Mountain Ash.

Tree 8 ft. to 25 ft. high, straight and regularly branched. Bark greyish-brown. Leaflets $2\frac{1}{2}$ in. long, taper pointed, sharply notched, bright green above, pale green below, 13 leaflets on each leaf stalk. Berries in flat-topped clusters, round, size of field peas, bright red or scarlet, has a peculiar astringent sour taste unlike that of any other berry, therefore unpleasant to the great majority, pulpy, juicy, with few seeds. Grow in great flat clusters nearly on every branch, often covering the tree in a canopy of scarlet fruit. In autumn it is our most beautiful tree, much used as an ornament for lawns and gardens. Ripens in September, remaining uninjured long after the first frosts. Seldom used as a food.

In moist woods, hanging over river and lake banks, which it greatly beautifies. Particularly abundant in Yarmouth and Shelburne counties, becoming less plentiful going east.

18. Amelanchier Canadensis Medic. (2 or more varieties). Shad-bush, Service-berry, June-berry, June plum, locally "Indian Pear."

(a). Tree 6 ft. to 30 ft. high, branches ascending at a slight angle with the trunk, thin limbs and open foliage, close tough wood. Bark moderately smooth, light grey with dark grey or light brown stripes, running vertically. Leaves oblong, pointed, 2 in. to $2\frac{1}{2}$ in. long, sharply notched, heart-shaped at base in some

larger varieties, thin, dark or dingy green. Berries deep reddish-purple, round, on $\frac{1}{2}$ in. leaf stalk, size of large peas, 10-seeded, very sweet and pleasant tasting, containing more sugar than any other native fruit. These, with huckleberries and witherod berries, are the most easily digested and nourishing wild fruit of Nova Scotia.

In low woods and along banks of streams and lakes where alone it is abundant. Is scattered elsewhere. Generally distributed, but more plentiful in the western than the eastern counties.

(b). Small bush or twig, with 2 to 5 thin branches. Bark brownish-grey. Leaves oblong or oval with round end, notched, light green. Berries purple, oval, slightly longer than thick, $\frac{4}{10}$ in. to $\frac{5}{10}$ in. long, very sweet and juicy, superior to any other variety in taste and size, and well worthy of domestication, 10-seeded, scattered irregularly over bush, never in clusters.

On level and not too rocky barrens, and dry open lowlands, mixed with blue and huckle berries; seldom on river banks with the larger varieties. Generally distributed, but not very abundant; more plentiful in the western than in the eastern counties.

19. Fragaria Virginiana Duchesne. Wild Strawberry.

So well known that for practical purposes it needs no description. Pleasant and digestible, very abundant. Ripens in July.

Found almost everywhere in cultivated grounds, barrens and open woods, usually never far from settlements.

20. Rubus strigosus Mich. Wild Red Raspberry.

Very abundant and well known, description superfluous.

Around cultivated grounds, in pastures, open woods, and on barrens far from settlements. A juicy, delicious. and easily digested fruit. Ripens in August.

21. Rubus villosus Ait. Common or High Blackberry.

Well known accompaniment of cultivation, description unnecessary.

Found nearer settlements, but not so abundant as the raspberry. Generally distributed. Ripens in early part of September.

22. Rubus Canadensis L. Low Blackberry, Creeping Blackberry. Dewberry (?)

Thin trailing prickly vines. Leaf stalks with 3 leaflets, prickly, oval, pointed, sharply notched, thin and smaller than those of the high blackberry. Berries black, not in bunches, much smaller than those of the high blackberry, much like it in structure, taste, and juiciness; pleasant and easily digested.

Found chiefly in rocky, low, but not swampy ground, on flat barrens or in open woods, especially after the underbrush has been burned. Common in Nova Scotia, but not very abundant.

23. Rubus triflorus Rich. Dwarf Raspberry, locally "Dewberry," and "Mulberry."

Vine 3 in. to 6 in. high, reclining or upright, with 2 or 3 branchlets of 3 leaves each. Leaves oblong, pointed, doubly notched, thin, smooth, 1 in. to 1½ in. long. Berries ½ in. thick, red, with few and almost separate lobes, each containing a seed. Juicy, vinous, and pleasant.

Wet mossy woods or moderately wet bogs partly tree covered. Nowhere in great abundance though quite common.

24. Rubus Chamæmorus L. Cloud-berry, locally "Bake Apple."

Single stem 2 in. to 9 in. high, with 2 or 3 leaves on 1½ in. leaf stalks half way to top of stems. Leaves almost round, roughly 5-lobed, 1½ in. to 2 in. across, rough and slightly hairy. Berries 1 to 3, usually 1 on each plant on separate fruit stalks,

at first hard and light red, changing to a dark amber color when ripe, $\frac{1}{2}$ in. thick, consisting of a fewer, but larger, lobes than raspberry. Has a thick rich yellow juice, which leaves little residue, slightly acid, pleasant, wholesome and easily digested though somewhat seedy. Ripens early in August.

Found only on dry mossy bogs (savannas, so called) in the eastern part of Nova Scotia. More plentiful in northern Cape Breton. It reaches its greatest size and perfection in Labrador. Nova Scotia is near the southern limit of its growth, and it is rarer now than forty years ago.

25. Ribes lacustre Poir. Swamp Gooseberry.

Small bush 1 ft, to 2 ft. high, erect or slightly reclining, stem and branches full of sharp spines, bark light grey. Leaves 3-lobed, 1 in. across, light green, downy, leaf stalks short. Berries round. dark red when ripe, $\frac{3}{10}$ in. to $\frac{5}{10}$ in. thick, covered with small prickles, in bunches of 2 and 3 growing chiefly on sides of stem; pulpy, juicy, moderately sour, with several large seeds. A pleasant food.

In open rocky or burned woods, old pastures or waste land. Common, but not very abundant.

26. Ribes oxyacanthoides L. Hawthorn Gooseberry, Northern Gooseberry.

Berries roundish, smooth, $\frac{1}{3}$ to $\frac{1}{2}$ inch in diameter, reddish purple when ripe. Low bush, spines solitary, light colored, $\frac{1}{4}$ to $\frac{1}{2}$ inch long, sometimes none. Prickles scattered or wanting. Leaves petioled, three to five lobed, nearly as broad as long, under surface and stalk generally bearing some down. Flowers, one to three on stalk less than $\frac{1}{4}$ inch, nearly $\frac{1}{4}$ inch long. Fruit more dainty and pleasant than the garden gooseberry when ripe.

27. Ribes prostratum L'Her. Fetid, Wild or Stinking Currant.

A reclining or creeping vine-like bush, ends of stems above being upright. Bark grey, when bruisod emits a peculiar and

intensely strong odor objectionable to some people at first, but not so disagreeable as elder. Leaves somewhat heart-shaped, but 5 to 7-lobed, 1 in. to 2 in. across, lobes pointed, doubly notched. Berries round, size of small field peas, red, slightly bristly, juicy, contains a few large seeds; in clusters of 8 to 20 on fruit stalks 2½ in. to 4 in. long; smell less strongly than bark or leaves, sour with a peculiar taste related to smell, but in spite of this is enjoyed by many people.

In rocky open woods or barrens. In greatest abundance where land is most rocky. Very abundant in southern and western counties of Nova Scotia and southern Cape Breton.

28. Ribes rubrum L. Wild Red Currant.

Stems straggling or reclining. Leaves somewhat heart-shaped, 3 to 5-lobed, notched. Berries round, a little larger than the stinking currant, smooth skinned, red, resembles the garden currant in size, taste, and foliage, without the strong smell of the former; makes a delicious preserve.

In open woods or waste land, in deep soil. Very scarce in Nova Scotia, found by me only in the northern counties.

29. Ribes floridum L'Her. Wild Black Currant.

Creeping stems, slightly spinous. Leaves much like those of the red currant. Berries round, black, same size as Ribes prostratum, bristly, with slightly musky smell and taste. Barely tolerable as a food.

In rocky open woods and moist barrens. Scarce in Nova Scotia.

30. Mitchella repens L. Partridge-berry, Snake-berry, sometimes locally "Wild Ivy-berry."

Slender evergreen vines, 4 in. to 12 in. long, scattered and creeping. Leaves round, $\frac{3}{10}$ in. long, scarcely pointed, arranged closely and regularly along vine, dark green and shining above,

light green below. Berries round or slightly flat at end, $\frac{3}{10}$ in. to $\frac{4}{10}$ in. thick, with 2 eyes or flower marks, the only common doubly marked berry we have, scarlet, almost tasteless or slightly sweet, nearly dry, fleshy, white pulp, remaining uninjured over winter and improving with time. Has 1 or 2 large seeds. Of little value as food.

In dry shady mossy woods where other plants are rare. Generally distributed, but not plentiful.

31. Sambucus Canadensis L. Common Canadian or Black-berried Elder.

Shrub 4 ft. to 9 ft. high, leaf stalks branching at almost right angles with stalk, woody, with large core of white pith. Bark, outside grey and paper-like, inside green and tender with a strong and disagreeable smell when bruised; often used for making a salve. Leaves 7 to 11 on each leaf stalk, 4 in. long, oblong, taper-pointed, notched, smooth. Berries round, $\frac{3}{20}$ in. thick, dark purple, our smallest berry, in thick, flat-topped bunches of 20 to 60; with purple juicy pulp, 3-seeded, peculiar acid taste. Liked by some people, disagreeable to others on account of taste. Probably nourishing if taste can be overcome.

In rich soil, open woods, burnt land, around old fields and brooks. Widely distributed, abundant in some places.

32. Sambucus pubens Mx. Red-berried Elder, "Boltry."

With large pyramidical clusters of red berries. Character very similar to those of the last mentioned.

33. Aralia nudicaulis L. Wild Sarsaparilla.

Stem 8 in. to 10 in. high, dividing at top into 3 leaf stalks, stems annual. Leaflets, 15 in number, viz., 5 on each leaf stalk, 2 in. to 4 in. long, oblong, taper-pointed, finely notched, altogether distinct from fruit stalks, though growing from the same long white far-reaching aromatic roots. Berries roughly round, dark brown to black, $\frac{1}{4}$ in. thick, with a few shart spines

around top of berry, watery, sweetish, not unpleasant, few seed; in large bunches or flat-topped clusters on tall fruit stalk. Food value slight.

Widely distributed and fairly abundant.

34. Aralia racemosa L. American Spikenard.

Herbaceous, much-branched, from 3 to 6 ft. high, in rich intervale soil. Leaves compounded of 3 or 5 leaflets, each roundish, heart-shaped at the base, pointed at the apex, 2 to 6 in. long, and sharply and finely toothed on the margins. Flowers in clusters, made up of numerous umbels, each floret small and greenish. The fruit, when ripe, consists of compound clusters of beautiful reddish-brown or purplish berries with a pleasant taste and peculiar aromatic flavor characteristic of the plant and its large rootstalk, which is used for flavoring home-made beer in some places. Not common.

35. Smilacina bifolia Ker. Two-leaved Solomon's Seal, locally "Cowslip."

Leaves and fruit on one stem, 3 in. to 5 in. high, roots creeping. Leaves, 2 in number, 2 in. long, 1 in. wide, heart-shaped, pointed, longitudinally ribbed, base almost clasping stem, somewhat downy. Berries red, round, $\frac{2}{10}$ in. thick, with 1 or two large seeds, very juicy, taste resembles somewhat the imported liquorice, with vinegar added. In bunches of 5 to 12 on each stem, on very short fruit stalks. Food value slight.

In damp or moderately dry deep soil in shady or partly open woods. Generally distributed, and in some places abundant.

36. Taxus baccata L. Var. *Canadensis* Marsh. American Yew, Ground Hemlock.

Stems 2 in. to 6 in. long, reclining and often thickly tangled, evergreen; bark and foliage resembles the large hemlock, except that the needles are larger. Berries round, the size of a large

pea, smooth and tender skinned, pulp colorless, resembling uncooked white of egg, juicy, sweetish, pleasant taste, large cup-shaped hollow in top containing a single hard smooth greenish seed, thus differing from every other Nova Scotian fruit. Berries scattered, growing on main stems rather than on branches. Digestible, but not abundant enough to count on as a food supply in a time of need.

In cool damp woods and ravines. Resembles a cone-bearing bush and therefore may be passed without notice. Most abundant in the western counties.

37. Empetrum nigrum L. Black Crowberry, Heath-berry.

Slender dark-colored spreading vines, many branched, ends erect 2 in. to 4 in. high. Leaves oblong, not pointed, scarcely $\frac{2}{10}$ in. long, set thickly along stems. Berries black, size of small peas, juicy, with mild sweetish taste somewhat like sarsaparilla berries, 6 to 9 seeds, palatable, though not of great value as a food.

In great abundance on dry savannas or undulating open barrens where the soil is thin. Widely distributed throughout Nova Scotia, especially the eastern part.

38. Streptopus roseus Mx. Rosy-flowered Twisted Stalk.

Annual, branching stem, 10 in. to 20 in. high, green tender stalk slightly bent at each leaf stalk. Its 2 to 4 branches often assume an umbrella-like form, being curved outwards and drooping at ends. Leaves, long, oval, taper-pointed at both ends, $1\frac{1}{2}$ in. to 3 in. long, light green, tender, finely haired, longitudinally ribbed, growing close to stems, alternate, 10 to 20 on each plant. Berries oval to almost round, $\frac{3}{10}$ in. to $\frac{5}{10}$ in. long, red, smooth-skinned, with pulp like white of egg in appearance, very juicy, with several large white seeds, hanging singly or in twos to thread-like fruit stalks to the number of 8 or 10 on each plant, almost tasteless.

In damp or cool shady woods. Generally distributed, but not very plentiful. Unimportant as a food.

S. amplexifolius D. C., with clasping leaves, whitish underneath, and greenish-white flowers; has similar oval berries, slightly larger.

39. Crataegus coccinea L. Scarlet Thorn, Hawthorn-berry.

Bush 4 ft. to 8 ft. high with small thorns, many branched. Leaves oval, somewhat lobed, thin, sharply notched, truncated base. Berries light coral red, slightly oval, with some seeds, light colored mealy pulp, mild sweetish sour, edible but not important as an article of food.

In dry soil in low woods. Generally distributed; most plentiful near coasts and settlements.

40. Cratægus tomentosa L. Black-thorn, Pear-thorn, locally "Thornberry."

Low tree, 4 ft. to 12 ft. high, many branched, with thorns $1\frac{1}{4}$ in. to $2\frac{1}{4}$ in. long. Leaves larger than last species, oval, sharply notched, abruptly narrowed at base. Berries light scarlet, round, or slight pear-shaped, few seeds, $\frac{1}{2}$ in. thick, pulp pinkish-white, moist though mealy, pleasant tasting and easily digested.

On rocky river banks in burnt or open woods. Generally distributed, but not very abundant.

ROOTS AND BULBS.

41. Apios tuberosa Mœnch. Ground-nut, Indian Potato, "Indian-bean."

A reclining and climbing vine. Leaflets 5 to 7 on each leaf stalk, round base, taper-pointed, 2 in. to 3 in. long, dark green. Blossoms brownish purple, pea-shaped, in cluster along flower stalk. Pods pea-shaped and many-seeded. Flowers early in September. Long roots, swelling into tubers resembling sweet

potatoes. Tubers grey, 1 in. to 2 in. long. Roots, 2 ft. to 16 ft. long, containing from five to fifty tubers. Each plant has several roots. Tubers tough and albuminous, somewhat strong tasting, but not more so than some cultivated potatoes. Nourishing, but needs much cooking. Parboil with salt, then roast. In dry intervale and rocky lake and river banks; but never far above water level, and never in the shade. Available any time.

Plentiful in western Nova Scotia. Have never seen it east of Halifax, though it may exist there.

42. Aralia trifolia Decaisne. Dwarf Ginseng, Ground-nut.

Annual, 3 in. to 4 in. high, 3 leaf stalks at two-thirds height. Leaflets 3 or 5, oblong, narrow, taper-pointed, notched on margin. Flowers in close set bunch at top of stem, white; blooms in latter part of May. Tubers set deep in ground at end of long tender white stalk, round, white, with 2 or 3 minute rootlets, starchy, pungent sweetish taste. Passable as a food only in extreme cases. Cut open and boil well.

43. Dentaria diphylla Michx. Two-leaved Toothwort, Pepper-root.

From 4 to 12 in. high, divided into 2 or 3 leaf stalks of 3 leaflets each. Leaves, roughly oval, coarsely toothed on margin, pointed, dark green. Flowers white. Roots, 3 in. to 7 in. long, irregular in size, $\frac{1}{16}$ in. to $\frac{1}{4}$ in. thick, white, tender, crisp; hot, like pepper, but pleasant when eaten raw.

In rich moist soil in limestone lands and intervales. Generally distributed, but not very abundant.

44. Typha latifolia L. Common Cat-tail, locally "Bulrush."

Stem 2 ft. to 6 ft. high, a tall column of overlying leaves with small central core, l aves long and grass-like. Top of flower stalk ending in a beautiful brown seed spike, 6 in. long, and resembling, when ripe, a cat's tail. Above this projects the

pollen producing portion of the plant to a height of 4 in. higher. At junction of stem and root is a starchy edible pith, tasting like tapioca. Eat roasted or boiled—but to extract all nourishment dry and grate the root, soak in water or boil, and strain. A valuable food, but not abundant enough to be important.

In quiet, shallow ponds or miry swamps. Common throughout Nova Scotia. Abundant only in some districts.

45. Osmunda cinnamomea L. Cinnamon Fern.

Fronds 1½ ft. to 4 ft. high, springing from a common root. Flowers and seed on a mass of curled fronds in centre. Edible part is core of root which is tender, white and sweet; found just below the surface. Root is massive, scaly, and fimly rooted and difficult to extract. Roasting or boiling in salt improves. Edible part 1½ in. long.

Plentiful in every swamp and wet tract of land throughout the province.

LEAVES.

46. Rumex crispus L. Curled Dock, Sourdock.

Stems 1½ ft. to 3 ft. high, upper part leafless and seed-bearing. Leaves spread from root and base of stem, 5 in. to 12 in. long, pointed, arrow-like, smooth with strongly crimped margins. Seeds with wings, which are heart-shaped or almost round, and nearly ¼ in. wide, in long tapering cluster of several hundred at top of stem. Root long, spindle-shaped, vertical, orange-colored.

In fields, pastures, waste lands, in woods around old lumber camps. Very abundant. Leaves tender, somewhat sour, used as a green boiled with salt, pleasant tasting and digestible especially from May to August. Generally distributed.

47. Rumex sanguineus L. var *Viridis.* Bloody-veined Dock, Sourdock.

Stems long, slender, leafless, spring from base of leaves. Leaves long, slender, pointed at both ends, except lower leaves

which are heart-shaped at base, tender, sour, pleasant. Boil in salt as before. Seeds winged, a somewhat triangular oval, rounded at ends.

In waste and cultivated lands, old roads, and lumber camps. Generally distributed and abundant.

48. Taraxacum dens-leonis Desf. Dandelion.

Low spreading leaves, 6 in. by 1 in., irregular, curve-toothed margin, exudes a milky juice when broken, very bitter, used as green, boiled. Disagreeable to some on account of its rather bitter taste. Flowers cluster golden yellow, composite, 1 in. across, on erect hollow tender stems 2 in. to 6 in. high, seeds downy, closely packed on crown-shaped base to number of 100 to 150.

Very abundant in and around all cultivated lands and roads.

49. Chenopodium album L. Lamb's-quarters.

5 in. to 13 in. high, erect and branching from a central stem. Leaves 1 in. to 2 in. long, pale green, tender, juicy, glistening mealy surface, oblong, pointed at both ends, irregular or notched margin, palatable and pleasant. Boiled as a green for the table. One of the best.

Common in waste and cultivated land, old clearings. Generally distributed. Abundant only in a few places.

50. Oxalis Acetosella L. Common Wood-sorrel.

Leaf and flower stalks spring from a creeping scaly root growing along the surface or beneath the leaves and moss. Leaves, 3 at top of each leaf stalk which is 2 in. to 3 in. high, strongly heart-shaped with wide end toward stalk, $\frac{1}{2}$ in. to $\frac{3}{4}$ in. across, slightly hairy above and below, juicy and sour. Parboil, then boil whole plant with salt. Unimportant as a food. Flowers 5 sepals, 5 petals, 10 stamens, white with pink veins, $\frac{4}{10}$ in. to $\frac{5}{10}$ in. across, each on a separate stalk 2 in. high. Seed

pods hanging, pear-shaped but reversed, brown, $\frac{1}{4}$ in. long, with 8 to 12 seeds.

In deep shady woods. Abundant everywhere.

51. Fagus ferruginea Aiton. American Beech.

Tree 30 ft. to 60 ft. high, spreading branches. Wood dark colored, hard, yearly growths not easily seen. Bark smooth, light grey, without an outer skin. Leaves 2 in. to 4 in. long, ovate, pointed at both ends, coarsely notched ribs start alternately from mid-rib, smooth above, hairy below, especially on edge of leaf, acid and tender when young, soon become bitter and tough, need much boiling and make an indifferent food. Available in May and June.

Abundant on dry land and in deep soil. Generally distributed.

52. Pteris aquilina L. Common Brake, Bracken.

The young curled fronds, when a few inches high, are tender and palatable. Boil well, as asparagus, which it much resembles. Best in May, soon becomes tough. Also *Osmunda cinnamomea* L., Cinnamon Fern, No. 44 preceding.

53. Allium schœnoprasum L. Chives.

Flower stalk 4 in. to 9 in. high, with round bunch of light purple flowers and pointed sepals. Leaves 4 in. to 7 in. high, awl-shaped, hollow, separate from flower stalk, taste and smell like onions or garlic, useful more as a seasoning than as a food.

Found in low wet lands near sea shore or rivers. In northern Nova Scotia. Have not seen it in the southern or western counties.

54. Medeola Virginica L. Indian Cucumber-root.

Stem of plant 1 to $2\frac{1}{2}$ ft. high, bearing a whorl of about six or more several nerved leaves from 2 to 6 in. long, and tapering to each end, about its middle, and a smaller whorl immediately

below an umbel-like cluster of from 2 to 9 greenish-yellow flowers, with it ovary cells and styles in 3's, and its stamens and perianth in 6's. Berries, dark purple, nearly $\frac{1}{2}$ in. in diameter. It grows from a tuber-like root stalk from 1 to 3 in. long, which has a flavor suggesting cucumber.

Not very abundant, and its food qualities not sufficiently tested.

FLOWERS.

55. Rosa blanda Aiton. Early Wild Rose.

Stem branching, with scattered spines, 1 ft. to 4 ft. high, flower stalk smooth. Leaflets, 5 to 7 on each leaf stalk, oblong, pointed, pale green, a little downy beneath, notched on margin. Flowers, 1 to 3 on each flower stalk, petals 5, stamens many, light rose color, fragrant, edible. Seed-pod round, red, smooth, $\frac{1}{3}$ in. to $\frac{1}{2}$ in. thick, many seeded. Blooms in June.

In rocky soil, barrens, and river and lake banks where not too wet. Common in all parts of Nova Scotia.

56. Rosa lucida Ehrhart. Dwarf Wild Rose.

As the description and range of this species is much like the preceding, it is difficult to distinguish. The flowers of both being edible, a mistake in identification is of no consequence.

57. Epigæa repens L. Mayflower, Trailing Arbutus.

Trailing matted vines from 6 in. to 24 in. long. Leaves, wide oval, $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. long, bristly inside, evergreen. Flowers at end of leaf stalks in clusters of 3 to 8, tube-like with 5 clefts, bristly inside, stamens 10 with slender filaments, anthers oblong, sepals long, scale-like, pointed, nearly distinct, flowers $\frac{5}{10}$ in. to $\frac{6}{10}$ in. long. Exhales a delicate perfume, white to pink, edible. Blooms in April. Nova Scotia's earliest flower.

In open woods, dry barrens, dry rocky or sandy soil. Abundant everywhere in Nova Scotia under above conditions.

NUTS AND SEEDS.

58. Fagus ferruginea Aiton. American Beech.

Described in No. 50. Nuts 3-sided, abrupt at base, pointed at top, $\frac{1}{3}$ in. to $\frac{1}{2}$ in. long, in pairs, each pair forms a 4-sided pyramid, and are enclosed in a coarse bristly 4-parted husk, open at top, and growing on extremity of branch. Nut shell brown, easily opened, kernel rich, sweet, and easily digested. A favorite food of squirrels. Very abundant in October. Does not produce regularly.

Generally distributed, but most abundant in the eastern counties.

59. Corylus rostrata Aiton. Beaked Hazel-nut, Filbert.

Tree-like, 3 ft. to 6 ft. high, branching near top, root often bent at right angles to stem. Bark, light-brown with light-grey spots, spotted appearance quite noticeable. Leaves oblong or somewhat heart-shaped, $1\frac{1}{2}$ in. to $2\frac{1}{2}$ in., pointed, soft and slightly downy, doubly notched. Nut round or slightly oval, with beaked top and thick shell, $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long, sweet and easily digested. Enclosed in a long bristly husk with ragged end, in the base of which lies the nut. Husks hang singly or in twos with rudimentary husks attached, and when green is juicy and extremely sour.

In dry or moderately dry open woods or barrens. Generally distributed and abundant.

60. Quercus rubra L. Red Oak.

Tree 50 ft. to 90 ft. high, and 1 ft. to 3 in. in diameter, with heavy spreading limbs. Wood heavy, strong, porous when dry, white in outer part with red heart. Bark grey and strongly corrugated, but not so regularly as the ash. Leaves 4 in. to 6 in. long, with 5-pointed lobes. Nuts round with small spur on end, flat base resting a scaly truncated cup. Size $\frac{1}{2}$ in. to $\frac{3}{4}$ in., with large white kerne , very bitter, which almost precludes its use

even in extreme cases, otherwise it would form a valuable article of food. Bitterness can however be modified considerably by boiling in salt or grating finely and soaking in water, and then roasting.

In dry and moderately wet soils. Very abundant in the western counties; rare or absent east of Halifax.

61. Polygonum convolvulus L. Black Bindweed, "Wild Buckwheat.

A climbing tree, 3 ft. to 10 ft. long, with slender stem and triangular leaves, long and pointed, climbing through fallen trees and bushes. Seeds very small, black and triangular, with dry starchy kernels. A poor substitute for common buckwheat.

In old clearings and open woods. Abundant in many districts.

62. Pinus Strobus L. White Pine.

Tree 60 ft. to 100 ft. high, evergreen and coniferous, with rough corrugated dark grey bark and often sweeping trunk, sometimes heavily branched. Wood white with red heart, softest of Nova Scotia coniferous woods, as well as most durable. No other Nova Scotian tree resembles it. Leaves, five from the same sheath, needle-shaped, $1\frac{1}{4}$ in. to $2\frac{1}{4}$ in. long, cones gently swelled in middle and pointed at outer ends, 4 in. to 5 in. long, Seeds $\frac{1}{8}$ in. to $\frac{3}{16}$ in. long, sweet, soft, slightly resinous, inside of and at base of cone scales, nourishing and easily digested, but not liked much.

In all sorts of soil except the wettest portion of swamps. Generally distributed and often abundant, but difficult to gather Available until spring.

63. Pinus resinosa Aiton. Red Pine.

Tree 40 ft. to 70 ft. high, coniferous, straight trunked with branches at right angles to trunk. Bark red, rough, not so regularly corrugated as that of the white pine. Wood harder,

more resinous, and darker in color than that of the white pine Needles, 2 from the same sheath, 3 in. to 5 in. long, and in far larger bunches than the preceding species. Cones pear-shaped, with ends reversed, $1\frac{3}{4}$ in. to $2\frac{1}{2}$ in. long, with short spurs on lower outside edge of each cone scale. Seeds enclosed at base of scales, $\frac{1}{4}$ in. long, sweetish, though resinous. Difficult to gather.

On dry barrens or sandy rocky soil. Abundant in western half of province, rarely seen east of Halifax. Available until May.

64. Acer, several species. Maple.

Tree 15 ft. to 60 ft. high. Wood firm, white, durable when dry. Bark black to grey with flaky outer bark. Leaves deeply notched, with radiating ribs ; some species turning many colored in autumn. One species, *A. Pennsylvanicum,* with striped bark, has leaves 5 in. to 8 in. across, turning to a bright yellow. Seeds winged, often in pairs, not always very palatable, are gathered by squirrels when beech and hazel nuts are scarce ; are more digestible than pleasant tasting. Ripens in October.

In all but the wettest and poorest soils. Abundant everywhere where conditions are suitable.

FUNGI.

65. Agaricus campestris L. Common Mushroom.

Appearance well-known. Description unnecessary.

Never found in a forest except, perhaps, near an old lumbering camp, Abundant in long settled parts of the country.

66. Lycoperdon. Puff Ball.

1 in. to $1\frac{1}{2}$ in. thick, skin rough and dark grey, without roots. White, dry, pithy or spongy inside, gradually turning black after completing its growth, earthy or musky smell. Parboil

twice. A poor substitute for nuts. Squirrels search for and eat them only when other food is exhausted. Grows just beneath the surface of moss or leaves without any visible sign of their presence, yet the squirrel detects them easily.

In moderately moist soil in shady woods. Widely distributed but not very abundant. Edible from August to October.

[Dr. A. H. MacKay has tested a large number of Nova Scotian species when cooked, some of them superior to the "mushroom." The edible list of fungi is a long one; but it requires an expert to distinguish them. This is very important, for a few common species are terribly poisonous.]

PARASITIC PLANTS.

67. Monotropa uniflora L. Indian Pipe, locally "Death-plant."

White semi-transparent stalk, 2½ in. to 5 in. high, with highly organized flower of five petals, without smell, stalk with thin transparent scales or leaflets, tender and almost tasteless. Parboil, then boil or roast, comparable to asparagus.

In dry or moderately dry soil in thick woods, June to August. Generally distributed and abundant.

JUICES AND EXTRACTS.

68. Acer saccharinum Wang. Sugar Maple, Rock Maple.

Tree 40 ft. to 60 ft. high, branches usually crooked and irregular. Bark dark grey, rough, flaky and corrugated, but not so much as the oak or ash. Wood extremely hard, fine-grained, and durable when dry. Leaves 3 in. to 5 in. in diameter, deeply notched into 5 unequal pointed lobes with 5 main ribs radiating from centre (turning color in autumn). A sweet sap is obtained by boring or cutting into the tree to a depth of ½ in. to 2 in. A spout of wood is fitted into a cut made below the boring, and this conducts the sap into a wooden trough or dish of birch-bark. It is then boiled down, about 4

gallons of sap making 1 pound of sugar or a larger quantity of syrup. One tree will make from 2 to 5 pounds of sugar a year. Supposed to be superior to cane sugar. Sap runs only in March or April.

In moderately dry soil, though sometimes found in low wet land. Common, though not abundant, except in few districts.

69. Ledum latifolium Aiton. Labrador Tea, locally "Indian-tea."

Leaves which grow directly from main stem are oblong, $1\frac{1}{4}$ in. × $\frac{3}{8}$ in., light green, smooth above with light brown woolly growth beneath, margins curved downward. Aromatic, somewhat bitter and pungent, though pleasant. Formerly much used as a substitute for tea, and a remedy for dysentery. Steep 20 to 30 minutes, slightly narcotic. Flowers few, large, white, 5-parted corolla, many stamens and petals though not composite.

In open bogs, savannas, barrens where not too dry, and also in partly wooded swamps. Abundant everywhere.

70. Gaultheria procumbens L. Creeping Wintergreen, Mountain Tea, locally "Tea-berry."

For description see No. 12. Leaves often used as a substitute for tea. It, however, requires much boiling. A very pleasant beverage, but somewhat astringent.

71. Chiogenes hispidula T. & G. Creeping Snowberry, locally "Maiden-hair, "Capillaire."

For description see No. 11. Leaves and vines steeped for $\frac{1}{2}$ hour makes a pleasant drink.

72. Fragaria Virginiana Duchesne. Wild Strawberry.

See No. 19. Leaves a substitute for tea.

73. Rubus strigosus Michx. Wild Red Raspberry.

See No. 20. Leaves a substitute for tea.

74. Betula lutea Michx. Yellow Birch.

Tree 40 ft. to 70 ft. high. Wood clear, white, and fine-grained. Tall clean trunk. Bark yellowish-grey when young, becomes dark and rough when old. Leaves elongated heart-shape, pointed, thin, soft, well-ribbed, slightly downy or bristly beneath. The young twigs are very aromatic, resembling tea-berry or creeping snow-berry. These, well boiled, give a delicious flavoring for beer, or a substitute for tea.

On dry deep soil. Very abundant everywhere.

75. Juniperus Sabina L. var. *procumbens* Pursh. Creeping or Ground Juniper.

A thick, prickly recumbent bush, with hard curved needles ½ in. long, light green above and greenish-white below. Low, spreading over large spaces, with many herby, resinous, slightly bitter seedy berries, which turn from light green to blue when ripe. Used as a blood purifier and a substitute for tea, as well as a flavoring for beer.

On dry open ground, barrens, or sandy stony plains and slopes. Abundant.

76. Rhus typhina L. Staghorn Sumach.

Large shrub or tree, 5 ft. to 20 ft. high. Moderately rough greyish-green bark. Stems once used for dyeing. Consists of an outer layer of nearly white wood. covering large core of deep greenish-yellow color, unlike any other Nova Scotian tree in this respect. Branches few and massive. Leaves 3 in. to 5 in. long and ½ in. to ¾ in. wide, pointed at both ends, strongly notched, soft, hairy above and below, especially the latter, arranged in regular order along the sides of long leaf stalks, the whole showing at a distance as a beautiful feathery mass of foliage. Seeds oval, size of truncated grains of barley, hard, covered with minute purplish-red bristles. These are impregnated with an intensely sour juice from which a pleasant acid

beverage is extracted by boiling. They grow close set in bunches, resembling at a distance rough tapering pods, each 3 in. to 5 in. long and 1 in. to 1½ in. thick. Each bush carries from 2 to 20 seed clusters. These clusters in the fall become much infested by worms.

Generally distributed, but much rarer in the eastern than in the western counties. Particularly abundant in the interior of Yarmouth county.

77. *Geum rivale* L. Purple or Water Avens, "Wild Chocolate."

A single erect stem, 6 in. to 12 in. high, with drooping peculiar purple flower ½ in. in diameter. Full of stiff hairy bristles projecting beyond the short round petals. One or two leaflets on flower-stalk. Leaves, 3 or 4, spring from root around flower-stalk, resemble geranium leaves, but are thinner, though they perhaps are more like the leaves of the Bake-apple. See No. 22. Roots from 2 in. to 6 in. long, and ¼ in. thick, dark purplish-brown inside, with many rootlets. Taste somewhat like chocolate, but astringent with a very slight addition of acid. Was once used as a substitute for chocolate. Boil well, and add sugar.

Common in open mossy bogs in eastern Nova Scotia, more rare in the western counties.

A Section of Carboniferous Rocks in Cumberland County. Nova Scotia: (1) Detailed Section of Rocks from West Ragged Reef to the Joggins Mines and Minudie, by Sir William E. Logan, (republished); and (2) from Shulie to Spicer Cove, by Hugh Fletcher, B. A., of the Geological Survey of Canada.

Introduction.

By Henry S. Poole, D. Sc., F. G. S.,
President of the N. S. Institute of Science.

The continuous exposure of Carboniferous rocks along the Cumberland County shore of the Bay of Fundy, Nova Scotia, early attracted the notice of observers, and in 1843 it was measured in detail by the late Sir William Logan. His section of 14,570 feet of strata was published in 1845 as an appendix to the Reports on a Geological Survey of the Province of Canada.* Copies of this section, however, cannot now be obtained. Students ask for them and so do others who are attracted to the locali y by the present boom in the coal trade and the possibilities of the field whose rocks are so well exposed in the so-called Joggins section.

To meet this demand, the council of the Nova Scotian Institute of Science has decided to republish Logan's section *verbatim et literatim.* Following the reprint of this section is given, with the sanction of Dr. R. Bell, the Acting Director of the Geological Survey of Canada, a hitherto unpublished detailed section of the rocks from Shulie to Spicer Cove, by Mr. Hugh Fletcher, who has made a life's study of the geology of

* Message from His Excellency the Governor General, with Reports on a Geological Survey of the Province of Canada, presented to the House on 27th January, 1845. Montreal, 1845.

Nova Scotia. That gentleman has also taken great trouble to prepare the accompanying map. *

The base of the section is occupied by rocks of the Carboniferous Limestone series. They form an anticline from the shore of the Bay of Fundy opposite Shepody Mountain across the country to Pugwash on the Straits of Northumberland. Resting on them, with a southerly dip towards the Cobequid range, approximately parallel to the anticline, lies the series of strata detailed in this section. Going southward, in ascending order, the highest members are reached at Shulie, and there Logan's section ended. Mr. Fletcher continued his examination, over the repeated measures to the flank of the hills, where at Spicer's Cove a continuous bed of conglomerate, the waste of the igneous rocks of the axis of the range, terminates the area under review.

The best exposure of the base of the Joggins series is on the west side of Maringouin peninsula where at the Pink Rocks the gypsum deposits are closely overlaid by marine fossiliferous limestones and marls dipping southerly. Then succeeds the series of the Middle Carboniferous, of red sandstone, shales and marly beds, in turn overlaid by the unbroken grey beds with which are associated some bitumenous shales and dark fireclays with small seams of coal from Ferris Cove to the Squaw's Cap, a repetition of the measures of the Joggins section north of Boss Point on the other side of Cumberland Basin.

The portion of the series remaining on the point of the peninsula, can be traced across Shepody Bay through Grindstone Island and Mary Point, where the strata are deflected to skirt the New Brunswick coast to Cape Enragé.

A visitor to the Pink Rocks on Maringouin will find a partial repetition to the northward, and structural features well

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* The Nova Scotian Institute of Science takes this opportunity to acknowledge on behalf of the practical and scientific Interests of the province, the public appreciation of the work performed by Mr. Fletcher, and of the zeal he has brought to bear en the study of our much complicated rock structure and the compilation of details relating to Nova Scotia.

worthy of examination. There is at Hard Ledge an exceptionally well exposed syncline with its axis inclined 15° towards Shepody Mountain, and an unconformity with members of the so-called Permian series. When in the neighborhood one should not fail to see The Rocks of Demoiselle Cape below Hopewell; conglomerate cliffs, caved by the sea, and on a grand scale carved into pinnacles and buttressed.

Mill Cove, the base of Logan's measurements, lies opposite Minudie, and between them, it is said, gypsum beds occur agreeing with the horizon of the Pink Rocks of Maringouin.

Section of the Nova Scotia Coal Measures, as developed at the Joggins, on the Bay of Fundy, in descending order, from the neighbourhood of the West Ragged Reef to Minudie, reduced to vertical thickness.

[Made by SIR WILLIAM E. LOGAN, in 1843 and published as an appendix in the first Report of Progress of the Geological Survey, for 1843, beginning at page 92, and extending to page 156, with figures on pages 157 to 159.]

1.

	Ft.	In.
Greenish gray or drab coloured sandstone or grit, with some conglomerate beds, of which the matrix is sandstone and the pebbles consist of white and of red veined quartz. These are generally as large as peas; some are of the size of pigeons' eggs, and a few as large as hens eggs, ...	30	0
Drab sandstone of a fine grit, but rather too hard for grindstones, ...	2	0
Red or chocolate coloured argillaceous shale, with small layers of sandstone of the same colour and quality as above, ...	15	0

	Ft.	In.
Drab sandstone, with small layers of chocolate coloured shale,	20	0
Dark red argillaceous shale, with some green spots,	10	0
Drab sandstone in two to three beds,	8	0
Drab sandstone of a coarse grit; the bed has an uneven bottom,	20	0
Dark red or chocolate coloured argillaceous shale, with a few bands of sandstone,	20	0
Dark red argillaceous shale,	10	0
Drab sandstone,	7	0
Dark red shale and drab sandstone in irregular beds,	20	0
Drab or greenish gray sandstone,	3	0
Red argillaceous shale,	9	0
Greenish gray or drab coloured sandstone in several layers, separated by bands of dark red or chocolate coloured argillo-arenaceous shale	20	0
Greenish gray or darb coloured sandstone of a fine grit,	4	0
Soft measures, concealed, probably dark red shale,	20	0
Coarse greenish gray sandstone, or rather a conglomerate with a fine matrix of sand and with fragments of plants, converted into coal,	30	0
Measures not well seen,	15	0
Greenish gray sandstone, with conglomerate beds and plants converted into coal,	60	0
Dark red shale,	15	0
Greenish gray sandstone, with conglomerate beds,	10	0
Dark red shale,	5	0
Greenish gray or darb coloured sandstone, with conglomerate beds,	15	0
Dark red shale,	10	0
Greenish gray sandstone, with conglomerate beds,	52	0
Dark red shale, with bands of red sandstone,	14	0
Greenish gray sandstone, with conglomerate beds,	25	0
Dark red shale,	10	0

	Ft.	In.
Greenish gray sandstone, with plants converted into coal,	30	0
Dark red shale, with thin beds of sandstone,	10	0
Greenish gray sandstone, with thin conglomerate layers,	3	0
Dark red shale,	6	0
Greenish gray sandstone, with beds of conglomerate,	55	0
Dark red or chocolate coloured shale,	1	0
Greenish gray sandstone, with much conglomerate and fragments of drift plants coated with coal,	50	0
Dark red or chocolate coloured shale,	9	0
Greenish gray sandstone, with conglomerate beds and carbonized drift plants,	14	0
Dark red shale,	5	0
Dark red shale, with beds of sandstone,	15	0
Greenish gray sandstone, with conglomerate beds,	20	0
Greenish gray sandstone, with bands of red shale,	21	0
Greenish gray sandstone, with conglomerate beds and carbonized drift plants of large diameter, say one foot, and wholly converted into coal. In many cases the action of the surf against the base of the perpendicular cliff has worn deep holes or caverns, where the stems lie prostrate in the reck. The plants are *sigillariæ*, so are nearly the whole of those already mentioned as met with in the grits or conglomerates. Fragments of *calamites* are occasionally seen,	30	0
Red or chocolate coloured shale,	10	0
Greenish gray sandstone of a conglomerate character, with many carbonized drift plants imbedded in it. Some beds of grit in this, towards the bottom, have been found fit for grindstones,	20	0
Dark red or chocolate coloured argillaceous shale,	60	0
Greenish gray sandstone inclining to yellow, chiefly of a coarse grit and free texture; some of it must be called conglomerate, the pebbles of which, consisting of quartz of various colours—white, yellow, and red,		

	Ft.	In.
with black chert and lydian stone,—are some of them as large as hens' eggs, a great many as large as almonds, and the majority as big as peas. Some of the beds have been found fit for grindstones. This sandstone constitutes the point of *West Ragged Reef*,*	30	0
Measures concealed,	42	0
Measures concealed, with sandstone at the bottom,	23	0
Greenish gray or drab coloured sandstone of a coarse grit,	12	0
Dark red shale with green bands,	30	0
Greenish gray sandstone of a coarse grit, some of which is fit for grindstones, but some parts are conglomerate, with red and white quartz pebbles, generally as large as peas, some of the size of pigeons' eggs, and a few as large as hens' eggs; some parts exhibit large spherical concretions rather harder than the surrounding material,	30	0
Dark red shale, with green bands,	6	0
Greenish gray or drab coloured sandstone of a coarse grit,	6	0
Dark red and light green shale, with some bands of drab sandstone,	50	0
Greenish gray sandstone of a coarse grit,	30	0
Dark red shale,	30	0
Greenish gray sandstone of a coarse grit, with some carbonized drift plants,	3	0
Greenish and red shale. This is on the west side of *South Brook, Two Rivers*,	3	0
Measures not well seen, being occupied by the brook, but consisting chiefly of greenish gray sandstone,	42	0
Greenish gray sandstone, with bands of greenish arenaceous shale and red arenaceous shale,	10	0
Red argillaceous shale,	1	0
Greenish gray sandstone,	7	0
Red arenaceous shale,	4	0

*In this reprint, place names are printed in a more prominent type than in the original, in order to facilitate reference to the section.—*Editor.*

	Ft.	In.
Red argillaceous shale,	6	0
Red argillo-arenaceous shale,	17	0
Greenish gray sandstone,	2	0
Red argillo-arenaceous shale,	2	0
Greenish gray sandstone,	1	0
Red argillo-arenaceous shale,	18	0
Greenish gray sandstone,	7	0
Red argillo-arenaceous shale,	6	0
Greenish gray sandstone,	1	0
Red argillo-arenaceous shale, with green bands,	8	0
Greenish gray sandstone of a coarse grit,	19	0
Measures concealed. This is where the *North Branch of the Two Rivers* occurs,	16	0
Greenish gray sandstone of a coarse grit, with some beds of conglomerate, having red and white quartz pebbles, the largest of which would weigh about two ounces,	20	0
Red argillaceous shale,	12	0
Greenish gray sandstone of a coarse grit, some parts of which are fit for large grindstones, commonly called *water-stones* by the quarrymen,	76	0
Greenish gray sandstone, with divisional layers of arenaceous shale,	4	0
Red argillaceous shale,	19	0
Red argillaceous shale, with greenish gray arenaceous shale at the top,	19	0
Greenish gray sandstone,	1	0
Red argillaceous shale,	4	0
Greenish gray sandstone,	2	0
Red argillaceous shale,	6	0
Greenish gray sandstone,	5	0
Red argillaceous shale and green arenaceous shale, with a few bands of greenish gray sandstone. This deposit is chiefly red shale,	32	0
Greenish gray sandstone,	24	0

	Ft.	In.
Red argillaceous shale with green bands,	10	0
Greenish gray sandstone in four beds, separated by bands of red argillaceous shale of one to two feet thick,	27	0
Red argillaceous shale,	11	0
Greenish gray sandstone, with one foot of shale towards the bottom,	5	0
Red argillaceous shale,	8	0
Greenish gray sandstone in three small beds separated by red shale; occasionally the sandstone occupies the whole of the thickness	5	0
Red argillo-arenaceous shale, with green bands,	27	0
	1617	0

Recapitulation.

Greenish gray or drab coloured sandstones, with conglomerate beds and large carbonized drift plants,	947	0
Dark red or chocolate coloured argillaceous and argillo-arenaceous shales,	670	0
	1617	0

2.

Gray arenaceous shale,	5	0
Greenish gray sandstone. This is an unequal band, and there are doubtful indications of the leaves of *stigmariæ ficoides* at the top,	8	0
Reddish and greenish gray argillaceous shale, with some bands of arenaceous shale,	28	0
Greenish gray sandstone of a coarse grit fit for water-stones,	7	0
Red argillaceous shale, with some bands of arenaceous shale.	5	0
Measures concealed,	26	0
Greenish gray sandstone,	3	0

	Ft.	In.
Measures only partially seen, and containing some arenaceous shale,	13	0
Reddish yellow sandstone,	2	0
Measures concealed, but shown by the shape of the surface to be soft,	4	0
Reddish yellow sandstone of a coarse grit, fit for water-stones,	15	0
Red argillaceous shale,	7	0
Reddish yellow sandstone of a coarse grit, fit for water-stones,	12	0
Red argillaceous shale, with greenish gray arenaceous shale in three beds,	47	0
Greenish gray sandstones,	7	0
Red argillaceous shale,	3	0
Greenish gray sandstone,	14	0
Dark green shale,	1	0
Gray sandstone,	25	0
Red argillo-arenaceous shale, with greenish gray arenaceous shale, and some few layers of sandstone,	42	0
Greenish gray sandstone,	9	0
Greenish gray arenaceous shale and sandstone, with red and gray argillaceous shale,	24	0
Red argillaceous shale, with green arenaceous shale,	26	0
Gray sandstone fit for grindstones,	21	0
Red and green shale,	11	0
Greenish gray sandstone,	4	0
Red argillaceous and arenaceous shale,	5	0
Greenish gray sandstone of various qualities, chiefly of coarse grit, fit for large grindstones or water-stones; much of it, however, is fine enough for small stones; both are made from the Reef,	97	0
Red argillaceous and greenish gray arenaceous shale,	13	0
Gray sandstone fit for grindstones, the bottom part of a coarse grit. This constitutes *Ragged Reef Point*,	35	0
Red argillaceous shale,	15	0

	Ft.	In.
Greenish gray sandstone, fit for grindstones,	10	0
Red argillaceous shale, with one foot of greenish gray sandstone,	9	0
Greenish gray sandstone fit for grindstones; the top of the bed is uneven,	20	0
Red argillaceous shale, gray arenaceous shale, and a few bands of greenish gray sandstone,	15	0
Red argillaceous shale,	4	0
Greenish gray sandstone,	2	0
Red argillaceous shale, with green bands,	13	0
Greenish gray shaly sandstone, or perhaps arenaceous shale,	7	0
Greenish gray sandstone fit for grindstones, with a few *calamites* nearly at right angles to the plane of the beds, as if in situ, but forced over at the top,	36	0
	650	0

Recapitulation.

Drab coloured sandstones without conglomerate beds,	219	0		
Gray sandstones,	81	0		
Reddish yellow sandstones,	28	0		
			328	0
Red, green and greenish gray argillaceous and arenaceous shales,			322	0
			650	0

(Indications of *stigmariæ ficoides* exist near the top, and of upright *calamities* at the bottom.)

3.

	F.	In.
Black carbonaceous shale	2	0
Greenish gray sandstone, with *stigmariæ ficoides*, (this would be called *understone* by the Welsh miners)	3	0
Gray argillaceous shale, with impressions of *ferns* and other plants, (*topstone*)	2	0
1. COAL of inferior quality—a regular seam	0	1
Greenish gray argillaceous shale, with *stigmariæ ficoides* (*understone*)	1	0
Greenish gray argillaceous shale, with *stigmariæ ficoides* and *ironstone* balls (*understone*)	1	0
Greenish gray sandstone	1	0
Red or chocolate coloured shale	6	0
Greenish gray sandstone, fit for grindstones, with a bed of red shale in the middle	23	0
Red shale, with a layer of sandstone	12	0
Red shale, in three beds	5	0
Greenish gray sandstone, in four beds	6	0
Red argillaceous shale	7	0
Gray sandstone, in small layers	7	0
Reddish gray sandstone	3	0
Greenish gray sandstone, in small layers	7	0
Reddish and green sandstone	13	0
Reddish and green shale	1	0
Reddish sandstone—soft	1	0
Red argillo-arenaceous shale, with balls of *ironstone*	3	0
Red and green sandstone	12	0
Measures concealed, but supposed to be soft	52	0
Red and green shale, with balls of *ironstone*	7	0
Gray sandstone and shale	3	0
Greenish grav sandstone	8	0
Greenish gray sandstone and red shale	5	0
Greenish gray or drab coloured sandstone, fit for grindstones	50	0

			Ft.	In.
Red shale			8	0
Greenish gray or drab sandstone, fit for grindstones; the top is uneven, and the whole is rather of a coarse grit. This constitutes *South Ragged Reef*			20	0
Red shale			7	0
Reddish gray sandstone			9	0
Red argillaceous shale			3	6
2. Coal	0	1		
Dark gray carbonaceous shale	0	4		
Coal	0	1		
			0	6
Red shale; the upper part is of a tough quality, and has *stigmariæ ficoides* in it (*understone*)			13	0
Greenish gray or drab coloured sandstone, occasionally separated into two beds. This sandstone appears to thin out within the distance of 100 yards on the strike			33	0
Red shale			2	9
Greenish gray or drab coloured sandstone			5	0
3. Coal			0	1
Greenish gray sandstone and reddish shale, with *stigmariæ ficoides* (*understone*)			5	0
Reddish green argillaceous shale			1	0
4. Coal			0	2
Reddish and green argillaceous and arenaceous shale, the green colour prevailing, with *stigmariæ ficoides* (*understone*)			5	0
Reddish and green argillaceous and arenaceous shale, the red prevailing			6	0
Red shale, separated by thin bands of sandstone; the top is of the tough crumbly quality of underclay, but no *stigmariæ* are visible			20	0
Gray sandstone and shale, the sandstone of soft quality			11	0
Dark red shale			0	6

	Ft.	In
Tough arenaceous shale, with *stigmariæ ficoides* in the upper part in two layers, a hard and a soft one (*understone*)	12	0
Red and green crumbly tough shale of the quality of underclay, but no *stigmariæ* visible	11	0
Greenish gray sandstone, in four thinly laminated divisions, separated by red and green shale	30	0
Gray sandstone and red shale in thin beds	10	0
Red and green shale	9	0
Greenish gray sandstone, with red and green shale	4	0
Greenish gray sandstone, in regular beds of three feet and upwards	17	0
Red shale, varying from two to seven feet thick	5	0
Greenish gray sandstone	4	0
Greenish shale	1	0
Gray sandstone and shale	4	0
Dark greenish red shale	2	0
Greenish gray sandstone	1	0
Dark green and red shale	1	0
Greenish gray or drab coloured sandstone, fit for grindstones, forming a reef	25	0
Reddish shale	8	0
Greenish gray sandstone, in three beds, and gray shale in beds of one foot each	20	0
Gray shale, with two beds of greenish gray sandstone of one foot each	20	0
(Into the above penetrate two upright stems (*calamites*), two inches in diameter; and replaced by sandstone with a coating of coal; they start from the top of the succeeding bed.)		
Dark gray argillaceous shale	8	0
5. Coal	0	2
Gray argillo-arenaceous shale (*fire clay?*) with *stigmariæ ficoides* (*understone*)	1	6

			Ft.	In.
Gray argillo-arenaceous shale			10	0
Gray sandstone			1	0
Gray arenaceous shale, in two equal beds			7	0
6. Coal			0	3
Gray argillo-arenaceous shale, with *stigmariæ ficoides*			2	0
Greenish gray sandstone			2	0
Gray argillaceous shale			1	0
Gray argillaceous sandstone, with *stigmariæ ficoides* (*understone*)			2	0
Gray argillaceous shale			3	0
Reddish gray sandstone			1	0
Gray argillaceous shale			1	6
(In this shale, and running into the sandstone above, is visible a *calamite* at an angle of 45° to the plane of the deposit. It appears to start from the coal below.)				
7. Coal	0	1		
Gray argillaceous shale, with *stigmariæ ficoides* (*underclay*)	1	6		
Coal	0	2		
Gray argillaceous shale, with *stigmariæ* (*underclay*)	0	4		
Coal	0	1		
			2	2
Gray argillaceous shale, with *stigmariæ* (*underclay*)			2	0
Greenish gray crumbly sandstone, with *stigmariæ* at the top			8	0
Red shale			12	0
Greenish gray sandstone			3	0
Red shale, with some few beds of sandstone			20	0
Red shale and reddish gray sandstone, in beds of one to three feet			12	0
Reddish gray sandstone, in thin layers, alternating with red shale			12	0
Red and green arenaceous shale			4	0

	Ft.	In.
8. Coal	0	1
Gray argillaceous shale, with *stigmariæ ficoides* (*understone*)	3	0
Gray argillaceous sandstone, with *stigmariæ ficoides* (*understone*)	2	0
Hard argillo-arenaceous shale, with *stigmariæ ficoides* (*understone*)	5	0
Red shale	20	0
Greenish gray or drab coloured sandstone, forming a reef	20	0
Red shale	23	0
Reddish gray sandstone	5	0
Red shale and greenish gray sandstone; not much sandstone	30	0
Red argillaceous shale and greenish gray sandstone, more sandstone than before	30	0
Red argillaceous shale	1	0
Reddish gray sandstone	1	0
Red argillaceous shale	3	0
Reddish gray sandstone	2	0
Red argillaceous shale	12	0
Greenish gray sandstone	15	0
Red argillaceous shale	20	0
Reddish sandstone	2	0
Red and green shale	8	0
Reddish gray sandstone	6	0
Red shale	2	0
Greenish gray sandstone	2	0
Red argillaceous shale	3	0
Greenish gray sandstone	3	0
Greenish gray sandstone, fit for grindstones, which are now quarried from it. This constitutes *North Ragged Reef*	12	0

	Ft.	In.
Reddish gray sandstone, in beds of one to three or four feet, separated by beds of reddish shale of one to two feet	60	0
Red shale	4	0
Reddish sandstone	2	0
Red argillaceous shale	20	0
Greenish gray sandstone, in beds of two to three feet, with beds of red shale of one to two feet	30	0
Red argillaceous shale	6	0
Reddish sandstone, separated at the top into moderate layers by red shale	49	0
Red shale	2	0
Reddish sandstone	1	0
Red argillaceous shale	35	0
Gray sandstone and red argillaceous shale, in alternating beds; the sandstone has a reddish tinge towards the top	30	0
Gray sandstone	1	0
Reddish argillaceous shale	5	0
Gray sandstone	1	0
Reddish argillaceous shale	5	0
Gray sandstone	2	0
Reddish and gray shale	1	0
Gray sandstone	2	0
Reddish argillaceous shale, with *ironstone* balls	3	0
Gray sandstone	1	0
Green and red argillaceous shale	2	0
Hard argillo-arenaceous shale	1	0
Gray argillaceous shale, with *ironstone* balls. This bed has something the appearance of underclay, but the *stigmariæ* are not distinct	7	0
9. Coal	0	3
Gray arenaceous shale, with *ironstone* balls, and *stigmariæ ficoides* (*underclay*)	5	0

			Ft.	In.
Reddish gray argillaceous shale			1	0
10. Coal and *carbonaceous shale*	0	8		
Gray argillaceous shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*)	2	0		
Coal	0	2		
			2	10
Gray argillaceous sandstone, with *stigmariæ ficoides* (*underclay*)			2	0
Reddish and green argillo-arenaceous shale, *ironstone* balls. This has much the character of underclay, but the *stigmariæ* are not well marked			12	0
Gray sandstone			1	0
Gray argillaceous shale, with *ironstone* balls			3	0
Greenish gray sandstone			4	0
Gray argillaceous shale			1	0
(From the succeding layer of coal there springs up an erect *sigillaria*. It is 1 ft. 6 in. in diameter, and penetrates the shale and sandstone above it, five feet of the plant being visible.)				
11. Coal			0	3
Gray sandstone, with *stigmariæ ficoides* (*underclay*)			2	0
Gray argillaceous shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*)			5	0
12. *Black carbonaceous shale*	0	9		
Coal	0	2		
			0	11
Gray argillaceous shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*)			1	6
Greenish gray sandstone			1	6
Gray argillaceous shale			9	0
13. Coal			0	7
Gray argillaceous shale, with *ironstone* balls and *stigmaria ficoides* (*underclay*)			2	0
Gray argillaceous shale			5	0

			Ft.	In.
14. Coal	0	4		
Gray argillo-arenaceous shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*)	1	6		
Coal	0	2		
			2	0
Gray argillaceous shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*)			7	0
Gray argillo-arenaceous shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*)			1	0
Greenish gray sandstone			1	0
Greenish gray sandstone and red and gray argillo-arenaceous shale. The sandstone is not in thick beds. *Ironstone* balls and *stigmariæ ficoides* are found through the whole deposit			40	0
Greenish gray argillaceous shale			3	0
15. *Carbonaceous shale*	0	2		
Gray argillaceous shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*)	1	0		
Coal	0	1		
			1	3
Gray argillaceous shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*)			3	0
Greenish gray sandstone, with three bands of red and gray shale, loaded with *ironstone* balls			12	0
Gray argillaceous shale			1	0
16. Coal and *carbonaceous shale*			0	2
Red argillaceous shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*)			7	0
Greenish gray sandstone			10	0
Red and green shale			2	0
Rough gray argillaceous sandstone			2	0
Red and green shale			2	0
Rough greenish gray argillaceous sandstone			1	6
Red and green shale			2	0

					Ft.	In.
Greenish gray sandstone					5	0
Red and green argillaceous shale					7	0
17. Coal			0	1		
Gray argillo-arenaceous shale, with *stigmariæ ficoides* (*underclay*)			4	0		
Coal	0	4				
Carbonaceous shale	0	4				
Coal	0	1	0	9		
					4	10
Gray sandstone, with 3 inches of soft gray argillaceous shale at the top, and penetrated by *stigmariæ ficoides* (*understone*)					1	3
Gray argillo-arenaceous shale					1	0
18. Coal					0	3
Gray arenaceous shale, with *stigmariæ* (*underclay*)					2	0
Gray arenaceous sandstone, with *stigmariæ* (*underclay*)					2	0
Red and green shale					3	0
Greenish gray sandstone, in several layers					6	0
Red and green argillaceous shale					7	0
Gray sandstone, with *stigmariæ* (*understone*)					2	0
Red and green argillo-arenaceous shale					4	0
19. Coal					0	1
Red argillaceous shale, with *stigmariæ* (*underclay*)					4	0
Greenish gray sandstone and red shale alternating, the sandstone in 7 beds of 2 to 8 feet, the shale in 5 beds of ½ to 3 feet					60	0
Red and gray argillaceous shale					13	0
Greenish gray sandstone					2	0
Greenish gray shale and sandstone					2	0
Greenish gray sandstone					2	0
Greenish gray shale					2	0
Greenish gray sandstone					2	0
Measures concealed					41	0

	Ft.	In.
Greenish gray sandstone	1	0
Measures concealed	1	0
Greenish gray sandstone	2	0
Measures concealed. Here occurs DENNIS RIVER*	9	0
Greenish gray sandstone	3	0
Measures concealed, but supposed to be shale	4	0
Greenish gray or drab coloured sandstone, fit for grindstones. There are quarries in it on the SOUTH REEF, DENNIS RIVER	25	0
Red argillo-arenaceous shale	9	0
Greenish gray or drab coloured sandstone, fit for grindstones. Some are quarried from the bed on the NORTH REEF, DENNIS RIVER	18	0
Measures concealed, but supposed to be argillaceous shale	4	0
Greenish gray or drab sandstone, almost fit for grindstones	14	0
Greenish gray argillaceous shale	1	0
Greenish gray sandstone	2	0
Dark gray argillaceous shale	1	0
20. COAL	0	1
Red and green shale, with *stigmariæ ficoïdes* (*underclay*)	1	0
Greenish gray sandstone	1	0
Red and greenish gray argillaceous shale, with *ironstone* balls	6	0
Carbonaceous shale	0	3
Gray crumbly argillo-arenaceous shale, with *stigmariæ ficoïdes* (*underclay*)	2	0
Greenish gray sandstone	1	0
Reddish shale, with *ironstone* balls	1	0
Greenish gray sandstone	4	0
Red argillaceous shale, with *ironstone* balls	23	0

* Now McCarren's Brook.—*Editor.*

	Ft.	In
Greenish gray sandstone, with red and green shale studded with *ironstone* balls	4	0
Red and greenish gray argillaceous and arenaceous shale, in beds of five feet, with greenish gray sandstone, in beds of one to three feet	30	0
Reddish and greenish gray argillaceous shale, with *ironstone* balls	15	0
Greenish gray sandstone, soft, with bands of red arenaceous shale	21	0
Red argillaceous shale	2	0
21. Coal	0	2
Greenish gray argillo-arenaceous shale, with *stigmariæ* (*underclay*)	2	0
Measures concealed	35	0
Greenish gray sandstone of good grit	4	0
Measures concealed	7	0
Greenish gray sandstone of good grit	1	0
Measures concealed	15	0
Greenish gray arenaceous shale	1	0
Measures concealed	43	0
Measures concealed, but probably sandstone	7	0
Measures not perfectly seen, but consisting in part of greenish gray sandstone	13	0
Greenish gray sandstone, with impressions and casts of *calamites*. This layer is almost fit for grindstones, but not sufficiently regular to be worked profitably	13	0
Measures not well seen, supposed to be red shale	22	0
Red and greenish gray argillo-arenaceous shale, the red prevailing, with some bands of greenish gray sandstone of six to twelve inches	40	0
Reddish and greenish gray sandstone, in beds of three to ten feet, separated by layers of red and greenish gray arenaceous shale of one to two feet. This forms Dennis River Point	31	0

	Ft.	In.
Greenish gray sandstone, soft and ragged, in aggregated beds of one to ten feet; the aggregations separated by beds of dark red and green argillaceous and arenaceous shale of one to two feet, having *ironstone* balls; impressions of plants, among them *sigillariæ* and *calamites,* prevail in the sandstone	60	0
Dark red and green argillaceous shale, with six beds of red and greenish gray sandstone; the shale is loaded with *ironstone* balls	40	0
22. Coal *and carbonaceous shale*	0	2
Gray argillo-arenaceous shale of a tough quality, with *stigmariæ* (*underclay*)	4	0
Dark red and green argillaceous shale, with a band of sandstone	16	0
Gray argillaceous and arenaceous shale, with *ironstone* nodules and some thin beds of sandstone	10	0
Gray sandstone, with *stigmariæ* (*understone*)	2	0
Dark gray shale, with *ironstone* nodules	22	0
Gray sandstone	1	0
Gray argillaceous shale	2	0
Gray sandstone	1	0
Greenish gray arenaceous shale	6	0
Gray sandstone, in layers of four inches each	4	0
	2,134	1

RECAPITULATION.

Coal, in 22 seams	5	5		
Carbonaceous shale associated with the coal seams, and in one instance without coal	3	10		
			9	3

Underclay or understone, being beds of various material, immediately subjacent to the seams of Coal and Carbonaceous shale, and universally penetrated by the branches and radiating leaves of the stigmariæ

					Ft.	In
ficoides. Every one of the Coal and Carbonaceous seams rests upon a bed of this description, and in two cases stigmariæ beds exist without superincumbent coal. The material constituting the stigmariæ beds is as follows:						
Sandstone—Gray	23	3				
Drab	43	0				
			66	3		
Argillaceous and arenaceous shale, having often the character of fireclay—						
Gray	58	4				
Greenish gray	7	0				
Red and occasionally green	42	0				
			107	4		
					173	7
Sandstone—Gray	82	0				
Greenish gray, chiefly fit for grindstones	657	0				
Reddish, of various shades	204	0				
					943	0
Shale—Gray-Argillaceous	92	6				
Arenaceous	44	0				
			136	6		
Red and green—						
Argillaceous	564	0				
Arenaceous	104	9				
			668	9		
					805	3
Measures concealed, supposed to be chiefly shale					203	0
					2,134	1

(Among the organic remains visible are one oblique and two upright calamites, and one upright sigillaria. One topstone bed of shale contains impressions of ferns.)

4

			Ft.	In.
1. *Bituminous limestone,* with *shells* and *fish scales*	4	0		
Coal	1	0		
			5	0
Greenish gray argillo-arenaceous shale, with *stigmariæ ficoides* (*underclay*)			4	0
Gray sandstone, in courses of six and nine inches, with *ironstone* balls and *stigmariæ ficoides* (*understone*)			2	6
Gray argillaceous shale			1	0
Gray sandstone			6	0
Gray argillaceous shale			1	0
Gray sandstone of a rough texture			1	0
(From the succeeding bed springs an upright stem (*sigillaria*). It widens towards the bottom, and penetrates into the sandstone above.)				
Gray argillaceous shale, with *ironstone* balls			6	0
Gray sandstone and arenaceous shale			5	0
Gray arenaceous shale			2	0
Hard gray arenaceous shale, with *stigmariæ ficoides* (*underclay*)			1	6
Gray argillaceous shale			20	0
2. Coal and *Carbonaceous shale*			1	0
Soft gray argillo-arenaceous shale, with *stigmariæ ficoides* (*underclay*)			1	0
Hard gray arenaceous shale, with *stigmariæ ficoides* (*underclay*)			2	0
Gray argillaceous shale			1	0
3. Coal and *Carbonaceous shale*			0	3
Hard argillo-arenaceous shale, with *stigmariæ ficoides* (*underclay*)			2	0
Gray argillaceous shale			4	0

			Ft.	In.
4. Coal	0 9			
Carbonaceous shale	0 6			
Coal	0 1			
Carbonaceous shale	0 4			
Coal	0 1			
Carbonaceous shale	0 8			
Coal	0 2			
		2 7		
Gray argillaceous shale, no *stigmariæ* visible, but across the bed appear two parallel regular cracks, about ¼ of an inch wide each, and about 18 inches apart, filled with coal, the fibre of which is at right angles to the cracks. This may be the section of an upright stem		1 7		
Coal		0 8		
			4	10
Hard gray argillo-arenaceous shale with *stigmariæ ficoides* (*underclay*)			4	0
Greenish argillaceous shale, with *ironstone* balls			12	0
Gray sandstone in several layers			1	0
Red and green argillaceous shale, with *ironstone* balls			20	0
Gray sandstone and green shale in alternating layers			24	0
Red or chocolate coloured argillaceous shale			3	6
(From the succeeding bed rises an upright *sigillaria* one foot in diameter; two feet of it are seen penetrating the bed above.)				
Gray argillaceous shale			1	6
Gray sandstone in thin beds			8	0
Gray argillaceous shale			8	0
5. *Bituminous limestone,* with *shells*		2 0		
Coal		0 0½		
Gray argillo-arenaceous shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*)		0 6		
Carbonaceous shale		0 0½		

			Ft.	In.
Gray argillo-arenaceous shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*) ..	1	6		
Carbonaceous shale	0	1		
Gray argillo-arenaceous shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*)	2	6		
COAL	0	6		
			7	2
Gray argillo-arenaceous shale, with *stigmariæ* leaves (*underclay*)			2	0
Gray arenaceous shale, with *stigmariæ* leaves (*underclay*)			6	0
Gray arenaceous shale and rough argillaceous sandstone			9	0
Greenish gray arenaceous shale			5	0
Gray sandstone			3	0
Red and green argillaceous shale, with *ironstone* balls..			7	0
Gray rough sandstone			17	0
Red argillaceous shale, with *ironstone* balls; thin beds of arenaceous shale and sandstone in the middle.....			10	0
Red sandstone			1	0
Red argillaceous shale, with *ironstone* balls.....			1	0
Red sandstone			1	0
Red and green shale, with *ironstone* balls and some arenaceous beds			18	0
Gray sandstone			2	0
Gray arenaceous shale			4	0
Green and red shale			3	0
Gray sandstone			3	0
(From the upper part of the succeeding bed there arises an upright *sigillaria.*)				
Gray argillaceous shale			17	0
Gray argillaceous shale, with a layer of sandstone....			3	0
Gray sandstone			0	6
Greenish gray argillaceous shale			17	0
Gray sandstone			1	0

			Ft.	In.
Gray argillaceous shale, with *ironstone* balls and a few bands of arenaceous shale			17	0
6. *Carbonaceous shale*	1	0		
Bituminous limestone, with *shells*	0	10		
Coal	0	4		
			2	2
Gray argillo-arenaceous shale, with *stigmariæ* (*underclay*)			2	0
Rough gray argillaceous sandstone, with the branches and leaves of *stigmariæ ficoides* (*underclay*)			7	0
(An upright stem penetrating the above bed springs from the one below.)				
Gray argillaceous shale, with *ironstone* nodules			1	0
Gray sandstone			1	0
Gray argillaceous shale, with *ironstone* nodules			2	0
Gray arenaceous shale			10	0
Gray sandstone			3	0
Gray argillaceous shale			3	0
Gray sandstone			2	0
7. Coal	0	10		
Carbonaceous shale	0	2		
Coal	0	10		
Carbonaceous shale	0	2		
Coal	2	0		
Coal and *Carbonaceous shale*	0	6		
			*4	6
Gray argillaceous shale, with *stigmariæ* (*underclay*)			6	0
Gray argillaceous shale, loaded with a multitude of *ironstone* balls			10	0
Gray argillaceous shale in beds of 1 to 3 feet, with sandstone and arenaceous shale in beds of 1 foot; *ironstone* nodules are very numerous in the whole			20	0
Gray argillaceous shale, with *ironstone* nodules			9	0

* Joggins "Main Seam."—*Editor.*

			Ft.	In.
Gray sandstone			3	0
Gray argillaceous shale, with *ironstone nodules*			10	0
Gray sandstone			1	0
Gray argillaceous shale			2	0
(From the succeeding bed springs an upright *sigillaria* of 1 foot in diameter; the lower part commences to spread.)				
Gray argillaceous shale, with *ironstone* balls and some sandstone			2	0
Gray argillaceous shale, with *ironstone* balls			5	0
8. Coal	0	2		
Gray argillaceous shale	0	4		
Coal	0	3		
Carbonaceous shale and *Coal*	1	3		
Coal	0	1		
Gray argillaceous shale, with *ironstone* balls and *stigmariæ* (*underclay*)	4	0		
Coal	1	0		
			7	1
Gray argillo-arenaceous shale, with *ironstone* balls in abundance and *stigmariæ ficoides* (*underclay*)			6	0
Gray rough crumbly sandstone			9	0
Dark gray shale, with *ironstone* balls			1	0
Gray arenaceous shale			3	0
Gray sandstone			3	0
Red argillaceous shale (chocolate coloured)			10	0
Gray sandstone			1	0
Red argillaceous shale as before			10	0
Gray rough sandstone			3	0
Red argillaceous shale, as before, in beds of 1 to 4 feet, with *ironstone* balls, and separated by beds of gray sandstone of 1 foot			20	0
Gray rough sandstone, in beds of 1 to 2 feet, alternating with beds of red or chocolate coloured shale of 1 foot			15	0

		Ft.	In.
Gray soft sandstone		1	0
Red shale		1	0
Gray rough sandstone		1	6
Gray arenaceous shale, with *stigmariæ* (*underclay*)		2	0
Gray crumbly arenaceous shale, with *ironstone* balls		6	0
Gray arenaceous shale		2	0
Gray crumbly sandstone		1	0
Gray argillaceous shale		0	10
Gray sandstone, with *stigmariæ* and upright *calamites* (*understone*)		1	6
Gray argillaceous shale, with *ironstone* balls		1	10
Gray rough crumbly sandstone		0	10
Gray argillaceous shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*)		10	0
9. Coal and *Carbonaceous shale*		1	3
Greenish gray argillaceous shale, with *stigmariæ ficoides* (*underclay*)		12	0
Gray rough sandstone, with *stigmariæ* (*underclay*)		3	0
Red argillaceous shale, with *ironstone* balls		2	0
Reddish sandstone		2	0
Red or chocolate coloured argillaceous shale, with *ironstone* balls		5	0
Gray argillo-arenaceous shale, with *stigmariæ* (*underclay*)		1	6
Red argillaceous shale and gray arenaceous shale		3	0
10. Coal and *Carbonaceous shale*	0 2		
Carbonaceous shale	0 6		
Coal	0 4		
		1	0
Argillo-arenaceous shale, with *stigmariæ ficoides* (*underclay*)		1	0
Measures concealed, probably underclay. Here occurs Bell's Brook		5	0
Red and green shale as before		9	0

	Ft.	In.
Gray sandstone	1	0
Red argillaceous shale and gray arenaceous shale	3	0
Red and green shale, as before	3	0
Gray arenaceous shale	2	0
Red and green shale, as before	7	0
Gray sandstone	3	0
Red and green shale, as before	3	0
Gray sandstone	1	0
Red or chocolate coloured argillaceous shale	2	0
Gray sandstone	1	0
Red and green shale, as before	5	0
Red or chocolate coloured argillaceous shale	1	0
Gray arenaceous shale	14	0
Gray sandstone, rough and uneven	12	0
(From the top of the succeeding bed spring several upright *calamites,* 3 of them in the distance of 2 feet, and 8 more—the whole 11, in the distance of 20 feet.)		
Gray crumbly argillaceous shale, like *underclay* but no *stigmariæ* visible	2	0
Greenish sandstone	0	6
Red or chocolate coloured argillaceous shale	3	0
11. Coal and *carbonaceous shale*	0	8
Gray argillaceous shale, with *stigmariæ ficoides* (*underclay*)	7	0
Gray rough sandstone and arenaceous shale, in alternate layers	12	0
Greenish gray sandstone	1	0
Gray argillaceous shale	1	0
Gray arenaceous shale	6	0
Strong gray arenaceous shale and rough sandstone	4	0
Gray argillaceous shale	6	0
12. Coal and *carbonaceous shale*	1	0
Gray argillaceous shale, witht *stigmariæ ficoides* and *ironstone* balls (*underclay*)	2	0

	Ft.	In.
Gray argillaceous sandstone, with *stigmariæ* (*understone*)	3	0
Dark gray argillaceous shale	8	0
13. Coal and *carbonaceous shale*	0	6
Gray argillaceous shale, witth *stigmariæ* and *ironstone* balls (*underclay*)	2	0
Gray argillaceous sandstone, with *stigmariæ* (*underclay*)	2	0
Red and green shale, as before	7	0
Gray argillaceous sandstone, with *stigmariæ* (*understone*)	1	0
Red and green argillaceous shale, with *stigmariæ ficoides* (*underclay*)	7	0
Gray sandstone and shale	1	0
Red or chocolate coloured and green argillaceous shale	3	0
Gray soft shaly sandstone	1	0
Measures concealed, but supposed to be soft	7	0
Greenish gray soft sandstone	4	0
Measures concealed, but supposed to be soft	2	0
Gray sandstone	4	0
Measures concealed, but supposed to be soft	3	0
Reddish green sandstone	3	0
Gray sandstone and shale	1	0
Red argillaceous shale	1	0
Green arenaceous shale	1	0
Gray sandstone	1	0
Gray argillaceous shale	6	0
Green and red shale	3	0
Gray sandstone, with a bed of argillaceous shale	2	0
Greenish gray argillaceous shale, with *ironstone* balls	17	0
Reddish green sandstone	1	0
(In this are upright *calamites*—3 of them in the space of 1 foot.)		
Gray argillaceous shale	2	0

					Ft.	In.
Gray rough sandstone					1	0
Gray argillaceous shale					2	0
Greenish gray or drab coloured sandstone; grindstones have been quarried from this, but they are too hard for the best quality. This constitutes COAL MINE POINT					30	0
Gray argillaceous shale, with balls of *ironstone*					3	0
Greenish gray sandstone					1	0
Gray argillaceous shale, with balls of *ironstone*					8	0
14. COAL	0	3				
Carbonaceous shale	0	2				
COAL	0	3				
			0	8		
Gray argillo-arenaceous shale, with *stigmariæ ficoides* (*underclay*)			6	0		
Carbonaceous shale	0	4				
Gray argillo-arenaceous shale, with *stigmariæ* (*underclay*)	1	0				
Carbonaceous shale	0	8				
COAL	0	2				
			2	2	8	10
Gray argillo-arenaceous shale, with *stigmariæ ficoides* (*underclay*)					2	6
Greenish gray sandstone					2	0
Gray argillo-arenaceous shale, with bands of sandstone (From the succeeding bed there spring up erect *calamites*, penetrating the above bed 2 feet; 2 of them are within 2 feet of one another, and there are 7 more in the space of 8 feet.)					2	0
15. *Carbonaceous shale*			1	0		
COAL			0	4		
					1	4
Gray crumbly sandstone and shale, with *stigmariæ* (*underclay*)					2	0

	Ft.	In.
Gray crumbly sandstone, very like *underclay*, but no *stigmariæ* visible	12	0
Gray argillo-arenaceous shale, with *stigmariæ* (*underclay*)	5	0
Greenish gray sandstone	2	0
Dark red shale, with *ironstone* balls	4	0
Greenish gray sandstone	5	0
Dark red shale	1	0
Greenish gray sandstone	3	0
Dark red or chocolate coloured argillaceous shale	6	0
Greenish gray sandstone, and red or chocolate coloured shale of an argillo-arenaceous character	12	0
Gray argillo-arenaceous shale, with *stigmariæ* and some beds of sandstone with *stigmariæ* leaves crossing them(*underclay*)	12	0
Gray crumbly sandstone, with beds of argillaceous shale, and *ironstone* balls, very like *underclay*, but no *stigmariæ* visible	25	0
16. Coal and *carbonaceous shale*	0	6
Gray argillo-arenaceous shale, witth *stigmariæ* (*underclay*)	3	0
Greenish gray sandstone	10	0
Gray argillaceous shale	1	0
Gray soft sandstone	1	0
Gray argillaceous shale	0	6
Gray argillo-arenaceous shale, with *stigmariæ* (*underclay*)	4	0
Gray argillaceous shale	6	0
17. Coal and *carbonaceous shale*	0	3
Gray argillo-arenaceous shale, witht *stigmariæ* (*underclay*)	2	0
Gray argillaceous sandstone	18	0
Gray argillaceous shale	11	0
18. Coal	0	8

			Ft.	In.
Gray argillo-arenaceous shale, with *stigmariæ* (*underclay*)			1	6
Gray soft flaggy sandstone			3	6
Gray argillaceous shale, with *stigmariæ*(*underclay*)			3	0
Gray arenaceous shale, with *stigmariæ* (*underclay*)			3	0
Gray argillo-arenaceous shale, witth *stigmariæ* (*underclay*)			4	0
Gray soft flaggy sandstone, with *stigmariæ* at the top (*understone*)			3	0
Fine gray argillo-arenaceous shale			4	0
Greenish gray sandstone			1	0
Dark gray argillaceous shale			6	0
19. *Carbonaceous shale*	4	0		
Bituminous limestone, with *shells* and *fish scales*	2	6		
Coal	0	1		
			6	7
Gray argillo-arenaceous shale, with *stigmariæ* (*underclay*)			2	6
Greenish gray sandstone			6	0
Gray argillaceous shale			12	0
20. *Black bituminous shale*	1	0		
Black bituminous limestone, with *shells*	1	6		
Coal	0	6		
			3	0
Gray argillo-arenaceous shale, with *stigmariæ ficoides* (*underclay*)			2	6
Greenish gray sandstone			4	0
Gray argillaceous shale			1	6
(From the top of the succeeding bed springs an upright *sigillaria* 10 inches in diameter; 2 feet, 6 inches of it are visible.)				
21. Coal and *carbonaceous shale*	0	3		
Gray argillaceous shale, with *stigmariæ* (*underclay*)	1	6		

			Ft.	In
Gray argillaceous sandstone, with *stigmariæ* (*underclay*)	7	0		
Gray argillaceous shale	4	0		
Coal	0	8		
			13	5
Gray argillaceous shale, witth *stigmariæ* (*underclay*).			2	0
Gray argillaceous sandstone, with *stigmariæ* (*underclay*)			3	0
Gray argillaceous shale			9	0
Greenish gray crumbly sandstone			1	0
Gray argillaceous shale			5	0
22. Coal and *carbonaceous shale*			0	2
Gray argillaceous shale, with *stigmariæ* (*underclay*).			1	0
Greenish gray agillaceous sandstone, with *stigmariæ* (*underclay*)			2	0
Greenish gray sandstone			3	0
(From the succeeding bed springs an upright *sigillaria* 4 inches in diameter; of it 5 feet are seen. On the beach there was a transverse slice of a *sigillaria* 1 foot 6 inches in diameter, with fragments of plants on the divisional surfaces.)				
Argillaceous shale			2	0
23. Carbonaceous shale, with some layers of argillaceous shale	4	0		
Coal and *carbonaceous shale*	0	4		
Bituminous limestone, with minute *shells* and *stigmariæ ficoides*	0	4		
Coal and *carbonaceous shale*	0	4		
			5	8
Gray argillo-arenaceous shale, witht *stigmariæ* (*underclay*)			1	0
Gray crumbly argillo-arenaceous shale, very like *underclay* in quality, but no *stigmariæ* visible			5	0

	Ft.	In.
Gray argillo-arenaceous shale, with *stigmariæ* (*under-*		
Gray sandstone	3	0
Gray crumbly argillo-arenaceous shale, or sandstone, with *stigmariæ* (*underclay*)	6	0

(From the top of the succeeding bed springs an upright *sigillaria*. Its roots spread out into the shale. It is coated with coal, and the material of the interior cast is not of uniform quality, being partly sandstone and partly shale. The shale occupies a transverse portion about 6 inches thick, and is rather less than half way up the stem, of which about 6 feet are visible, running into the underclay above. From the root of the plant, as if it had wound round or been pushed aside by the root, proceeds a *stigmaria* branch. It runs horizontally a short distance, and the turns up vertically. The leaves proceeding from the vertical portion, are not at right angles to the branch, but in part at least assume a vertical direction, and run parallel with it; those emanating from the groved side (in ordinary cases the under part or belly of the branch) taking a downward, and those from the back an upward course. The leaves issuing from the sides may be at right angles to the branch, and run horizontally into the bed, but being thus concealed they could not be traced. At first sight the stigmariæ branch had much the appearance of being a continuation of the root of the sigillaria, but close inspection shewed that the two, although touching, were distinct. The former rested on the latter nearly one-eighth of a circle, but being then suddenly cut off, it may when entire have wound much farther round, and the carbonaceous envelopes of the two plants were clearly discernible. See fig. 5 [of the original cuts.])

Gray argillaceous shale	10	0

			Ft.	In.
24. *Bituminous limestone,* with *shells* and *cone in cone*	1	0		
Coal and *carbonaceous shale*	0	1		
			1	1
Gray argillo-arenaceous shale, with *stigmariæ ficoides* (*underclay*)			2	0
Gray argillaceous shale			3	0
25. Coal and *carbonaceous shale*			0	8
Gray argillaceous shale, with *stigmariæ* (*underclay*)			2	0
Greenish gray sandstone, with *stigmariæ* leaves (*underclay*)			6	0
Greenish gray sandstone			9	0
Greenish gray sandstone and shale			4	0
Gray argillaceous shale, with *ironstone* balls			2	0
Greenish gray sandstone, with some beds of arenaceous shale			20	0
Gray argillaceous shale			2	0
Greenish gray sandstone			35	0
Gray argillaceous shale			10	0
Gray sandstone			7	0
(From the succeeding bed springs an upright *sigillaria* 1 foot 6 inches in diameter; it penetrates through the sandstone.)				
Gray argillaceous shale			2	0
Greenish gray sandstone			10	0
Gray argillaceous shale			2	0
26. *Carbonaceous shale*			0	4
Gray argillaceous shale, with *stigmariæ* (*underclay*)			3	0
Gray crumbly sandstone, being probably argillaceous; it contains *stigmariæ* leaves (*underclay*)			8	0
Gray argillaceous shale			2	0
27. Coal			0	3
Gray argillo-arenaceous shale, with *stigmariæ* leaves (*underclay*)			5	0

					Ft.	In.
Greenish gray sandstone, with shale dividing the beds; in the lower part is an upright *calamite* which springs from the succeeding bed					4	0
Gray argillaceous and arenaceous shale, witht *ironstone* balls and a few beds of sandstone					14	0
Greenish gray sandstone in 3 beds, divided by argillo-arenaceous shale					12	0
Gray argillaceous shale					3	0
Gray argillaceous shale, with *ironstone* balls and one course of sandstone					13	0
Greenish gray sasdstone					4	0
Gray argillaceous shale, with *ironstone* nodules					3	0
28. *Bituminous limestone* and *carbonaceous shale* in alternate layers of 1 to 3 inches, with *plants, shells* and *fish scales*			6	0		
Coal and *carbonaceous shale*—not much coal	3	0				
Coal and *carbonaceous shale*—a good deal of coal	4	0				
			7	0		
Gray argillo-arenaceous shale, with *stigmariæ* (*underclay*)			4	0		
Carbonaceous shale	1	0				
Coal	0	6				
			1	6		
					18	6
Gray rough sandstone, with *stigmariæ* leaves (*underclay*)					3	0
Greenish gray argillaceous shale, with *ironstone* balls.					6	0
Gray sandstone					6	0
Greenish gray argillaceous shale with nodules of *ironstone* disseminated through it					7	0
Gray argillo-arenaceous shale, with *ironstone* balls and small seams of *coal*					7	0

			Ft.	In.
(From the succeeding bed rises an upright *sigillaria*; the roots spread on the top of it; the diameter of the plant is a foot; only 1 foot of the length is visible.)				
29. Coal and *carbonaceous shale*; the coal being a small seam on the top of the carbonaceous shale			2	0
Gray argillo-arenaceous shale, with *stigmariæ* and *ironstone* balls disseminated through it (*underclay*)			2	0
Coal	1	8		
Carbonaceous shale	0	3		
Coal	0	11		
Carbonaceous shale	0	4		
Coal	0	10		
			4	0
Gray argillo-arenaceous shale, with *stigmariæ* leaves crossing the bed (*underclay*)			8	0
Carbonaceous shale, gray argillo-arenaceous shale, with *stigmariæ* and small seams of *coal*			6	0
Coal and *carbonaceous shale*	0	6		
Gray argillaceous shale	0	6		
Coal	0	6		
			1	6
Gray argillaceous shale (*underclay?*)			0	10
Bituminous limestone, with *plants, shells* and *fish scales*			0	3
			24	7
Gray argillo-arenaceous shale, witth *ironstone* nodules and *stigmariæ* leaves (*underclay*)			7	0
Gray arenaceous shale and sandstone; the sandstone exhibits some *stigmariæ* leaves crossing it, and in the shale are *ironstone* nodules (*underclay*)			20	0
(From the succeeding bed rises an upright fluted stem (*sigillaria*) 10 inches in diameter, of which 12 feet are visible; and 2 upright *calamites.*)				

			Ft.	In.
Gray argillaceous shale with *ironstone* balls			6	0
30. Coal	0	4		
Dark gray argillaceous shale (*underclay?*)	2	0		
Coal and *carbonaceous shale*	0	2		
Coal	0	3		
Carbonaceous shale	0	6		
Coal	0	1		
			3	4
Gray soft clay (*underclay*)			2	0
Gray argillo-arenaceous shale and sandstone; the shale contains balls of *ironstone* at the bottom; there are *stigmariæ* leaves visible towards the top; towards the lower part of the bed of sandstone there is an upright *calamite* of 2 inches diameter, of which 18 inches are visible			15	0
Gray sandstone, with impressions of prostrate *sigillariæ* underneath			2	0
31. Coal and *carbonaceous shale*	1	0		
Gray argillo-arenaceous shale, with *stigmariæ* (*underclay*)	1	0		
Gray argillaceous shale with streaks *coal*	0	6		
Coal	0	2		
	0	8		
			2	8
Gray argillaceous shale, with *ironstone* balls and *stigmariæ* leaves (*underclay*)	9	0		
Bituminous limestone, with *stigmariæ, shells* and *fish scales*	0	2		
			9	2
Gray sandstone			1	0
Gray argillaceous shale, with *ironstone* balls			7	0
Gray sandstone			2	0
Gray argillaceous shale, with *ironstone* balls			4	0

			Ft.	In.
Gray sandstone			6	6
Gray argillaceous shale			4	0
32. Coal	0	8		
Carbonaceous shale	0	1		
Coal	0	8		
Carbonaceous shale	0	1		
Coal	0	4		
Carbonaceous shale	0	3		
Coal	0	1		
Carbonaceous shale	0	1		
Coal	0	1		
			2	4
Gray argillo-arenaceous shale, with *stigmariæ* (*underclay*)			4	0
Greenish gray argillo-arenaceous sandstone, with *stigmariæ ficoides* (*underclay*)			1	0
Greenish gray argillo-arenaceuos shale, with *stigmariæ* (*underclay*)			4	0
Greenish gray sandstone, with *stigmariæ* (*underclay*)			4	0
Greenish argillaceous shale			6	0
Reddish sandstone, with dividing bands of red shale of 3 inches to 1 foot			20	0
Reddish sandstone. The bed is of irregular thickness, the bottom swelling out suddenly in many places. The bed holds carbonized plants			2	0
(From the top of the succeeding bed there springs an upright *sigillaria*. Two feet of the length is seen, but it is cut clean off at the top and at the bottom by the measures, which pass both without disturbance. See fig. 6 [of original cuts.])				
Red argillaceous shale			5	0
Reddish arenaceous shale, with thin bands of sandstone			3	0
Reddish and greenish sandstone			4	0
Red and green arenaceous shale with *ironstone balls*, some bands of sandstone			25	0

		Ft.	In.
Red and green sandstone		12	0
Reddish and greenish argillaceous shale, loaded with *ironstone* balls, and having bands of sandstone		10	0
Reddish and greenish sandstone		10	0
Red and green argillaceous shale, loaded with *ironstone* nodules		10	0
Red and green sandstone		5	0
Greenish gray argillaceous shale		15	0
Greenish gray sandstone		2	0
(From the succeeding bed there starts an upright *sigillaria* 4 inches in diameter; it is planted 2 feet in it, penetrates the sandstone above, being 4 feet in length altogether.)			
Greenish gray argillaceous shale		6	0
33. *Carbonaceous shale*	1 0		
Coal	0 1		
		1	1
Grenish gray argillaceous shale, with *stigmariæ* leaves (*underclay*)		4	0
Red and gray sandstone, with arenacous shale		7	0
Red argillaceous shale, with a band of sandstone		4	0
Red sandstone, with bands of red arenaceous shale		10	0
Red and green argillaceous shale		20	0
Reddish sandstone		1	0
Red and green argillaceous shale		3	0
Reddish sandstone in uneven layers, with reddish bands of arenaceous shale		18	0
Red and green argillaceous shale		18	0
Reddish sandstone		2	0
Red arenaceous shale		3	0
Red and green argillaceous shale		4	0
Reddish sandstone		1	0
Red and green arenaceous shale		4	0
Reddish sandstone		1	0

	Ft.	In.
Red and green arenaceous shale	7	0
Reddish sandstone	1	0
Red argillaceous shale	3	0
Red and green argillaceous shale, with bands of sandstone	25	0
Red sandstone	1	0
Red and green shale, with bands of sandstone	12	0
Red and green sandstone	4	0
Red and green argillaceous shale, with bands of reddish sandstone	15	0
Red and green sandstone and shale	3	0
Red or chocolate coloured shale, with large balls of red argillaceous *ironstone*	12	0
Red and green sandstone, separated by bands of red and green argillaceous shale of about 1 foot each	30	0
Red or chocolate coloured argillaceous shale, with some balls of red argillaceous *ironstone*	12	0
Reddish sandstone	4	0
Red argillaceous shale	1	6
Red sandstone	2	0
Red argillaceous shale	2	0
Reddish sandstone	1	0
Red argillaceous shale, with a band of sandstone	12	0
Gray sandstone with *ironstone* nodules and *stigmariæ* leaves (*underclay*)	10	0
(From the succeeding bed rises 2 upright *sigillariæ*. The roots of one of them spread out just on the top of the bed, and 2 feet of the plant are visible. The roots of the other spread out likewise, but they sink deeper into the shale by 2 feet, and the plant penetrates further into the superincumbent sandstone. See fig. 7 [of the original cuts.])		
Red and gray variegated shale, with small balls of *ironstone* and *stigmariæ* (*underclay*)	28	0

			Ft.	In.
Gray sandstone			2	0
Greenish shale, with *ironstone* balls and *stigmariæ ficoides* (*underclay*)			4	0
34. *Carbonaceous shale* and *coal*	0	2		
Greenish gray argillaceous shale, with *ironstone* balls and *stigmariæ* branches and leaves; one of the branches replaced by ironstone, is 8 feet long	4	0		
Carbonaceous shale	0	2		
			4	4
Gray argillo-arenaceous shale, with black streaks and *stigmariæ* (*underclay*)			3	0
Gray sandstone, with *stigmariæ* (*understone*)			0	10
Red and green argillaceous shale, with *stigmariæ* (*underclay*)			4	0
Gray crumbly sandstone			3	0
Gray argillo-arenaceous shale, with *stigmariæ* (*underclay*)			3	0
35. *Carbonaceous shale*			0	3
Red and green argillaceous shale, with *stigmariæ* leaves at the top (*underclay*)			6	0
Argillaceous *ironstone* in a bed			0	6
Red and green argillaceous shale			1	0
Gray sandstone, with *stigmariæ* leaves (*underclay*)			1	0
Greenish gray argillaceous shale, with dark bands; argillaceous iron ore nodules abound, and towards the top *stigmariæ* branches and leaves are visible (*underclay*)			28	0
Greenish gray crumbly sandstone			8	0
Gray argillaceous shale, with *ironstone* balls. In this there is visible an upright stem (*sigillaria*), 1 foot in diameter; the top only is visible, and it is at the top of the bed			12	0

			Ft.	In.
36. *Black bituminous limestone,* with branches and leaves of *stigmariæ* well marked and very minute *shells*	1	3		
Carbonaceous shale and streaks of *coal*	0	3		
			1	6
Red argillaceous shale, with *ironstone* (*underclay?*)			4	0
Gray argillo-arenaceous shale, with *stigmariæ* and *ironstone* balls (*underclay*)			6	0
Gray argillaceous shale, with *ironstone* balls			5	0
Gray arenaceous shale			2	0
Gray argillaceous shale			5	0
37. *Dark bituminous limestone,* with shells replaced by pyrites	0	3		
Coal and *carbonaceous shale*	0	10		
Gray argillaceous shale, *stigmariæ* (*underclay*)	1	6		
Coal	0	6		
Gray argillaceous shale, with *stigmariæ* (*underclay*)	1	0		
Dark bituminous limestone, with *stigmariæ* branches and leaves, and also *shells*	0	3		
Gray argillaceous shale	0	3		
Coal	1	0		
			5	7
Gray argillaceous shale of a crumbly character, with *ironstone* balls and *stigmariæ* (*underclay*)			6	0
Greenish gray rough sandstone			4	0
Dark gray argillaceous shale, with *ironstone* balls			7	0
Greenish gray sandstone			1	0
Red argillaceous shale			4	0
Greenish gray sandstone			2	0
Red argillaceous shale, with *ironstone* balls			8	0
Red and green sandstone, with bands of red argillaceous shale under 8 inches thick			6	0

			Ft.	In.
Red argillaceous shale, with bands of sandstone under 8 inches thick			20	0
Reddish sandstone, hard			1	0
Red argillaceous shale, with balls of *ironstone*			4	0
Reddish sandstone, hard			0	3
Green argillaceous shale			0	6
Greenish gray sandstone, with carbonized fragments of drift plants			1	0
Dark gray argillaceous shale, with a red band near the top			10	0
38. Coal	0	1		
Black bituminous limestone, with *shells* and *plants, stigmariæ* branches and leaves	0	6		
Coal	0	2		
			0	9
Red argillaceous shale, studded with *ironstone* balls; *stigmariæ* not visible (*underclay?*)			10	0
Reddish sandstone			2	0
Green arenaceous shale, with red argillaceous bands			15	0
Red and green sandstone			2	0
Red argillaceous shale			1	0
Green arenaceous shale			1	0
Red argillaceous shale			3	0
Green arenaceous shale			1	0
Red argillaceous shale			5	0
Gray bituminous limestone, with *minute shells*			0	6
Red argillaceous shale, with *ironstone* balls			11	0
Green and dark gray argillaceous shale, with *ironstone* balls			14	0
Red and green argillaceous shale, with *ironstone* balls; in this are some dark bands of shale			25	0
Greenish gray sandstone, with a confused mass of carbonized drift plants			10	0
Greenish gray sandstone			2	6
Red argillaceous shale, with a band of sandstone			2	0

			Ft.	In.
Gray and black shale			3	0
Carbonaceous shale			1	0
Red and green argillaceous shale, studded with *ironstone* balls; no *stigmariæ* visible (*underclay?*)			15	0
39. Coal	0	0½		
Gray argillaceous shale, with *stigmariæ*	0	6		
Dark gray limestone, with *stigmariæ* branches and leaves, and minute shells	0	4		
			0	10½
Red and green argillaceous shale, with *stigmariæ* leaves (*underclay*)			1	6
Red and green sandstone			1	0
Red argillaceous shale, with some green and gray bands; the whole containing thin bands of sandstone			18	0
Greenish gray sandstone			8	0
Dark red and green argillaceous shale, studded with *ironstone* balls			15	0
Gray hard argillaceous sandstone			1	0
Dark gray argillaceous shale, with *ironstone* balls in considerable number, with some red argillaceous beds			20	0
40. *Black bituminous limestone,* with *shells.*	0	1½		
Carbonaceous shale	0	0½		
Black bituminous limestone, with *shells*	0	1		
Gray argillaceous shale	0	2		
Black bituminous limestone, with *shells*	0	2		
Gray argillaceous shale, with *ironstone* balls (*underclay?*)	1	0		
Coal	0	1		
Carbonaceous shale, with thin seams of *coal*	0	3		
Gray argillo-arenaceous shale, with *stigmariæ ficoides* (*underclay*)	1	0		
Black bituminous limestone, with *shells* and *stigmariæ*	0	6		
Carbonaceous shale and thin *laminæ* of *coal*	0	2		
			3	7

			Ft.	In.
Green argillaceous shale, with many coarse nodules of clay *ironstone,* all small, and impressions of *stigmariæ* leaves crossing the bed (*underclay*)			5	0
41. *Black calcareo-bituminous shale* with *shells*	0	8		
Black calcareo-bituminous shale, more calcareous, with *shells*	0	2		
Black calcareo-bituminous shale, less calcareous, with *shells*	1	0		
Carbonaceous shale, with *laminæ* of *coal*	1	6		
Gray argillaceous shale, with *stigmariæ* (*underclay*)	3	0		
Carbonaceous shale	0	1		
			6	5
Gray argillaceous shale, with *stigmariæ* (*underclay*)			2	0
Greenish gray argillo-arenaceous shale, in alternate hard and soft layers, with *stigmariæ* leaves (*underclay*)			2	6
Greenish gray sandstone			2	0
Dark gray argillaceous shale, studded with *ironstone* nodules			4	0
42. *Carbonaceous shale*	0	7		
Black bituminous limestone, with *shells* replaced by pyrites	0	2		
Coal	0	3		
Carbonaceous shale	1	0		
Coal	1	0		
Gray argillaceous shale, with *stigmariæ* (*underclay*)	1	0		
Coal	0	2		
			4	2
Dark gray argillaceous shale, with *stigmariæ* (*underclay*)			5	0
Red argillaceous shale, with some green bands, and studded with *ironstone* balls			25	0
Reddish sandstone			1	0

			Ft.	In
Red argillaceous shale, with *stigmariæ* (*underclay*) ..			4	0
43. *Carbonaceous shale*			0	1
Red shale, with *stigmariæ* (*underclay*)	0	3		
Gray sandstone, very hard, (*ganister,* as the Lancashire miners call it), with *stigmariæ*	0	8		
Red argillaceous shale, with *stigmariæ* (*underclay*)	3	0		
Gray sandstone, very hard, with *stigmariæ* (*ganister* or *understone*)	0	10		
Gray argillaceous shale, with *stigmariæ* (*underclay*)	0	10		
Gray sandstone, very hard, with *stigmariæ* (*understone*)	1	0		
Gray sandstone, very hard, with *stigmariæ* leaves running across the bed, (*ganister* or *understone*)	2	0		
			8	7
Red argillaceous shale, green at the bottom			15	0
Gray arenaceous and argillaceous shale, with greenish gray sandstone containing prostrate carbonized plants			12	0
(Into this bed penetrate several upright *calamites* which start from the one subjacent, on the top of which one 3 inches in diameter is seen to spread its roots, and 21 more are visible along the face of the bank in the space of 20 yards; their diameters vary from ½ inch to 4 inches.)				
Dark gray argillaceous shale			2	0
Gray sandstone			1	0
Dark gray argillaceous shale			15	0
Gray sandstone			0	4
Dark gray argillaceous shale, with *ironstone* balls and bands of sandstone			4	0
Dark gray argillaceous shale, with *ironstone* balls....			5	0

			Ft	In.
44. *Carbonaceous shale*	1	6		
Dark gray argillaceous shale	2	0		
Carbonaceous shale, with *ironstone* balls	0	4		
Dark gray argillaceous shale, with *ironstone* balls	6	0		
Black bituminous limestone, with *shells*	0	1½		
Dark green argillaceous shale	0	1½		
Coal	0	0½		
Black bituminous limestone with plants and minute *shells*	0	0½		
Coal	0	5		
Black bituminous limestone, with *stigmariæ* and other plants	0	2		
Coal	0	1		
Black bituminous limestone, with *stigmariæ* branches and leaves, and fragments of other plants	0	2		
Coal	0	0½		
			11	0½
Gray crumbly argillo-arenaceous shale, with indistinct *stigmariæ leaves* (*underclay*)			3	0
Red and green crumbly argillaceous shale (*underclay*)			10	0
Red and green sandstone			5	0
Red or chocolate coloured argillaceous shale			1	6
Reddish sandstone			1	0
Red or chocolate coloured argillaceous shale			1	0
Greenish gray sandstone			9	0
Red argillaceous shale, with thin green beds and some patches of sandstone			40	0
Red shale, with a considerable number of small beds of sandstone			6	0
Greenish gray sandstone, with upright *calamites* about 2 inches in diameter; some of them are traceable for 4 feet in the upper part of the bed; 6 of them are visible; the top of the bed is reddish in colour			10	0

			Ft.	In.
Red argillaceous shale, studded with *ironstone* balls..			10	0
Gray hard argillo-arenaceous shale, with *stigmariæ* (*underclay*)			1	0
Red argillaceous shale			1	0
45. *Carbonaceous shale*	0	10		
Coaly matter	0	0½		
Gray hard argillo-arenaceous stone, with *stigmariæ* (*underclay*)	2	0		
Coaly matter	0	0½		
Green argillaceous shale, with *stigmariæ* (*underclay*)	7	0		
Coal	0	3		
			10	2
Greenish gray arenaceous shale with *stigmariæ* (*underclay*)	3	0		
Red arenaceous and argillaceous shale, with sandstone	2	0		
Red sandstone of a soft quality	0	6		
	2539	1		

RECAPITULATION.

Coal in 45 seams	37	9½		
Carbonaceous shale associated with the above coal seams, and in one instance without coal	36	4		
Gray argillaceous shale interstratified with the coal seams in 8 cases, in two of which the shale is 1 foot and upwards thick without exhibiting any remains of stigmariæ.....	4	4½		
Black and grey bituminous limestone touching the coal and carbonaceous shale, often interstratified and containing the remains of fishes, shells and occasionally stigmariæ. In one instance the limestone has no coal with it; in 16 cases it is associted with the coal seams	23	3		
			101	9

					Ft.	In.
Underclay or understone, being beds of various materials, immediately subjacent to the seams of coal and carbonaceous shale and bituminous limestone, and invariably penetrated by the recumbent branches or radiating leaves of the stigmariæ ficoides. Every one of the seams of coal and carbonaceous shale rests upon a stigmaria bed, with the exception of one instance, where 4 feet of gray argillaceous shale, destitute of the plant, is interposed between the stigmariæ bed and the coal, and one instance where the stigmariæ are doubtful. There are twelve instances of stigmariæ beds without superincumbent coal. The material constituting the stigmariæ beds is as follows:						
Ganister, a hard silicious stone					4	6
Sandstone—						
Gray and crumbly, sometimes a doubtful fireclay			72	10		
Greenish gray			4	0		
					76	10
Arenaceous shale, fit for fire clay—						
Gray			189	0		
Greenish gray			25	6		
Red			6	0		
					220	6
Argillaceous shale, sometimes fit for fireclay—						
Gray	99	4				
Greenish gray	28	0				
Green	12	10				
Red and green	45	0				
Red	17	3				
			202	5		
					504	3

					Ft.	In.
Sandstone—						
Gray in colour, and much of it of a crumbly nature, resembling the quality in which the remains of stigmariæ are found			259	2		
Greenish			4	6		
Greenish gray or drab coloured, some of it fit for grindstones, and patches of it containing carbonized drift plants			232	6		
Red and green, less durable in quality than the drab coloured stone			69	0		
Reddish, similar to the preceding in durability			67	3		
Red or chocolate coloured, easily yielding to the influence of weather			15	6		
					647	11
Shale—Arenaceous—						
Gray	91	0				
Gray, with ironstone balls	13	0				
			104	0		
Greenish gray			5	0		
Green			18	6		
Reddish			15	8		
Red and green	42	0				
Red and green, with iron stone balls	4	0				
			46	0		
					189	2
Shale—Argillaceous—						
Gray	224	8				
Gray, with ironstone balls	199	4				
			424	0		

							Ft.	In.
Greenish gray	32	0						
Greenish gray, with ironstone balls	17	0						
			49	0				
Green			38	6				
Red and green	153	6						
Red and green, with ironstone balls	118	6						
			272	0				
Red or chocolate coloured	230	6						
Red or chocolate coloured, ironstone balls	82	0						
			312	6				
					1096	0		
							2539	1

(Among the organic remains visible, are to be enumerated 15 upright sigillariæ and 56 upright calamites.)

5

	Ft.	In.
Red argillaceous shale, with *ironstone* balls	6	0
Red arenaceous shale	2	0
Red argillaceous shale, with beds of arenaceous shale	16	0
Red sandstone	1	0
Red argillaceous shale	22	0
Red sandstone	1	0
Red argillaceous shale	7	0
Red argillaceous shale, with a bed of sandstone	38	0
Red sandstone	1	0
Red argillaceous shale, with a bed of red sandstone	50	0
Measures concealed, but supposed to be red shale and sandstone	19	0
Red sandstone	1	0

	Ft.	In.
Measures concealed, (red shale and sandstone?)	33	0
Greenish gray soft sandstone, with fragments of plants carbonized	3	0
Measures concealed	32	0
Measures concealed, (red shale and sandstone?), a bed of sandstone at the top	39	0
Greenish gray sandstone	3	0
Measures concealed, (red shale and sandstone?)	19	0
Measures concealed, (red shale and sandstone?) a bed of red sandstone at the top	50	0
Red sandstone	30	0
Measures concealed, (red shale?)	3	0
Red sandstone	1	0
Measures concealed, (red shale and sandstone?)	40	0
Red shale, with some red sandstone	33	0
Measures concealed, (red shale and sandstone?)	30	0
Reddish gray sandstone	5	0
Measures concealed	3	0
Red and gray sandstone of a soft quality	32	0
Red arenaceous shale and sandstone	6	0
Reddish gray sandstone of a soft quality	6	0
Red argillaceous and arenaceous shale	20	0
Red sandstone	2	0
Red argillaceous shale	25	0
Red sandstone	2	0
Red argillaceous and arenaceous shale	12	0
Red sandstone and shale	8	0
Red shale and sandstone	54	0
Measures concealed, (red shale?)	12	0
Measures concealed, (red sandstone and shale?)	3	0
Measures concealed, (red shale?)	28	0
Red shale and sandstone	11	0
Red sandstone	2	0
Measures concealed, but supposed to be red shale	6	0

	Ft.	In.
Measures concealed, but supposed to be red sandstone.	12	0
Measures concealed, but supposed to be red shale.....	138	0
Red arenaceous shale, with some beds of red sandstone.	12	0
Red arenaceous shale, with some beds of red sandstone.	43	0
Red sandstone	17	0
Red arenaceous shale	14	0
Measures concealed	30	0
Red sandstone	6	0
Measures concealed, but supposed to be red shale and sandstone	6	0
Reddish gray sandstone	9	0
Measures concealed, but supposed to be red shale and sandstone	5	0
Red sandstone	2	0
Measures concealed, but supposed to be red sandstone.	44	0
Red shale and sandstone	12	0
Measures concealed, but supposed to be red shale and sandstone	33	0
Red argillaceous and arenaceous shale, with some beds of red sandstone	132	0
Red sandstone	3	0
Red arenaceous shale and sandstone	17	0
Greenish gray sandstone, with patches of concretionary limestone	13	0
Red argillaceous and arenaceous shale	51	0
Reddish sandstone	17	0
Measures concealed	37	0
Reddish green sandstone	24	0
Measures concealed	17	0
Reddish gray sandstone	18	0
Measures concealed	19	0
Reddish sandstone	5	0
Measures concealed, probably red shale	73	0
Reddish gray sandstone, soft, with fragments of plants carbonized	22	0

	Ft.	In.
Measures concealed, but supposed to be red shale	37	0
Red and green sandstone, with probably some patches of concretionary limestone	37	0
Red argillaceous and arenaceous shale, with bands of sandstone	38	0
Red sandstone	2	0
Red argillaceous and arenaceous shale, with bands of sandstone	18	0
Red sandstone	3	0
Red argillaceous shale	1	0
Greenish gray sandstone	9	0
Green argillaceous shale	2	0
Greenish gray sandstone	5	0
Red argillaceous and arenaceous shale, with some beds of red sandstone	50	0
Greenish gray sandstone	7	0
Greenish gray sandstone, with concretions of limestone giving it much the appearance of a conglomerate	1	0
Red argillaceous shale	1	0
Red and green sandstone	6	0
Green shale	2	0
Greenish gray sandstone	1	0
Grenish gray sandstone, with many calcareous concretions, giving it much the appearance of a conglomerate	6	0
Red arenaceous and argillaceous shale, with some beds of sandstone	17	0
Red argillaceous shale and sandstone	16	0
Red arenaceous and argillaceous shale, with some sandstone	8	0
Red argillaceous shale	6	0
Red arenaceous shale, with some bands of sandstone	6	0
Red sandstone	12	0
Red argillaceous shale	1	0
Red sandstone	1	0

	Ft.	In.
Red argillaceous and arenaceous shale, with a two feet bed of sandstone	29	0
Red sandstone, thinning off and replaced by red shale	5	0
Red argillaceous shale	5	0
Red sandstone	2	0
Red argillaceous shale	3	0
Red arenaceous shale	1	0
Red argillaceous shale	3	0
Red arenaceous shale and sandstone	3	0
Red argillaceous shale	22	0
Reddish sandstone	7	0
Reddish sandstone with a one foot bed, having calcareous concretionary nodules, and resembling a conglomerate, with carbonized plants on the top	16	0
Red argillaceous and arenaceous shale	20	0
Red sandstone	8	0
Red arenaceous shale and argillaceous shale	12	0
Red sandstone and shale, half of each	12	0
Red argillaceous shale	5	0
Red arenaceous shale	1	0
Red sandstone	5	0
Red arenaceous shale	7	0
Red sandstone	3	0
Red arenaceous shale	3	0
Red sandstone	2	0
Red argillaceous shale	8	0
Red sandstone	1	0
Red arenaceous shale	5	0
Red sandstone	1	0
Red argillaceous shale	6	0
Red sandstone	1	0
Red argillaceous shale	28	0
Red arenaceous shale	2	0
Red argillaceous shale	15	0
	2082	0

RECAPITULATION.

					Ft.	In.
Sandstone—						
Greenish gray, with occasional drift plants carbonized	28	0				
Greenish gray, with concretionary limestone, having the aspect of conglomerate	20	0				
			48	0		
Reddish gray, with occasional drift plants carbonized	104	0				
Reddish gray, with concretionary limestone	16	0				
			120	0		
Shale—						
Red argillaceous	640	0				
Red arenaceous	230	0				
			870	0		
Green argillaceous			4	0		
					874	0
Measures not well exposed, but probably composed of red shale and sandstone					740	0
					2082	0

6

Greenish gray or drab coloured sandstone, fit for grindstones of good quality, which are extensively quarried from it. This is called the SOUTH REEF	50	0
Red argillaceous shale	14	0
Red sandstone	20	0
Measures concealed, probably red shale	2	0
Red sandstone	3	0
Red sandstone, with probably red shale on the top	7	0

	Ft.	In.
Measures concealed, but said to be red argillaceous and arenaceous shale, with occasional beds of red sandstone	103	0
Dark gray argillaceous shale, with a small quantity of fine grit in it. This would be called a fine *bluestone* in some parts of South Wales. At the Joggins, there is usually a bed of it above a good grindstone reef	4	0
Greenish gray or drab coloured sandstone, fit for grindstones of the very best quality. The whole reef has been quarried away up to the bank	36	0
Greenish gray sandstone, fit for grindstones of good quality. This has been much quarried	17	0
Greenish gray sandstone, fit for grindstones. This has been very much quarried	7	0
Greenish gray sandstone, fit for grindstones. This and the preceding greenish gray sandstones constitute what is called the North Reef	9	0
Red and green argillaceous shale	18	0
Red sandstone of a soft quality	6	0
Red argillaceous shale	14	0
Red argillaceous and arenaceous shale, with 6 bands of red sandstone	27	0
Greenish gray sandstone	7	0
Red argillaceous shale	6	0
Red sandstone	4	0
Red arenaceous shale	4	0
Red argillaceous and arenaceous shale	10	0
Red argillaceous and arenaceous shale and red sandstone, in alternating beds	12	0
Red argillaceous shale, with 2 small beds of red sandstone	21	0
Red sandstone, with bands of red argillaceous shale	9	0
Red arenaceous shale, with bands of red sandstone	6	0
Red sandstone	1	0

			Ft.	In.
Red argillo-arenaceous shale, with thin bands of red arenaceous shale and red sandstone			30	0
Black calcareous bed, no shells visible			0	1
Red and green variegated argillaceous shale			6	0
Green arenaceous shale			1	0
Red arenaceous and argillaceous shale, in alternating beds			4	0
Red argillaceous shale			6	0
Reddish gray sandstone			6	0
Red argillaceous and arenaceous shale			10	0
Red and green variegated shale and sandstone			15	0
Red and green argillaceous shale			4	0
Red and green variegated sandstone			2	0
Red argillaceous shale			12	0
Red and green calcareous band			0	6
Green arenaceous shale, mixed in patches with red arenaceous shale			9	0
Red arenaceous shale of a crumbly character			12	0
Dark gray argillaceous shale, with *ironstone* balls			5	0
1. *Calcareous* shale	1	0		
Dark gray argillaceous shale	3	0		
Coaly clay	0	2		
			4	2
Reddish and dark gray argillaceous and arenaceous shale, crossed by *stigmariæ* leaves (*underclay*)			6	0
Gray argillaceous shale			2	0
Dark gray argillo-arenaceous shale, of a fine smooth quality (*bluestone*)			7	0
Greenish gray or drab coloured sandstone, fit for grindstones			10	0
Gray arenaceous shale of a fine quality, in even beds			8	0
Dark gray argillo-arenaceous shale, of a fine smooth quality, such as usually covers grindstone beds			3	0

	Ft.	In.
Greenish gray sandstone, fit for grindstones. The top part contains large spherical concretions of harder sandstone, with a rusty exterior, and concentric variations of colour. This constitutes BACON LEDGE	54	0
Greenish gray sandstone, with a vast number of drift plants with a coating of coal. It holds also patches of limestone concretions, which have much the aspect of a conglomerate	10	0
Dirty green calcareous concretionary bed. This has so much the appearance of a conglomerate bed with limestone pebbles, that there is some doubt whether it be not so. It is a very irregular bed and holds carbonized plants	4	0
Reddish green argillo-arenaceous shale	1	0
Greenish arenaceous shale of a hard quality, probably fireclay, crossed by *stigmariæ* leaves (*underclay*)...	8	0
Red and green variegated argillaceous shale, with 2 feet of sandstone	8	0
Red arenaceous shale with green spots	5	0
Green arenaceous shale	1	0
Red arenaceous shale	1	0
Green arenaceous shale	1	0
Red argillaceous shale	2	0
Red and green arenaceous shale	2	0
Red argillaceous shale	1	0
Greenish gray arenaceous shale	3	0
Red and green arenaceous shale	2	0
Red argillaceous shale	3	0
Greenish gray arenaceous shale	4	0
Green clay	0	1
Red argillaceous shale	6	0
Reddish sandstone	1	0
Red argillaceous shale	5	0
Gray argillaceous shale	2	0

			Ft.	In.
2. Coaly clay, probably coal further in the bank			0	1
Red and green argillo-arenaceous shale of a soft quality, crossed by *stigmariæ* leaves (*underclay*)			3	0
Red and green crumbly argillo-arenaceous shale, rather harder than the preceding, crossed by *stigmariæ* leaves (*underclay*)			6	0
Reddish sandstone, no *stigmariæ* visible			0	6
Red crumbly argillo-arenaceous shale, with *stigmariæ* (*underclay*)			2	0
Red argillo-arenaceous shale of a tough crumbly nature, with *stigmariæ* strongly marked (*underclay*)			2	0
Red argillaceous shale, with thin green bands and nodules of *ironstone,* a tough, crumbly mass			6	0
3. *Carbonaceous shale*	0	1		
Greenish argillaceous shale	0	6		
Carbonaceous shale	0	1		
Greenish argillaceous shale	2	6		
Carbonaceous shale	0	3		
Greenish argillaceous shale in thin leaves ..	0	1		
Coaly matter and *carbonaceous shale*	0	3		
			3	9
Green argillo-arenaceous shale of a soft quality, crossed by *stigmariæ* leaves (*underclay*)			3	0
Gray argillo-arenaceous shale, rather harder than the preceding, with *stigmariæ* leaves and many nodules of *ironstone* at the top where the bed is more arenaceous (*underclay*)			4	0
Gray sandstone, with *stigmariæ* leaves (*underclay*)..			1	0
Green argillo-arenaceous shale of a rather soft quality, with *stigmariæ* leaves (*underclay*)			4	0
4. Coal and *carbonaceous shale*			0	3
Green argillo-arenaceous shale, with *stigmariæ* leaves (*underclay*)			2	0
Red and green tough crumbly arenaceous shale, with *stigmariæ* branches and leaves (*underclay*)			2	0

	Ft.	In.
Red and green tough crumbly claystone, with balls of *argillaceous iron ore, stigmariæ* leaves crossing the bed (*underclay*)	2	0
Gray rough sandstone and tough crumbly red and green arenaceous shale; one *stigmariæ* branch visible without leaves, but leaves exist in other parts of the bed (*underclay*)	4	0
Red and green tough crumbly clay, some very like *underclay,* but no *stigmariæ* leaves visible	2	0
Dark gray argillaceous shale, no *stigmariæ* visible, but the mass tough and crumbly	1	0
Reddish argillo-arenaceous shale, with *stigmariæ* branches and leaves (*underclay*)	2	0
Red sandstone with green spots	3	0
Red and green variegated sandstone, the green in spots	3	0
Gray argillaceous shale	3	0
5. Coaly matter	0	0⅛
Greenish arenaceous shale, with *stigmariæ* branches and leaves, the recumbent branches crossing one another and running in all directions (*underclay*)	8	0
Green sandstone	2	0
(From the succeeding bed there starts an upright *sigillaria* about 1 foot in diameter, only 2 feet of the length are visible.)		
6. *Carbonaceous shale*	0	3
Gray argillo-arenaceous shale, with *stigmariæ* leaves (*underclay*)	6	0
Greenish gray sandstone, with *stigmaræ* leaves (*underclay*)	4	0
Greenish gray sandstone, with *stigmariæ* branches and leaves (*underclay*)	2	0
Red argillo-arenaceous shale, with *stigmariæ* leaves (*underclay*)	3	0

	Ft	In.
(In these 15 feet of underclay there is a beautiful exhibition of stigmariæ. They are not very abundant, that is to say, in such profuse confusion as usual, but each plant is very distinct. One branch floats along just beneath the surface of the 2 feet bed mentioned, and 24 feet of its length are finely exposed without interruption. The leaves radiate from it distinctly, and individual leaves can be followed down 5 feet, crossing both the hard and the soft parts of the deposit continuously, and others can be traced 2 feet upwards. Where the branch enters a projecting part of the bed, its measurement is 2 inches vertically by 3 inches horizontally, and where the other extremity is lost beneath the beach the measurement is about the same, so that I could not come to any conclusion as to the direction in which the branch issues from the stem, if it has one. See fig. 8 [of the original cuts.])		
Greenish gray or drab sandstone in irregular beds ...	70	0
Greenish gray sandstone, with a vast quantity of drift plants lying in confusion and coated with coal. In one of the beds there appears a bundle of no less 10 plants squeezed together side by side, as represented in fig. 8 [of the original cuts.] Each has a core of sandstone surrounded by a good thick coating of crystallized coal. They run through and through a projecting ledge of 10 feet (see fig. 9 [of the original cuts]), and lie rather oblique to the plane of the bed, but conformably with its elementary layers....	30	0
Greenish gray sandstone, with some spherical concretions of a harder quality, with a rusty exterior	50	0
Greenish gray sandstone	22	0
Dark gray argillaceous shale	0	6

			Ft.	In.
Greenish gray arenaceous shale, with some fibrous impressions like *stigmariæ* leaves crossing the bed (*underclay*)			2	0
Red argillaceous shale			0	6
Greenish gray arenaceous shale			0	6
Red argillaceous shale			2	0
Green arenaceous shale			2	0
Greenish gray sandstone, with spherical concretions			4	0
Greenish gray sandstone and shale			5	0
Greenish gray sandstone			1	0
Gray argillaceous shale			0	10
Gray rough crumbly sandstone			5	0
Gray calcareous sandstone			0	6
7. *Bituminous limestone*	0	3		
Gray argillaceous shale	3	0		
Gray calcareous bed	0	2		
Carbonaceous shale	0	6		
Bituminous limestone, with *shells* and *fish scales; fish jaws* occur	0	3		
Carbonaceous shale, being a mass of platted plants, apparently grasses	1	0		
Coal	0	1		
			5	3
Gray argillo- arenaceous shale, with *stigmariæ* (*underclay*)			5	0
Gray arenaceous shale			5	0
Greenish gray sandstone			7	0
Gray arenaceous shale			2	0
Greenish gray sandstone			1	0
Gray arenaceous shale			2	6
Greenish gray sandstone			0	6
Gray soft arenaceous shale			4	0
Greenish gray soft flaggy sandstone, with ripple mark			10	0
Greenish gray soft flaggy sandstone			4	0

	Ft	In.
Gray arenaceous shale	4	0
Greenish gray sandstone	4	0
Greenish gray soft flaggy sandstone, scarcely standing the weather	14	0
Greenish gray sandstone, in regular beds	27	0
Measures concealed, but no doubt soft, probably argillaceous shale, with a mixture of arenaceous	100	0
Gray arenaceous shale	8	0
Gray argillaceous shale	6	0
Greenish gray sandstone, fit for grindstones. This has been quarried to a considerable extent, and worked deep into the bank. It is the best quarry of this reef, but the stone is rather too hard	10	0
Greenish gray sandstone of grindstone quality	6	0
Greenish gray sandstone. This has been worked for grindstones, but the quality is rather hard	14	0
Greenish gray sandstone fit for grindstones, but rather too hard. This bed exhibits spherical concretions in some parts, some of which are 6 to 8 inches in diameter. These grindstone beds constitute what is called the UPPER COVE REEF	18	0
Greenish gray sandstone	34	0
Greenish gray sandstone in flaggy beds	49	0
Greenish gray sandstone of a stronger quality	8	0
Greenish gray sandstone in flaggy beds	15	0
Greenish gray sandstone	34	0
Greenish gray argillaceous shale	9	0
Greenish gray sandstone. This constitutes BOSS POINT	42	0
Greenish gray sandstone	6	0
Greenish gray sandstone, with drift plants coated with coal	12	0
Greenish gray sandstone in regular beds	28	0
Greenish gray sandstone, with carbonized drift plants	7	0

	Ft.	In.
Greenish gray sandstone in more regular beds	9	0
Greenish gray sandstone, with drift carbonized plants	9	0
Greenish gray sandstone, pervaded by a tangled mass of carbonized drift plants	6	0
Greenish gray sandstone	12	0
Gray argillaceous shale	1	0
8. Coal occurring in patches	0	0½
Gray argillo-arenaceous shale, with the aspect of fire-clay, with *stigmariæ* branches and leaves very distinctly exhibited (*underclay*)	7	0
Gray arenaceous shale	3	0
Greenish gray argillaceous shale, with nodules of *clay ironstone* disseminated in considerable quantity	5	0
Gray argillaceous shale	10	0
Greenish gray sandstone	18	0
Greenish gray sandstone, with carbonized drift plants in confusion	7	0
Greenish gray sandstone	10	0
Greenish gray sandstone, with carbonized drift plants in confusion	4	0
Greenish gray sandstone	7	0
Greenish gray sandstone, with carbonized drift plants in confusion	3	0
Greenish gray sandstone	15	0
Greenish gray sandstone, with spherical concretions of a harder qualit y	7	0
Greenish gray sandstone, with a few carbonized drift plants	18	0
Gray arenaceous shale	2	0
Greenish gray sandstone	12	0
Greenish gray sandstone, with a confused multitude of carbonized drift plants	4	0
Greenish gray sandstone, with a few carbonized drift plants	21	0

	Ft.	In.
Greenish sandstone, with calcareous concretionary nodules, having much the aspect of a conglomerate, with limestone pebbles. The bed is very uneven ...	1	0
Greenish gray sandstone, with carbonized drift plants	13	0
Greenish gray sandstone, in even beds	12	0
Greenish gray sandstone, with carbonized drift plants	10	0
Greenish gray sandstone	51	0
Gray argillaceous and red argillaceous shale	23	0
Greenish gray sandstone, fit for grindstones, but rather hard. This constitutes Boss Quarry	10	0
Greenish gray sandstone	25	0
Greenish gray sandstone, with carbonized drift plants.	6	0
Greenish gray sandstone	24	0
Greenish gray sandstone, with nodules of *clay ironstone,* casts of *calamites* and other plants.....	1	0
Gray arenaceous shale	4	0
Red argillaceous shale	6	0
Greenish gray arenaceous shale	3	0
Gray argillaceous shale	12	0
Gray arenaceous shale	3	0
Yellow sandstone, very soft and yielding to the weather	4	0
Gray argillaceous shale	7	0
Yellow sandstone, very soft and yielding to the weather	21	0
Greenish gray sandstone in even beds	4	0
Gray arenaceous shale	4	0
Greenish gray sandstone, fit for grindstones	18	0
Gray arenaceous shale	4	0
Greenish gray sandstone	7	0
Greenish gray sandstone, with carbonized drift plants	9	0
Greenish gray sandstone in regular beds	21	0
Gray arenaceous shale and sandstone.....	1	0
Greenish gray sandstone	13	0
Gray argillaceous shale	1	0
Greenish gray sandstone	27	0

	Ft.	In
Gray argillaceous shale	6	0
Greenish gray sandstone	30	0
Greenish bed with concretions of limestone very much resembling a calcareous conglomerate	5	0
Gray argillaceous shale	5	0
Greenish bed of calcareous concretions, very much resembling a calcareous conglomerate	9	0
Gray arenaceous shale, with some bands of sandstone	23	0
Greenish gray sandstone	64	0
Greenish gray sandstone	27	0
(Here there appears to be a small fault. It does not disturb the strike, but the dislocation, if there is any, is not ascertained. I do not think it can be many yards.)		
Greenish gray sandstone	34	0
Greenish gray sandstone, with many carbonized drift plants	14	0
Greenish gray sandstone, more regular in the beds	16	0
Greenish gray sandstone, with some carbonized drift plants	18	0
Greenish gray sandstone, with many carbonized drift plants in great confusion	9	0
Greenish bed, with calcareous concretions, having much the aspect of a calcareous conglomerate	1	0
Greenish gray sandstone, with many prostrate carbonized drift plants	9	0
Greenish gray sandstone, a solid mass without divisions	21	0
Greenish gray sandstone, with a vast and confused collection of carbonized drift plants, one lying prostrate measured 25 feet in length and about 1 foot in diameter, at the small end	19	0
Greenish gray sandstone more regular	117	0
Greenish gray sandstone with carbonized drift plants, and holding small patches of concretionary nodulous limestone very like conglomerate	39	0

	Ft.	In.
Gray arenaceous shale, with small *clay ironstone* balls desseminated. This has something of the character of underclay, but the *stigmariæ* are not distinct....	4	0
Gray arenaceous shale	1	0
Gray argillaceous shale	3	0
Gray arenaceous shale	3	0
Gray argillaceous shale, with some balls of *clay ironstone*	5	0
Gray arenaceous shale	1	0
Gray argillaceous shale with 2 beds of arenaceous shale	8	0
Greenish gray sandstone in regular beds	61	0
Greenish gray sandstone, with cabonized drift plants, and occasional patches of concretionary nodulous limestone, very like conglomerate	63	0
Greenish gray sandstone with carbonized drift plants..	1	0
Greenish gray sandstone fit for grindstones	20	0
Gray concretionary limestone, very like a conglomerate with calcareous pebbles	4	0
Greenish gray sandstone	25	0
Lead gray concretionary limestone with carbonized drift plants, and mixed up with calcareous sandstone	8	0
Gray argillaceous shale	10	0
Red or chocolate coloured argillaceous shale	40	0
Dark gray coarse limestone, no organic remains visible	1	0
Gray argillaceous shale	1	0
9. Coaly matter and *carbonaceous shale*	0	2
Gray argillo- arenaceous shale, resembling fireclay, with the leaves and branches of *stigmariæ ficoides* strongly marked, the branches recumbent, and near the top of the bed *ironstone* balls are disseminated through the deposit (*underclay*)	5	0
Gray argillaceous shale and greenish gray sandstone..	2	0
Gray argillaceous shale	2	0
Red argillaceous shale	5	0

	Ft.	In.
Greenish argillaceous shale	7	0
Greenish gray sandstone	96	0
Greenish concretionary limestone	2	0
Greenish gray hard sandstone with a number of large spherical masses still harder. Some of them are 1 foot in diameter, and in section exhibit beautiful deep black and bright red concentric circles towards the exterior. These spheres are said to be occasionally 4 feet in diameter. This constitutes DOGFISH REEF	20	0
Greenish concretionary limestone, the calcareous concretions are lodged in an argillaceous matrix	1	0
Gray argillaceous shale	12	0
Greenish gray sandstone	6	0
Measures concealed, but supposed to be soft	3	0
Dark gray argillaceous shale with disseminated *clay ironstone* balls	10	0
Dark gray argillaceous shale with a course of *clay ironstone* balls at the bottom, some of them 6 inches in diameter	5	0
Black carbonaceous shale, with *shells* in some parts	4	0
Dark gray argillaceous shale	0	10
Dark gray argillaceous shale with a course of poor *ironstone* balls at the top, making about ½ inch	8	0
Greenish gray sandstone fit for grindstones	17	0
Greenish concretionary limestone, having much the appearance of a calcareous conglomerate	3	0
Greenish gray sandstone	5	0
Greenish gray sandstone with carbonized drift plants, *calamites* and others squeezed flat	3	0
Brown argillaceous shale	1	0
Greenish gray sandstone	1	0
Reddish gray shale	1	0
Measures concealed, probably shale	77	0

	Ft.	In.
Red or chocolate coloured sandstone	3	0
Red or chocolate coloured arenaceous shale	7	0
Red or chocolate coloured sandstone and shale	21	0
Red sandstone	1	0
Red shale	1	0
Red sandstone	6	0
Red shale	1	0
Red sandstone	2	0
Red arenaceous shale	1	0
Red sandstone	10	0
Red shale	2	0
Red sandstone	0	6
Red shale	0	8
Dark green limestone	0	4
Red shale	3	0
Red sandstone	2	0
Red argillaceous shale	6	0
Greenish argillaceous shale	0	3
Red or chocolate coloured shale	1	0
Red or chocolate coloured sandstone	1	0
Red or chocolate coloured shale	8	0
Black bituminous limestone	0	3
Red or chocolate coloured shale	1	0
Black bituminous limestone	0	6
Red or chocolate coloured argillaceous shale	1	6
Black bituminous limestone, with *fish scales*	0	6
Brownish red soft shale	52	0
Red or chocolate coloured shale	18	0
Greenish gray sandstone	9	0
Red shale	37	0
Black bituminous limestone, with *fish scales*	0	6
	3240	9

RECAPITULATION.

			Ft.	In.
Coal in 9 seams		0 10		
Carbonaceous shale associated with the coal, and in one instance without coal, and then containing remains of shells		7 4		
Bituminous limestone with remains of fish, and calcareous beds, associated with the coal and carbonaceous shale seams in one instance, and in six instances independent		4 10		
Greenish and gray argillaceous shale, associated in some instances with the coal and carbonaceous seams		9 1		
			22	1
Underclay or understone, being beds of various material, immediately subjacent to the seams of coal and carbonaceous shale, and invariably penetrated by the recumbent branches and radiating leaves of the stigmaria ficoides. Every one of the coal seams rests upon a stigmaria bed, and there is one instance of the stigmaria bed without superincumbent coal. The material of which the stigmaria beds consists, is as follows:				
Sandstone of a gray colour and crumbly quality		5 0		
Shale—				
Gray argillo-arenaceous, frequently fit for fireclay	50 0			
Green argillo-arenaceous	21 0			
Red and green argillo-arenaceous	17 0			
		88 0		
			93	0

			Ft.	In.		
Sandstone—						
Greenish gray or drab coloured, of which much is fit for the purpose of good grindstones, and it is in it that the chief quarries of the Joggins exist. Of this mass 350 feet in various parts are filled with vast collections of drift plants, coated with crystalline coal. The plants are in general confusion, and are in general prostrate. Spherical concretions, some 4 feet in diameter with a rusty black exterior, occur in 51 feet of it.....	1886	6				
Greenish	2	0				
Yellow of a finer but less durable quality than the drab	25	0				
Reddish gray (and gray 5).....	19	6				
Red and green	15	0				
Red and chocolate coloured	95	6				
			2043	6		
Limestone of a concretionary character very much resembling conglomerate generally of a greenish colour and in very irregular layers			43	0		
Shale—						
Greenish gray arenaceous and argillaceous	136	0				
Gray arenaceous and argillaceous with a few small beds containing ironstone balls	234	0				
Red and green variegated	77	0				
Red and chocolate coloured	592	2				
			1039	2		
					3240	9

(Among the organic remains is to be remarked one upright sigillaria.)

7

	Ft.	In.
Measures concealed	19	0
Red arenaceous shale	1	0
Measures concealed	37	0
Red arenaceous shale	1	0
Measures concealed, probably red shale	139	0
(Here is said to occur a bed of gypsum. I am informed that it has been occasionally seen when the beach was washed clean by the tide. A fragmentary mass of gypsum about half a hundred weight lay on the beach.)		
Measures concealed, probably red shale	85	0
Red sandstone conglomerate with white, red, yellow and black silicious pebbles. The black is lydian stone, the others are quartz. The pebbles vary in size from that of a pea to that of a hen's egg	105	0
Red sandstone conglomerate of a coarser quality. The pebbles are of the same colour, but some of them would weigh two pounds	3	0
Red sandstone conglomerate, not quite so coarse	16	0
Red arenaceous shale with several bands of sandstone	21	0
Red sandstone	5	0
Red shale	3	0
Red sandstone	6	0
Red shale	3	0
Red sandstone conglomerate with white, gray and black silicious pebbles as before	16	0
Red sandstone	22	0
Red and green spotty variegated sandstone	11	0
Red sandstone of soft quality	3	0
Red and green spotty variegated sandstone. The green colour constitutes the spots which are circular with a black speck in the centre. The bed appears to be partly calcareous	9	0

	Ft.	In.
Red sandstone of a soft quality and red arenaceous shale	11	0
Red arenaceous shale	24	0
Red sandstone conglomerate with white, red and yellow quartz, and black lydian stone pebbles, varying in size from that of a pea to that of an egg	17	0
Red sandstone of a very coarse grit, with streaks of white parallel with the bedding	16	0
Red sandstone conglomerate with quartz and limestone pebbles. The matrix is coarse	4	0
Red sandstone with thin white streaks deposited in it..	35	0
(This bed is cut by a regular vein of sulphate of barytes 3 inches wide. Its colour is tinged with red. The course of the vein is N. & S. The underlie E. < 82°.)		
Red sandstone conglomerate. The bed is very uneven and contains calcareous material	3	0
Greenish concretionary limestone, looking very like a conglomerate with limestone pebbles	8	0
Greenish gray sandstone	1	0
Greenish concretionary limestone as before	3	0
Reddish sandstone	7	0
Greenish concretionary limestone as before	5	0
Red or chocolate coloured shale	8	0
Red sandstone	2	0
Red or chocolate coloured shale	1	0
	650	0

RECAPITULATION.

Sandstone—					
Greenish gray	1	0			
Reddish	7	0			
Red and green	20	0			
Red	65	0			
			93	0	
Red with white streaks			51	0	
				144	0

					Ft.	In.
Conglomerate, with red, white, gray and yellow quartz and black lydian stone pebbles, in a matrix of red sandstone			148	0		
Limestone in concretionary nodules placed in a matrix of greenish sandstone and shale, occasionally associated with carbonized fragments of plants			16	0		
Shale—						
Deep red and chocolate red arenaceous.	62	0				
Measures concealed, but supposed to be of the same quality	280	0				
			342	0		
					650	0

8

Greenish gray sandstone, red towards the top	12	0
Greenish gray arenaceous limestone, with a band of concretionary limestone, resembling conglomerate	6	0
Greenish concretionary limestone and coarse sandstone, with carbonized drift plants	1	0
Greenish gray sandstone	11	0
Greenish gray sandstone, with two bands of concretionary limestone	12	0
Reddish black and reddish brown shale, with beds containing calcareous septariæ	9	0
Dark gray sandstone, with nodules of concretionary limestone	2	0
Reddish black argillaceous shale, with nodules of ferruginous limestone	9	0
Greenish gray sandstone	30	0
Greenish concretionary limestone	1	0
Greenish gray sandstone	21	0

	Ft.	In.
Greenish concretionary limestone, with carbonized drift plants	3	0
Greenish gray sandstone	17	0
Greenish concretionary limestone	1	0
Greenish gray or drab coloured sandstone	4	0
Red shale	8	0
Red sandstone	12	0
Red shale, with some bands of soft red sandstone	37	0
Red sandstone of a soft quality	6	0
Red shale, with bands of red sandstone	40	0
Greenish gray sandstone	30	0
Greenish concretionary limestone	1	0
Greenish gray sandstone, 10 feet; greenish concretionary limestone, 2 feet	12	0
Greenish gray sandstone, at the bottom of which there is a layer of carbonized drift plants, occasionally replaced by *gray sulphuret of copper* invested with a thin pellicle of the *green carbonate*	8	0
Red shale	8	0
Red sandstone	17	0
Red shale	3	0
Greenish gray sandstone, at the bottom which is a layer of drift plants converted into coal, and occasionally replaced by *gray sulphuret of copper* invested with the *green carbonate*	6	0
Red shale	9	0
Red shale and red sandstone	10	0
Red shale	10	0
Red sandstone	7	0
Red shale	8	0
Red and greenish gray sandstone	19	0
Greenish gray sandstone, with drift plants converted into coal, and occasionally replaced by *gray sulphuret of copper* with *green carbonate*	1	0

	Ft.	In.
Red arenaceous shale	37	0
Red sandstone of a soft quality	16	0
Greenish gray sandstone	6	0
Red hard arenaceous shale	25	0
Reddish sandstone	13	0
Red shale	2	0
Greenish gray sandstone, with carbonized remains of plants	6	0
Greenish concretionary limestone, 2 feet; red shale, 1 foot	3	0
Greenish gray sandstone, with concretionary limestone and carbonized remains of plants at the bottom	11	0
Greenish gray sandstone, with one foot of red shale on top	3	0
Red shale	16	0
Red sandstone, with some of a drab colour at the bottom, with carbonized remains of plants and balls of argillaceous shale	12	0
Red arenaceous shale	3	0
Red sandstone	3	0
Red arenaceous shale	60	0
Red sandstone of a coarse quality	14	0
Greenish gray sandstone, coloured red in parts	10	0
Red arenaceous shale	4	0
Greenish gray sandstone, with remains of plants converted into coal	6	0
Red arenaceous shale	30	0
Red sandstone, fit for first quality flagging	15	0
Greenish gray sandstone, with many remains of plants converted into coal, and occasionally replaced by *gray sulphuret of copper* with a pellicle of *green carbonate* around it	6	0
Red arenaceous shale	14	0
Red sandstone fit for flagging	16	0

	Ft.	In.
Red arenaceous shale	16	0
Red sanstone fit for inferior flagging	3	0
Red arenaceous shale	100	0
Red sandstone fit for flagging	4	0
Red arenaceous shale	29	0
Red sandstone fit for flagging	6	0
Red arenaceous shale	39	0
Red sandstone fit for flagging	30	0
Red arenaceous shale, with two bands of red sandstone	19	0
Red sandstone fit for flagging	22	0
Red arenaceous shale	119	0
(Here is said to occur gypsum of a red colour, in small quantities, but the bank being rather obscured by debris it was not visible.)		
Red arenaceous shale	108	0
Red arenaceous shale, with bands of red sandstone	3	0
Red arenaceous shale	79	0
Red arenaceous shale, with bands of red sandstone	3	0
Red arenaceous shale	43	0
Red arenaceous shale, with green veins crossing it	19	0
Red sandstone	1	0
Red arenaceous shale	2	0
Red sandstone	1	0
Red arenaceous shale	39	0
Red sandstone, partly greenish gray	4	0
Red arenaceous shale	1	0
Red sandstone of a soft quality	3	0
Red arenaceous shale	12	0
Red sandstone	1	0
Red arenaceous shale	14	0
Red arenaceous shale of a hard quality, with a band of red sandstone above	9	0
Red sandstone of a soft quality	1	0
Measures concealed, probably red shale	4	0

	Ft.	In.
Red arenaceous shale, with a band of greenish gray sandstone above	14	0
Red arenaceous shale	10	0
Measures not well seen, but probably red arenaceous shale	27	0
Red arenaceous shale, with a band of red sandstone above	7	0
Red hard arenaceous shale	1	0
Measures concealed, but probably arenaceous shale	15	0
Red arenaceous shale	53	0
Measures concealed, but probably red arenaceous shale of the same quality as before. Here occurs SEAMAN'S BROOK, MILL COVE	75	0
	1658	0

(In the exact strike of the lower gypsum above mentioned, in its course to Hebert River, there is a sink-hole about half way, in which gypsum has been found by excavation; and where the strike would come upon the Hebert, a mass of the mineral, apparently in situ, is seen in the bank, with red shale on both sides of it. At such a distance to the north of this mass as gives a vertical thickness of 300 feet of subjacent red shale, there is exposed a deposit of limestone, which, with some associated strata, appears to be about 100 feet thick; and this may, therefore, be considered as terminating the foregoing section. The limestone contains organic remains, among which there is, in some abundance, a bivalve shell, which I recognize as identical with the *Producta Lyelli* of Windsor, in Nova Scotia.)

RECAPITULATION.

			Ft	In.	
Sandstone—					
Greenish gray, occasionally holding carbonized remains of plants, and in four instances the plants (underlying the sandstone) are replaced by gray sulphuret and green carbonate of copper	206	0			
Reddish	13	0			
Deep red	213	0			
			432	0	
Concretionary limestone associated with the greenish gray sandstone. The concretions are held in an argillo-arenaceous matrix. In one instance the whole of the bed is calcareous, and there occur 9 beds altogether			20	0	
Shale—					
Red arenaceous, sometimes more and sometimes less argillaceous.	1186	0			
Reddish black and gray, with calcareous septaria and nodules...	20	0			
			1206	0	
					1658 0

TOTAL THICKNESS.

No. 1	1617	0
" 2	650	0
" 3	2134	1
" 4	2539	1
" 5	2082	0
" 6	3240	9
" 7	650	0
" 8	1658	0
	14570	11

Section of Rocks from Shulie to Spicer Cove, Cumberland Co., N. S., in descending order.—By Hugh Fletcher, B. A., of the Geological Survey of Canada.

Section I.

ROCKS FROM SHULIE TO SAND COVE,

In descending order.

The section begins at a cove where the highest rocks come on top of the cliff. From this cove a school-house on the opposite side of Shulie river lies S. 22° E., and a little wharf near a point is N. 48½° E., the extreme tip of the point being N. 46° E.*

	Ft.	In.
1. Greenish gray and gray fine sandstone with irregular layers of conglomerate. Dip N. 68½° E. < 2°, but becomes southerly immediately down Shulie River	25	0
2. Red argillaceous shale	10	0
3. Gray fine sandstone in thick layers nearly massive, passing on the strike into conglomerate	8	0
4. Red marl	5	9
5. Red and olive-green marl, finely banded, passing on the strike into sandstone	5	3
6. Gray, very fine-grained, irregularly-bedded sandstone, passing into arenaceous shale. Cuts out all the shales; contains at one point a lenticular layer of coal, two feet long and two inches to half an inch in thickness and with these there are patches of yellowish underclay; passing in places into conglomerate with pebbles chiefly of pre-Carboniferous rocks	5	5
7. Red marl with layers of greenish calcareous flag; with very irregular interchanges	17	0

*All bearings in Mr. Fletcher's sections are magnetic. The sections were measured from 9th to 18th November, 1896.—*Ed.*

	Ft.	In.
8. Greenish gray sandstone, passing into conglomerate, more than half being in places conglomerate....	5	0
9. Greenish gray sandstone and conglomerate, irregularly mixed; in places nearly all conglomerate; many large fragments of carbonized plants. One band at the point nearest the wharf opposite is very fine and wavy.....	25	0
10. Red marl with layers of harder shale	8	6
11. Reddish-gray, very fine, shaly sandstone	7	11
12. Red marl	8	0
13. Red flaggy sandstone in layers four inches thick and downward	3	0
14. Red marl	8	0
15. Red, somewhat massive sandstone in irregular blocks, passing into red flags. The top of the bank at the entrance of Shulie River	7	0
16. Red marl, with olive green blotches	2	6
17. Red shale, with greenish, harder, calcareous bands	2	0
18. Red marl	2	0
19. Red and gray, very fine, glistening sandstone in flaggy layers	5	0
20. Red marl of somewhat irregular thickness, from one foot four inches to four feet	2	8
21. Very fine gray sandstone in beds from four feet downward	10	0
22. Red and gray shale, lenticular, replaced by gray sandstone	1	3
23. Gray, very fine, massive sandstone with coal pipes.	10	0
24. Red marl with greenish and gray streaks; very irregular, sometimes all red	5	0
25. Gray sandstone with blackish stripes, interbedded with red marl; all more or less lenticular	6	0
26. Greenish-gray, very fine calcareous sandstone; lenticular	2	4
27. Red marl	1	4

		Ft.	In.
28.	Reddish-gray, very fine sandstone in flaggy layers.	4	0
29.	Light-gray fine sandstone with comminuted plants	16	4
30.	Greenish argillaceous shale	3	0
31.	Rusty-gray, fine sandstone, massive, passing in places into conglomerate, and in other places altogether into greenish argillaceous shale	5	0
32.	Gray, very coarse, pebbly sandstone, full of prostrate trees, with veins of bright coal half an inch thick	10	0
33.	Greenish, very fine sandstone, replaced by coarser sandstone	1	0
34.	Greenish and reddish rusty-weathering marl, replaced by sandstone	1	0
35.	Greenish and reddish, very fine, argillaceous sandstone, replaced by greenish-gray, pebbly sandstone	3	0
36.	Red marl with layers of jointed sandstone and shale.	7	0
37.	Very fine, coherent, calcareous sandstone, in two or three layers	0	9
38.	Red marl	4	7
39.	Gray flags, verv fine and sandy, replaced on the strike by gray sandstone	6	9
40.	Gray massive sandstone. Much thicker in places, but replaced by the lower band of red marl	3	0
41.	Greenish crumbly marl	0	3
42.	Red marl with a layer of harder rock	6	0
43.	Reddish and greenish, mottled, flaggy, rubbly rock; replaced by greenish sandstone	2	6
44.	Greenish-gray very fine sandstone, passing into gray pebbly sandstone	6	6
45.	Gray and rusty pebbly sandstone, with very irregular surfaces. The rocks are unfit for grindstone; many of the layers show broken leaves and fruit of fossil plants, with sometimes large		

	Ft.	In.
46. Red marly rock, seen for a great distance on the strike with various replacements	2	0
47. Gray, fine, massive, rusty-weathering sandstone all replaced by red marl, and again by sandstone	5	0
48. Red marl	4	6
49. Reddish sandy flags	3	0
50. Greenish-gray sandstone	2	1
51. Greenish argillaceous shale with a blackish streak at the top	2	0
52. Reddish and gray, very fine, flaggy sandstone	4	1
53. Red marl, replaced by sandstone. The bottom of this bed is at water-level at a little brook	7	0
54. Greenish-gray sandstone. An eight inch fault with up-throw on the south side	1	8
55. Red marl	7	6
56. Greenish-gray calcareous rock in two layers	0	10
57. Red marl. Another little fault with upthrow on the south side	5	6
58. Gray very coherent sandstone	1	2
59. Red argillaceous shale with greenish blotches	2	6
60. Reddish-gray sandstone	2	10
61. Red argillaceous shale	4	0
62. Light-gray, very coherent, knobby sandstone	0	8
63. Gray and greenish-gray very fine sandstone	5	0
64. Red sandstone and argillaceous shale	5	10
65. Reddish argillaceous shale with three layers of gray fine sandstone	9	0
66. Red marl and sandstone, replaced by the gray sandstone of No. 67	7	6
67. Gray sandstone at water level at the mouth of a tiny brook	2	0
68. Red marl	5	6
69. Gray fine sandstone in three layers, much thicker in places	2	6

	Ft	In.
70. Red marl	4	0
71. Greenish-gray sandstone with lenticular layers of red marl; blackish pebbly patches	4	4
72. Greenish and red argillaceous shale	1	6
73. Greenish argillaceous shale and flaggy sandstone. Dip S. 76°—52° E.< 4°	5	0
74. Red marl and gray sandstone in layers. Dip S. 80° E.< 4°	6	10
75. Light gray very fine sandstone, passing into red marl at the top and into arenaceous shale	8	0
76. Gray, coarse and fine, pebbly sandstone at the mouth of Fitzgibbon Brook	4	6
77. Greenish-gray conglomerate, with pebbles often larger than a hen's egg. Forms the base of the island on the south side of the brook. The lowest three feet is finer in places	24	6
78. Red marl	6	0
79. Reddish, rubbly, argillaceous sandstone with irregular thin layers of red marl	11	4
80. Red marl with layers of rubbly argillaceous sandstone	11	6
81. Reddish-gray, very fine, flaggy sandstone	4	0
82. Red jointed marl	2	6
83. Greenish and reddish mottled sandstone and arenaceous shale in alternate layers	21	0
84. Reddish-gray sandstone, a few inches on top passing into gray fine and coarse sandstone	6	0
85. Measures concealed in a cove at the mouth of a little brook	10	5
86. Light gray, fine, micaceous sandstone, blackened in places by minute plants; rusty spots, with coal pipes and greenish shale. Thickens in places by encroaching upon No. 87	10	0
87. Reddish and greenish argillaceous shale	4	6

		Ft.	In.
88.	Gray fine sandstone in irregular layers	10	0
89.	Greenish-gray argillaceous shale with harder layers of sandstone	3	6
90.	Gray sandstone as before with lenticular layers of red shale	10	0
91.	Red marl and sandstone	6	6
92.	Greenish arenaceous shale	1	6
93.	Gray pebbly sandstone, irregularly bedded	7	6
94.	Greenish, soft, argillaceous underclay	0	3
95.	Red marl	3	6
96.	Gray sandy flags, not well seen	1	9
97.	Measures concealed	2	9
98.	Red marl and sandy flags	2	1
99.	Gray pebbly sandstone at the mouth of a little brook	15	0
100.	Red marl	2	6
101.	Measures concealed at Cranberry Head to a little pond or marsh. Dip S. 23° E.< 4°	41	9
102.	Light gray flaggy sandstone	5	6
103.	Gray coarse pebbly sandstone with patches of conglomerate	5	6
104.	Greenish and gray, reddish and rusty conglomerate with pebbles as large as a hen's egg; of irregular thickness	4	0
105.	Gray coarse sandstone	9	0
106.	Greenish argillaceous shale	0	3
107.	Red shale	4	0
108.	Reddish-gray sandstone, passing into gray fine sandstone	12	0
109.	Greenish and gray and reddish argillaceous shale	3	6
110.	Greenish and gray, rusty and reddish flaggy sandstone, and arenaceous shale with three patches of greenish coarse shale and coal-pipes; lenticular beds of conglomerate also	23	0

		Ft.	In.
111.	Greenish argillaceous shale	0	5
112.	Red argillaceous shale	1	0
113.	Greenish-gray and gray sandstone, passing into red marl and flaggy sandstone	9	0
114.	Red marl	6	6
115.	Greenish-gray argillaceous shale	1	0
116.	Gray, coarse, pebbly sandstone in thick layers	10	6
117.	Greenish arenaceous and argillaceous shale	1	7
118.	Red argillaceous shale and sandstone	6	6
119.	Greenish and gray very fine sandstone and arenaceous shale	6	11
120.	Greenish and reddish, mottled, nearly compact sandstone, passing into gray sandstone	5	0
121.	Gray and rusty sandstone in part pebbly and with patches of conglomerate	6	7
122.	Reddish-gray argillaceous shale	1	4
123.	Reddish, rubbly, argillaceous sandstone	4	0
124.	Red shale	4	6
125.	Red marl and sandstone in alternate layers	9	0
126.	Light gray arenaceous shale with a tinge of red on top, passing into gray flaggy sandstone; lenticular patches of greenish argillaceous shale and red marl, sometimes ten feet thick	23	0
127.	Greenish-gray argillaceous shale	5	0
128.	Light-gray fine flaggy sandstone	2	0
129.	Gray, coarse, pebbly sandstone with patches of conglomerate and a finer rock; in part very rusty with many streaks of coal and prostrate trees	29	0
130.	Measures concealed at the mouths of five little brooks, Clam Cove. Dip N. 66° E. $<12°$. The change of dip from S. E. to E. and then back to S. E. requires further examination. That it extends across this concealed interval is doubtful.	493	0

	Ft.	In.
131. Gray and rusty sandstone irregularly bedded; patches of fine conglomerate in lenticular masses sometimes six feet thick	15	6
132. Red argillaceous shale and sandstone. Dip N. 66° E. < 12°	16	0
133. Light gray and greenish flaggy sandstone	6	0
134. Light greenish and bluish gray argillaceous and arenaceous shale	3	6
135. Red marl	2	0
136. Dark gray argillaceous shale	0	5
137. Red and greenish, more or less concretionary rubbly shale	5	0
138. Red and greenish mottled argillaceous flag	4	0
139. Red and greenish argillaceous shale	5	6
140. Reddish and greenish coherent sandstone, very fine and argillaceous	1	0
141. Red marl with dark-greenish blotches and shaly layers	9	0
142. Greenish and gray very fine wavy sandstone and shale	1	0
143. Greenish and light gray very fine sandstone, full of carbonized plants	6	0
144. Gray, coarse, pebbly sandstone and conglomerate	26	0
145. Red marl with harder layers	17	6
146. Greenish fine argillaceous sandstone in flaggy and shaly layers	4	6
147. Light gray and rusty jointed sandstone of fine texture with broken plants, wavy, with lenticular patches of coal	17	0
148. A lenticular layer of coal and pyrite in bands; from four to two inches thick	0	3
149. Gray, rusty-weathering, irregularly bedded sandstone, with patches of conglomerate and wedges of coal. Many of the sandstones are false-bedded and hard to measure	20	0

		Ft.	In.
150.	Red and green argillaceous shale	0	6
151.	Gray fine sandstone, passing at the bottom into pebbly, coarse sandstone with pebbles as large as a hen's egg	10	0
152.	Greenish coarse nut-and-egg conglomerate	14	0
153.	Greenish argillaceous shale, passing into rusty coarse twisted sandstone with coal-pipes	1	9
154.	Rusty sandstone and fire-clay, light gray at the top	6	0
155.	Alternate layers of sandstone and conglomerate, replaced in part by greenish argillaceous shale	11	6
156.	Arenaceous shale replaced by argillaceous shale	2	0
157.	Gray massive sandstone, broken by irregular joints, with lenticular replacements of greenish and reddish shale	17	0
158.	Greenish-gray argillaceous shale	0	9
159.	Gray, rusty-weathering, fine sandstone with pebbly patches	10	0
160.	Greenish-gray argillaceous shale; in places replaced by sandstone	1	2
161.	Gray and greenish-gray flaggy sandstone, passing at the bottom into pebbly coarse sandstone	19	0
162.	Dark gray argillaceous shale, more or less lenticular	0	2
163.	Gray broken and jointed sandstone. All the sandstones contain comminuted carbonized plants	10	0
164.	Greenish flaggy sandstone with thin layers of red argillaceous shale. A three-feet fault with upthrow on the west side	9	0
165.	Red argillaceous shale, with thin band of greenish-gray coherent sandstone	9	6
166.	Gray rusty-weathering sandstone in somewhat flaggy layers, with small wedges of argillaceous shale. Another fault of nine feet five inches with upthrow on the west. Dip of fault N. 42° E. $< 67°$	12	6

	Ft.	In.
167. Red argillaceous shale and greenish-gray argillaceous flags with wavy arenaceous shale in alternate bands, in part replaced by greenish sandstone	18	6
168. Greenish-gray fine flaggy sandstone, becoming coarse at the bottom. A downthrow fault dips S. 60° W. < 85°. Another dips S. 28° W. < 85°, the amount of downthrow to the south being nine feet. The sandstone contains coal-pipes, and wedges of argillaceous shale. Here the bottom of No. 167 shows two inches of black coaly shale and the upper surface of the sandstone becomes rusty underclay. A little further south is a twenty-two feet upthrow on the south side, the dip being N. 43° E. < 28°. The faults are easily traced by the coaly shale	20	6
169. Greenish-gray argillaceous shale	1	0
170. Reddish and greenish sandstone in alternate layers thrown up a few feet on the south side. On the strike these beds pass at the bottom into dark argillaceous shale	11	6
171. Gray arenaceous shale	4	6
172. Greenish-gray and rusty conglomerate, jointed and with small lenticular layers of red and greenish argillaceous shale. In the joints are veins of barytes a quarter of an inch thick	6	6
173. Greenish-gray and gray fine sandstone divided into two by a foot of greenish argillaceous shale. An upthrow-fault of perhaps twenty-five feet, not well seen, separates No. 172 from this sandstone	25	0
174. Reddish argillaceous shale with blotches of greenish shale; passes in places into greenish shale	2	0
175. Reddish, rubbly, argillaceous sandstone and shale in alternate layers, passing into sandstone with coal-pipes. No. 67 of Section II (See page 514).	12	0

	Ft.	In.
176. Gray jointed pebbly sandstone. At the water level on the point of Sand Cove and following for some distance to the southward, while still further south the sandstone of No. 173 comes to the water level	10	0
177. Greenish-gray conglomerate with layers of finer grit and of arenaceous shale	10	0
178. Greenish-gray and gray fine sandstone with a little coal, seen only on the reefs. The dip now turns to S. 12° W.< 18°. (All the bearings in these sections are magnetic). A number of small faults, not well seen now obscure the section which is repeated in ascending order towards the large brook that flows into Sand Cove, as in Section II.	27	0
Total thickness of section	1769	4

From the top of the 25 feet sandstone (No. 173 of Section I.) south along the shore at about 60 yards the dip changes to S.< 50°. At 155 yards, sandstone and conglomerate dip S. 20° W.< 25°. At 260 yards, a 3-inch band of black shale underlaid by fine sandstone dips S. 35° W.< 33°. At 365 yards, sandstone dips S. 84° W.< 31°, but seems at 475 yards to dip northerly at a very high angle. There is here every indication of a fault with a downthrow to the north. The dip at one point is overturned to S 1° E.< 69°; the red marl, sandstone and conglomerate to the northward are greatly altered, then for 17 yards farther the dip is westerly, while for the next 100 yards the shore follows the strike, the dip being towards the sea.

Few rocks are then seen to 560 yards where the dip is perhaps N. 45° E.< 20°, beyond which for 526 yards to the mouth of Sand Brook a sand beach conceals the rocks.

From the outermost reef a section was measured as follows:

Section II.

NORTH OF SAND COVE.

In descending order.

	Ft.	In.
1. Rusty conglomerate with bands of gray sandstone. Dip S. 81° W. < 50°	35	6
2. Rusty and light-gray fine sandstone in thick beds, seen at intervals on the reefs	60	0
3. Rusty and greenish-gray pebbly sandstone and conglomerate	11	6
4. Rusty and greenish-gray pea-and-nut conglomerate with many larger pebbles. Extends to the fault.	10	0
5. Light-gray argillaceous shale with a layer of blackish coaly matter on the top	1	6
6. Red argillaceous shale with layers of flaggy sandstone	10	0
7. Greenish-gray and rusty nut-and-egg conglomerate. Little downthrows on the east side	10	0
8. Reddish argillaceous shale with greenish layers and blotches	1	0
9. Greenish-gray argillaceous shale with red bands	2	0
10. Gray and greenish-gray, pebbly sandstone with irregular layers of conglomerate	7	0
11. Greenish argillaceous shale and flags with reddish layers	12	6
12. Greenish arenaceous shale with red spots and blotches	2	0
13. Light-gray fine sandstone with coal-pipes and a few patches of conglomerate	12	0
14. Rusty and gray pea-and-nut conglomerate	7	0
15. Light greenish-gray fine sandstone with plants and patches of argillaceous shale	5	0

	Ft.	In.
16. Red and green argillaceous shale. A band of black shale and coal 3 inches on top (p. 510)	1	0
17. Light gray very fine sandstone with an underclay at the top	3	0
18. Red argillaceous shale	1	3
19. Greenish argillaceous shale	0	8
20. Bright-red conglomerate, passing into red sandstone	1	0
21. Light-gray fine sandstone with coal-pipes	7	0
22. Greenish and gray pea-and-nut conglomerate	9	0
23. Greenish argillaceous shale, passing into harder flags	1	2
24. Greenish coherent flag	0	5
25. Red argillaceous shale and sandstone or arenaceous shale and flags, faulted	14	0
26. Light bluish-gray very fine sandstone	4	0
27. Red flags with greenish layers and blotches	6	0
28. Gray very fine sandstone with a reddish tinge	2	0
29. Red argillaceous shale with layers of greenish sandstone	10	0
30. Gray, coarse, pebbly sandstone	2	0
31. Red argillaceous shale with bands of greenish, fine coherent, flaggy sandstone	12	0
32. Light gray, ripple-marked sandstone with the footprints of some land animal	5	0
33. Red argillaceous shale	0	6
34. Light-gray and rusty very fine sandstone with small patches of conglomerate	12	0
35. Red argillaceous shale and sandstone, not well exposed	10	0
36. Greenish-gray very fine sandstone	1	6
37. Red argillaceous shale, not well exposed but apparently not faulted	20	0
38. Light-gray, fine, flaggy sandstone, with patches of conglomerate	10	0
39. Greenish-gray and rusty sandstone and conglomerate mixed	5	0

	Ft.	In.
40. Red and green mottled argillaceous shale	1	0
41. Reddish sandstone with green spots	7	0
42. Red argillaceous shale with a layer of white clay near the top	10	0
43. Rusty-gray sandstone with a lenticular layer of greenish and reddish argillaceous shale	4	0
44. Red and green argillaceous shale	1	0
45. Greenish-gray and rusty, flaggy sandstone, with thin layers of red argillaceous shale	4	0
46. Red argillaceous sandstone, flag and shale	2	0
47. Greenish and gray, fine, flaggy sandstone with carbonized plants and argillaceous streaks	5	0
48. Greenish and gray, coarse, pebbly sandstone and conglomerate, with lenticular layers of greenish argillaceous shale	10	0
49. Red argillaceous shale with greenish flags	15	0
50. Greenish, fine, flaggy sandstone	15	0
51. Greenish-gray and red argillaceous shale	3	0
52. Greenish-gray, fine, flaggy sandstone, lenticular	2	0
53. Red arenaceous shale	2	0
54. Red argillaceous shale with bands of red and greenish sandstone	30	0
55. Measures concealed	30	0
56. Gray, fine, flaggy and shaly sandstone	2	0
57. Rusty-gray fine sandstone, with pebbly patches	7	0
58. Measures concealed, probably soft	10	0
59. Gray and rusty, pebbly, coarse sandstone	7	0
60. Measures concealed	15	0
61. Rusty and gray, crumbly, pebbly sandstone with coal-pipes	15	0
62. Red argillaceous shale, not well exposed	18	0
63. Greenish and gray and rusty, pebbly sandstone, with plants and coal-pipes. The dip changes to easterly	25	0
64. Greenish-gray arenaceous and argillaceous shale	5	0

	Ft.	In.
65. Red argillaceous sandstone with greenish patches, rubbly and in irregular beds	8	0
66. Red argillaceous shale with a light greenish clay-parting at the top. Thinner in places	9	0
67. Reddish arenaceous shale with greenish blotches and layers	2	6
68 Greenish and gray arenaceous shale; passes into fine sandstone	2	6
69. Rusty-gray, fine sandstone with streaks of argillaceous shale. To the water-level at the point of Sand Cove. No. 176 of Section I.	5	0
Total thickness	597	0

There is probably no break in this section which repeats the measures of Section I. as far as the fault.

Across Sand Brook, at 344 yards farther south, gray pebbly sandstone in a cliff dips N. 75° E. < 19°. Including all the rocks to the top of this and the succeeding cliffs, the section is as follows:

Section III.

SOUTHWEST OF SAND COVE,

In descending order.

1. Gray sandstone	20	0
2. Red argillaceous shale and sandstone	40	0
3. Gray sandstone with pebbly patches	20	0
4. Red argillaceous shale with harder layers of reddish anud greenish sandstone. Some layers of reddish sandstone are of coarse texture	55	0
5. Gray fine sandstone in broken layers. Thin bands of greenish argillaceous shale and beds of arenaceous shale; coal streaks; very thin patches of pebbly rock	66	0
Total thickness	201	0

The first cliffs include only Nos. 4, 5 and ten ft. of 3. Then a downthrow fault on the south side brings red rock against the gray sandstone the whole height of the cliff, the displacement being probably sixty feet nearly vertical in a southeasterly direction. Further along, at another downthrow, a bed, perhaps 3. is seen to be twenty feet thick, while overlying come 2 and 1 as given in the section.

Outside on the point, a band of sixty feet of fine gray sandstone is overlaid by red rocks and gray sandstone at another fault.

Again a thick sandstone, perhaps 5, comes on the shore and is faulted. This is nearly all of fine texture, whereas further along the shore there are bands of coarser material. It seems possible that for all this distance the same sandstone (5) runs along on the strike, broken by many little faults.

Then comes a thickness of seventy-five feet of red rocks with conglomerate bands nearly horizontal. Then a heavy gray sandstone with a band of conglomerate twenty feet thick, greenish and reddish and gray, underlaid by pebbly sandstone.

Towards Sand River the section is in ascending order, red shale, sandstone of coarser texture with more conglomerate being abundant as far as a clean cliff of sandstone, nearly all fine, about 100 feet high. The highest beds at Sand River show thin layers of shale. A descending section is as follows:

Section IV.

FROM SAND RIVER EASTWARD,

In descending order.

	Ft.	In
1. Red marl with green layers, broken in the bank, beneath the first house behind the Post Office at Sand River. Dip S. 19° W. < 20° to 44°. Thickness undefined	5	0

	Ft.	In.
2. Gray and greenish, fine, wavy sandstone and arenaceous shale, with rusty spots and small streak of coal	15	0
3. Red marl with flaggy layers and greenish blotches and bands	6	6
4. Reddish, somewhat massive, fine sandstone and argillaceous shale	3	0
5. Red marl with irregular bands of harder flags. Dip S. 11° W. < 27°	13	0
6. Red, very fine sandstone, in two wedge-shaped layers	1	6
7. Red marl	2	0
8. Red sandstone with greenish blotches	1	6
9. Red marl with light green blotches	3	6
10. Red argillaceous sandstone and flag with green patches	1	6
11. Red marl or argillaceous shale with thin harder layers	10	8
12. Greenish, coherent, argillaceous flag	0	4
13. Red marl with two thin layers of sandy flag	4	6
14. Red argillaceous sandstone with green blotches; passes into argillaceous shale	2	0
15. Red argillaceous shale with green pipes and blotches	7	6
16. Gray or rusty fine grit	1	6
17. Red argillaceous shale	2	0
18. Greenish and rusty gray very fine sandstone with a few pebbles, rusty spots and coaly blotches	7	0
19. Greenish or bluish-gray argillaceous shale	6	0
20. Greenish-gray arenaceous shale and flaggy sandstone	1	4
21. Greenish and bluish-gray argillaceous shale; passes into sandy flags	2	0
22. Greenish-gray flaggy arenaceous shale and sandstone	5	0
23. Reddish argillaceous shale with greenish thin layers and blotches	12	0
24. Reddish flaggy sandstone	1	6

	Ft.	In.
25. Red argillaceous shale with a layer of rubbly fine sandstone	13	0
26. Reddish sandstone with green patches	2	6
27. Red crumbly argillaceous shale with four layers, sometimes lenticular, of arenaceous flag	22	0
28. Greenish-gray and rusty fine arenaceous shale and sandstone, blackened with comminuted carbonized plants; rusty and coaly spots; small lenticular basins of greenish argillaceous shale; has in places an Indian-red tint. The water-level of the base of the sand bar is at 31 feet, the rest of the measurement being on the outer shore. The layers are usually thick, very irregular, and in the lower part occur a few pebbles as large as a hen's egg. Dip at the bar S. 5° E. < 25°	75	0
29. Red argillaceous shale	10	0
30. Greenish-gray, gray and rusty, coarse sandstone with patches of pea-and-nut conglomerate; pipes and gash-veins of coal from one inch downward	12	0
31. Greenish-gray argillaceous shale	5	0
32. Gray and greenish, flaggy, fine sandstone	12	0
33. Red argillaceous shale	8	0
34. Greenish-gray shaly sandstone or arenaceous shale	12	0
35. Rusty-gray thick-bedded sandstone, with a few small pebbles	15	0
36. Red argillaceous shale	7	0
37. Greenish-gray arenaceous shale, passing into sandstone	13	0
38. Rusty gray fine sandstone, jointed into rectangular blocks, with pebbly patches	8	0
39. Greenish and bluish-gray argillaceous shale, of irregular thickness	2	0
40. Greenish-gray arenaceous flag	4	0

	Ft.	In.
41. Light-gray and greenish-gray, false-bedded, rusty-weathering sandstone, of somewhat loose texture; coal-pipes and pebbly patches	25	0
42. Rusty-gray and greenish pea-and-nut conglomerate with larger pebbles	5	0
43. Greenish-gray and rusty, very coarse, pebbly sandstone in irregular beds, for the most part thick-bedded	67	0
44. Greenish and rusty nut-and-egg conglomerate with finer bands	8	0
45. Reddish argillaceous shale with greenish and dark layers and blotches, probably No. 5 of next section	5	0
46. Greenish-gray arenaceous shale	1	6
47. Reddish-gray argillaceous shale and flags	4	0
48. Reddish-gray sandstone in bands	4	0
49. Red argillaceous shale	8	0
50. Greenish arenaceous shale and flaggy sandstone	2	0
51. Rusty, thick-bedded, fine sandstone	7	0
52. Red argillaceous shale with greenish bands and blotches. Dip S. 5° E. <18°	2	0
53. Red and green argillaceous shale with harder flags	5	6
54. Reddish argillaceous shale with fewer green blotches	2	0
55. Greenish and reddish arenaceous shale	1	0
56. Gray and rusty fine sandstone, false-bedded and in thick layers	11	0
57. Gray sandstone of the same texture, but pebbly	3	0
58. Greenish pea-and-nut conglomerate, in irregular bedding	1	6
59. Rusty and grav pebbly sandstone. Dip S. 21° E. to S. 14° E. < 16° to 23°	3	0
60. Greenish-gray and rusty conglomerate and fine sandstone mixed in lenticular beds. Below No. 60 the beds do not appear in the cliff but only on reefs below high-water	7	0

	Ft.	In.
61. Greenish-gray conglomerate	5	0
62. Greenish-gray sandstone	5	0
63. Greenish and reddish, mottled argillaceous shale with harder flaggy bands	12	4
64. Greenish sandy flags and sandstone in a massive bed; conglomerate at the bottom	5	0
65. Measures concealed. Red marl and greenish argillaceous coherent flags seen on the reefs	13	0
66. Greenish-gray and gray fine sandstone	30	0
Total thickness	579	2

Here the section is broken by a fault with a downthrow of considerable amount to the east, its dip being east and hade nearly vertical. The throw could not be determined, but perhaps the following beds succeed as indicated.

Section V.

BETWEEN SAND RIVER AND SAND COVE.

1. Greenish-gray sandstone like No. 43 of Section IV. Dip S. 2° to 5° W.< 14° to 24°	75	0
2. Greenish argillaceous shale passing into sandstone.	3	0
3. Greenish-gray argillaceous shale passing into sandstone	5	0
4. Greenish-gray and gray fine sandstone with some layers of greenish argillaceous shale	20	0
5. Red argillaceous shale. Possibly No. 45 of the previous section	2	0
6. Red marly sandstone	6	0
7. Red argillaceous shale with greenish layers	2	0
8. Rusty and greenish fine sandstone, with carbonized plants and pebbly patches	10	0
9. Gray and rusty pebbly sandstone, with small patches of pea-and-nut conglomerate and veins of coal one inch thick and downward	5	0

	Ft.	In.
10. Greenish and rusty nut-and-egg conglomerate; passes partly into sandstone	10	0
11. Rusty and greenish-gray pebbly sandstone, irregularly bedded	10	0
12. Red marl or argillaceous shale not well exposed	23	0
13. Reddish-gray and gray arenaceous shale and flaggy sandstone	3	6
14. Gray fine sandstone. Possibly No. 51 of Section IV.	5	0
15. Greenish-gray arenaceous shale, passing in part into red argillaceous shale	1	0
16. Gray and rusty fine sandstone with a few small pebbly patches at the bottom	10	0
17. Greenish-gray conglomerate; passes into pebbly sandstone	3	0
18. Greenish-gray pebbly sandstone	4	0
19. Greenish-gray and reddish argillaceous shale	4	0
20. Gray fine sandstone with coal-pipes, very irregularly bedded towards the top	12	6
21. Greenish and reddish argillaceous shale in alternate layers with harder flags	6	0
22. Greenish argillaceous shale and fine sandstone	4	0
23. Rusty-gray pebbly sandstone in irregular beds; coal-pipes and lenticular layers of argillaceous shale	25	0
24. Red argillaceous shale	7	0
25. Reddish-gray argillaceous sandstone	3	6
26. Red marl with a few greenish streaks	9	0
27. Rusty-gray pebbly sandstone; many fossil plants in some layers	10	0
28. Greenish-gray argillaceous shale	1	6
29. Rusty-gray pebbly sandstone as above	11	0
30. Red argillaceous shale and flags with greenish blotches at the bottom	9	0
31. Greenish and gray argillaceous sandstone in one layer	1	0

		Ft	In.
32.	Rusty-gray fine flaggy sandstone	5	0
33.	Greenish and gray argillaceous flags	2	6
34.	Red argillaceous shale; passes into rusty sandstone.	2	0
35.	Greenish fine sandstone	17	0
36.	Reddish argillaceous shale	5	0
37.	Greenish-gray shaly sandstone	4	0
38.	Red argillaceous shale	6	0
39.	Greenish arenaceous shale and sandstone, with prostrate trees and small lenticular layers of greenish argillaceous shale	20	0
40.	Red argillaceous shale and flags; passes into rusty sandstone with prostrate trees	1	6
41.	Greenish, fine, evenly-bedded arenaceous flags	2	0
42.	Red and greenish argillaceous shale and flags	1	6
43.	Greenish argillaceous shale and flags	3	0
44.	Rusty-gray, pebbly, thick-bedded sandstone with prostrate trees and patches of conglomerate	85	0
45.	Red argillaceous shale with greenish bands and streaks. The debris of the bank here obscures the section so that the thickness given for 44 may be too great	20	0
46.	Reddish sandstone	4	0
47.	Red argillaceous shale	5	0
48.	Reddish-gray fine sandstone	3	0
49.	Red argillaceous shale	5	0
50.	Reddish sandstone with green spots	2	0
51.	Red argillaceous shale	2	0
52.	Red sandstone	3	0
53.	Red argillaceous shale	5	0
54.	Red sandstone	2	0
55.	Red argillaceous shale	2	0
56.	Reddish sandstone	3	0
57.	Red argillaceous shale	1	0

	Ft.	In.
58. Reddish sandstone and argillaceous shale in alternate beds	12	0
59. Greenish-gray flaggy sandstone and argillaceous shale	2	0
60. Rusty-gray, thick-bedded, very fine sandstone with a thin layer of argillaceous shale	5	0
61. Greenish-gray argillaceous shale	2	6
62. Very rusty fine and pebbly sandstone, passing into a mixture of gray conglomerate and sandstone	22	0
63. Red argillaceous shale	8	0
64. Gray pebbly sandstone with patches of conglomerate	5	0
65. Greenish-gray conglomerate with patches of fine sandstone	15	0
66. Greenish-gray, coherent, thick-bedded sandstone	15	0
67. Measures concealed with perhaps one or more breaks. Dip S. 80° W. < 16°	22	0
68. Greenish and rusty sandstone in a cliff	50	0
69. Reddish argillaceous shale and sandstone	25	0
Total thickness	310	0

Beds 68 and 69, instead of belonging to the base of the section, may be a repetition of some of those above. Several downthrows to the northeast then seem to repeat others, but are perhaps counterbalanced by faults with downthrow to the southwestward.

Ninety yards northeastward from the outcrop of 69, after two little downthrows have brought the red shale upon the beach, the gray sandstone (68) is in the cliff to a height of forty feet as before, the reefs striking apparently along the shore. About 275 yards farther east, red rock is capped in the cliff by gray and rusty sandstone, and at 140 yards still farther northeast is brought against greenish and gray sandstone by a fault. These latter are almost certainly the beds 45 to 58 of Section IV.; and the succeeding strata are those of Section III.

The direction of the line of fault is N. 53° W., with downthrow to the southwestward. At the last reefs, 225 yards west of the mouth of Sand Brook, the dip is S. 61° E. <15° to 22° near the landwash and N. 77° E. <10° farther seaward.

Ignoring faults, the strata west of Sand River appear to overlie those on the east side and may represent some of those between Sand Cove and Shulie. And unless there is a fault, the uppermost beds of the Pudsey Point section must be near, or repeat the lowest strata of Hetty Point. It may therefore be possible from the measurements to shew the entire section from Shulie to Spicer Cove.

On the west side of Sand River the first rocks exposed dip N. 80°-83° E.< 21°, and their section is as follows:

Section VI.

WEST OF SAND RIVER,

In descending order.

	Ft.	In.
1. Gray fine sandstone with layers of dark-gray argillaceous shale; coal-pipes. Dip N. 82° E. <21°. At water-level 250 yards southwest of the end of the road to the beach	10	0
2. Gray, coarse, pebbly grit with layers of gray sandstone, full of carbonized plants	11	0
3. Red and green mottled argillaceous shales	0	10
4. Light gray fine sandstone	7	0
5. Dark bluish-gray argillaceous shale, lenticular	0	6
6. Light-gray and greenish-gray fine sandstone, in thick irregularly jointed beds, with a few pebbly patches of grit, coarser at the bottom; for the most part very massive	49	0
7. Greenish argillaceous shale. Dip S. 15° E. <9°	0	9

A fault, the direction of which is S. 5° W. and the dip apparently S. 85° E.< 85°, seems to pro-

		Ft.	In.
	duce this change of dip from east to south. A thin band of red and greenish argillaceous shale on the east side is lost against the sandstone on the west, and the amount of the fault may be more than 20 feet, for nothing is seen of the shale on top of the bank. Usually at these faults very little of the rock is turned on edge, the course being marked only by a quantity of soft clay or "gouge"; but here a block of 10 feet seems to have been dropped off the gray sandstone on the west side. This fault shows in the cliff 150 yards southwest of the first rocks, or 400 from the end of the road to the beach on the southwest side of Sand River.		
8.	Red argillaceous shale. A two feet fault with a nearly vertical upthrow on the west side.....	19	0
9.	Gray and cream-colored, massive, fine sandstone...	9	0
10.	Greenish and gray coarse grit; cut out at one point and nearly all replaced by red argillaceous shale at a pillar-rock	22	0
11.	Greenish and reddish argillaceous shale, replaced on the strike by sandstone	2	0
12.	Reddish and greenish, mottled, argillaceous sandstone	6	0
13.	Gray, coarse, pebbly grit and conglomerate.....	16	0
14.	Red fine sandstone and argillaceous shale, replaced in part at the bottom by gray sandstone.....	10	0
15.	Gray and greenish fine and coarse sandstone in thick beds, with thin lenticular patches of pea-and-nut conglomerate; coaly streaks associated with the coarser patches and some finer bands of gray arenaceous shale are full of broken carbonized plants. The bottom of the upper ten feet of this band is at water-level at the mouth of the Mile Brook, the lower, at the next little brook quarter of		

	Ft.	In.
a mile further west. On the strike there are of course many changes. The upper part is in places fine arenaceous shale and at the mouth of this second brook patches of conglomerate contain pebbles of gray, fine, micaceous sandstone and shale almost certainly newer than Devonian. The bedding is very irregular and also the lenticular layers of conglomerate and greenish shale	77	0
16. Red argillaceous shale with greenish blotches.....	9	0
17. Greenish and reddish mottled argillaceous and arenaceous rock	5	0
18. Gray sandstone like No. 15, the upper part being in places fine wavy arenaceous shale. Nearly all the pebbles of the conglomerate are of Pre-Carboniferous rocks, the layers varying from six feet to two inches in thickness	55	0
19. Dark bluish-gray argillaceous shale, with bands of dark-reddish shale and lenticular layers of greenish very fine sandstone and shale; an upright *Calamite* with the bark converted into coal. The overlying sandstones are very rusty and full of broken carbonized plants	10	6
20. Gray and rusty fine massive sandstone, jointed at right angles to the bedding; pebbly patches and lenticular layers of dark shale	23	0
21. Rusty nut-and-egg conglomerate with pebbles up to three inches in diameter. Thicker in places, the sandstone cutting it out	4	6
22. Red argillaceous shale with bands of light gray and greenish very fine, coherent sandstone	25	0
23. Light gray very fine sandstone, with thin layers of red and gray argillaceous shale	15	0
24. Red argillaceous shale interbedded with reddish fine sandstone	13	0

	Ft.	In.
25. Red crumbly argillaceous shale	7	0
26. Dark reddish and gray argillaceous flags	4	6
27. Gray fine massive sandstone, with lenticular patches of reddish and dark shale	6	6
28. Bluish-gray rubbly argillaceous shale	2	0
29. Red argillaceous shale with greenish-gray blotches and reddish sandstone in regular layers	14	6
30. Gray and cream colored fine flaggy sandstone	5	0
31. Red argillaceous shale with blotches and thin layers of greenish and gray shale	5	0
Total thickness	424	7

The dip, S.<41°, now takes the rocks out to sea and they are repeated on the shore from the bottom of No. 29, but reversed in the following section:

Section VII.

ROCKS REPEATED ON THE SHORE SOUTHWEST OF SAND RIVER,

In descending order.

1. Coal in layers with pyrite, about fifteen feet long. It ends at a two feet fault with an upthrow on the left side, followed by a much larger fault, apparently a similar upthrow, which brings up the shale No. 3, the upper part of which is here red. No. 3 comes to the water level at a brook of some size, where the overlying sandstone contains lenticular bands of argillaceous shale. A little further west, behind a narrow point, there is another brook, at which again the dark shale is at water-level, but a short distance further it is replaced by pebbly sandstone, the whole cliff probably two hundred feet in height, being composed of pebbly sandstone dipping at a low angle	0	4

	Ft.	In.
2. Gray and greenish-gray and rusty massive sandstone with coal-pipes of large size; more or less pebbly. In some places sandstone occupies the whole height of the cliff, but in other places it shows a few inches of argillaceous shale	18	6
3. Greenish-gray and gray, rusty-weathering, somewhat rubbly argillaceous shale	10	0
4. Gray thick-bedded sandstone containing patches of conglomerate and a prostrate tree eight feet in length. The lowermost forty feet come to the water-level at the mouth of Two Mile Brook, where there are exposed overlying beds which dip S. 5° E. < 30°, and give a total thickness of 105 feet to the old dam at the head of the cove. Certain layers are coarse and pebbly, others fine and shaly, but none are fit for building stone, containing very irregular concretions. On the right bank of this brook there is a lenticular layer of greenish-gray argillaceous shale, five feet thick, overlaid by conglomerate and underlaid by fine sandstone, some of which, about eighty feet from the bottom of the mass, is of good grindstone grit. On the opposite bank some of the beds turn to red shale, but only for a few feet. There is a very persistent band of ten feet of this shale with reddish-gray sandstone. Below this horizon the rocks to the southwest change largely into conglomerate, the coast nearly following the strike of the rocks	105	0
5. Dark-gray argillaceous shale. Here occurs a downthrow on the west side, of considerable amount, at a tiny brook. None of the measurement is, however, lost	3	0
6. Red argillaceous shale and sandstone in alternate bands	25	0

	Ft.	In.
7. Greenish-gray argillaceous shale	3	0
8. Rusty-gray coarse pebbly sandstone, with finer layers and lenticular patches of conglomerate	50	0
9. Bluish-gray argillaceous flag, with concretionary arenaceous "bulls-eyes"	12	0
10. Gray and greenish and rusty pebbly sandstone; passes in part into conglomerate and contains lenticular patches of conglomerate and argillaceous shale	37	0
11. Rusty-gray nut-and-egg conglomerate. No. 21 of last section	4	6
12. Red sandstone and shale with greenish and gray layers and a lenticular layer of dark arenaceous shale	20	0
13. Greenish-gray and rusty fine sandstone. A 10-feet downthrow on the west side	10	0
14. Red sandstone and argillaceous shale in alternate layers	25	0
15. Red marl	10	0
16. Dark gray and greenish argillaceous shale	0	6
17. Reddish argillaceous sandstone	4	0
18. Gray, very fine sandstone	5	0
19. Bluish-gray argillaceous shale	1	6
20. Gray and greenish argillaceous shale, with pebbly patches	5	0
21. Red shale and light-gray and greenish fine sandstone, in alternate layers. No. 29 of previous section	14	0
Total thickness	363	4

Section VIII.

DESCENDING BELOW NO. 3 OF LAST SECTION.

1. Gray pebbly sandstone of the usual character	20	0
2. Dark-gray argillaceous shale in a lenticular band ranging from ten feet to one inch	5	0

	Ft.	In.
3. Gray sandstone, fine on top but becoming pebbly below. 38 feet of this sandstone comes to water-level at the next little brook. With so much sandstone the measurement of some parts of the section is incorrect no doubt, but the bedding is usually plain	50	0
4. Red argillaceous shale with bluish and greenish layers; replaced by gray coarse pebbly sandstone.	5	0
5. Gray pebbly sandstone. In places the layers of shale are thicker and contain bands of gray fine sandstone	7	0
6. Greenish and reddish argillaceous rubbly rock; also replaced by gray sandstone	4	0
7. Rusty-gray or cream-colored fine sandstone, passing into coarse sandstone and intermixed with pebbly layers. In places it turns nearly all into nut-and-egg conglomerate. Lenticular layers sometimes six inches thick and ten feet long, show alternate bands of impure coal and pyrite. At ninety feet there is a landing place. Here the rocks are largely conglomerate and in certain bands this assumes a reddish tint as well as in patches of the finer sandstone. Some of the pebbles are of brick-red sandstone, others, of greenish-gray and gray micaceous sandstone, like Carboniferous. The lower part is very rusty and full of veins and blotches of coal	95	0
8. Greenish-rubbly argillaceous shale with red patches and layers	4	0
9. Gray-flaggy argillaceous sandstone with a lump of coal near the top	5	0
10. Greenish-gray and cream-colored alternations of fine sandstone, pebbly sandstone, and pea-and-nut conglomerate with larger pebbles; coal streaks and pipes	22	0

	Ft	In.
11. Reddish argillaceous shale. Al these bands are lenticular	5	0
12. Greenish-gray argillaceous shale. Thickens to the westward	2	0
13. Gray and rusty sandstone and conglomerate, irregularly mixed. This is on the strike for some distance, then the overlying No. 12 comes to the water-level. The top of No. 10 is at the water-level at the first little brook in Birch Cove. Here bands that represent Nos. 8 and 9 are, however, Indian-red, the material being still sandstone and conglomerate. Then rocks of a bright red color overlie to a height of fifty feet. Dip S. 47° W.< 20°	35	0
Total thickness	259	0

The top of 110 feet of reddish and gray sandstone and conglomerate, for the most part red, with coal-pipes, and veins of barytes in the joints, overlying No. 13, comes to the water-level at the second little brook in Birch Cove.

From this point 60 yards west, a large brook empties and a little brook comes into it. The brook turns from S. 15° W, the shore runs N. 53° W. to a headland, then trends more westerly. The top of the following descending section here comes to the water-level, probably about 13 feet below the top of the 110 feet above mentioned or 97 feet over No. 13.

Dip on the southeast side of the cove S. 8° W. < 14°.

Dip on the northwest side of the cove S. 60° E. < 12°; S. 24° to 17° E < 14° to 16° (mean dip S. 34° E. < 14°).

Section IX.

FROM BIRCH COVE WESTWARD TO HETTY POINT,

In descending order.

1. Gray and greenish-gray pebbly sandstone and conglomerate with thin lenticular layers of Indian-red conglomerate	52	0

	Ft.	In.
2. Greenish-gray, dark-bluish-gray and reddish argillaceous shale, the dark portions full of fossil plants	12	6
3. Gray and rusty fine sandstone, full of broken plants and having a one-inch lenticular layer of coal, sometimes in the bedding, sometimes in the joints	9	0
4. Greenish and bluish-gray pea-and-nut conglomerate	11	0
5. Gray and cream-colored pebbly sandstone, fin sandstone and conglomerate, a large proportion of which is conglomerate. It passes on the strike into Indian-red conglomerate, resembling that of Polly Brook and the Morang River, and soon it all turns to Indian-red. Many of the pebbles are as large as a cocoanut. Where coal-pipes are seen the rock is rusty and gray. Dip S. 21° E.< 15° . .	90	0
6. Gray fine flaggy sandstone with a nine-inch lenticular layer of greenish-gray argillaceous shale . .	6	6
7. Red argillaceous shale or marl. These beds are all lenticular and thin out	5	0
8. Mottled red and green argillaceous shale	2	0
9. Greenish and gray coarse grit and nut-and-egg conglomerate	45	0
10. Red argillaceous shale with greenish layers, cut out to form a fine cave behind a bluff	2	6
11. Red, rubbly, more coherent flag	0	11
12. Reddish sandstone with greenish blotches	0	10
13. Gray and greenish, fine, massive sandstone with broken plants	4	10
14. Gray and rusty fine sandstone, the upper surface of which is spotted with prostrate plants	3	0
15. Rusty-gray pea-and-nut conglomerate with layers of sandstone, the latter being blackened with carbonized plants. Veins of coal lie at various angles to the bedding, seldom exceeding half an inch in thickness. The gray sandstone is in very irregular		

	Ft	In.
wedges. Some of the pebbles are three inches in diameter; they consist chiefly of various gray Devonian rocks, but among them there are finer soft micaceous bluish-gray sandstone and shales, apparently derived from Carboniferous strata. Twenty feet to high water-level at the bluff about half a mile from Birch Cove Brook; and thirty-five feet to the bottom of the same cliff, but all cut out behind back to the band of red shale. Several fine prostrate trees occur, and on the strike some of these rocks turn again Indian or brick-red, although for the most part they are gray and rusty	12	0

The overlying band thins out, but again takes up in an attenuated form in a few places, the rocks following the coast for a great distance on the strike. The line of the red band (10 to 12) is occupied by a definite bedding-joint, into which lenticular small patches of argillaceous shale sometimes come, while above it about twenty feet and in other parts of the high cliff, there are thin layers of argillaceous shale.

Nearer McCarren Cove, the finer bands have a tinge of reddish or brown, and are nearly all pebbly. Further along, parts of the fine beds become fit for grindstone, the red bands in the cliff retaining their horizontal position, so that there is absolutely no doubt that this part of the section is on the strike. Dip not far from the cove, S. 23° E. $<15°$, S. 7° E. $< 4°$ to 18°. The section here below No. 9 is as follows:

1. Greenish-gray sandstone and argillaceous shale	2	9
2. Greenish-gray argillaceous shale with two layers of clay	1	6

	Ft.	In
3. Greenish-gray and reddish rubbly argillaceous sandstone	3	2
4. Reddish argillaceous shale with a lenticular layer of fine greenish sandstone	1	5
5. Red and green fine flags	2	6
6. Greenish and reddish very fine sandstone, in flaggy beds fit for grindstone, probably a part of No. 15 but very different in texture	2	8
7. Light gray very fine massive sandstone with pebbly patches, but no coarse layers	45	6

Beyond the bluff at which this section ends, conglomerate is again cut out in a cove, but the red band reappears on the next point, where the underlying sandstone is, however, somewhat pebbly, but only in places, for on the whole there is a distinct improvement in the texture. On the point west of Birch Cove the thickness of the sandstone was found to be forty-seven feet; on the next headland, forty-five feet six inches as above, whereas on the point near McCarren Cove, the lower part has turned into the section as continued below:

	Ft.	In
16. Red argillaceous shale	0	9
17. Greenish-gray argillaceous shale, with thin lenticular layers of greenish arenaceous rock	5	0
18. Clay parting	0	2
19. Greenish-gray arenaceous shale passing at the bottom into greenish, coarse, pebbly sandstone, with coal veins, two inches and downward, in gashes in the rock	10	0
20. Gray sandstone of fine texture almost fit for grindstone, but with pebbly patches in some of the massive layers. The lower part passes into conglomerate	15	0

	Ft.	In.
21. Gray conglomerate with lenticular patches of fine sandstone; all very coarse, some of the pebbles being three inches in diameter. Dip S. 5° to 9° W. <7° to 8°	6	0
22. Gray sandstone in thick layers, of fine grit but with pebbles. In texture the rocks generally resemble those of River John	12	0
23. Greenish-gray conglomerate	1	6
24. Gray fine sandstone of uniform texture, with very few pebbles	4	0
25. Measures concealed. Dip S. 34° to 33° E.	6	3
26. Gray or brownish sandstone seen only on the reefs; pebbles scattered throughout the mass and with some beds of conglomerate. Not all exposed, but seen in frequent reefs across McCarren Cove. Dip S. 34° E. < 16°.	265	0
27. Gray pebbly sandstone in thick beds. The first rock of the cliff north of McCarren Cove	15	0
28. Rusty-gray sandstone; irregular layers of pea-and-nut conglomerate; coal-pipes and veins	31	0
29. Reddish and greenish lenticular argillaceous shale, replaced entirely at both ends by the sandstone and containing layers of sandstone	9	0
30. Light gray sandstone, in thick beds, with a few pebbles. Some beds have a reddish tinge and some are fit for grindstones. Other small lenticular replacements occur. A very large proportion of the lower beds on the outer shore is of fine grain and without pebbles. At the first point, a thickness of forty-five feet is exposed, then higher beds appear in a rough cove. Dip, about the middle of the point, S. 45° E. < 12°; in places large regular flags break out and the bottom becomes more shaly	70	0

	Ft.	In
31. Red argillaceous shale with bands of reddish arenaceous shale; layers of greenish or whitish-gray calcareous, fine sandstone and of bluish-gray shale in a deep little cove	50	0
32. Greenish and rusty-gray fine grained arenaceous shale and sandstone, with carbonized plants; cut into long blocks by irregular joints; some pebbly patches occur towards the bottom, but the fine beds greatly predominate. Changes in the lower part into Indian-red sandstone like that of Birch Cove	68	0
33. Red argillaceous shale with greenish thin bands	15	0
34. Indian or brick-red fine sandstone with pebbly patches containing layers of arenaceous shale, precisely like the greenish and gray varieties except in color; shows the usual whitish and greenish blotches of the red rocks. At the lighthouse on Hetty Point, the red layers are underlaid by gray or brown, and these latter replace certain beds on the strike	58	0
35. Greenish-gray and rusty fine sandstone with very few pebbles, generally in thick beds, some patches very rusty; in part concertionary, with "bulls-eyes"; many of the beds have wavy lines. Certain layers at the bottom turn into red. Almost the whole thickness may be said to lie below high water on Hetty Point and to extend to the lowest point seen on the reefs	140	0
Total thickness	1038	9

The beds now rise on the right bank of Apple River. They appear to be but very little higher than the strata of the following section at Pudsey Point on the opposite side of the river, or may represent a portion of the latter.

Section X.

AT PUDSEY POINT AT THE MOUTH OF APPLE RIVER,

In descending order.

		Ft.	In.
1.	Gray sandstone, with a few pebbles	5	0
2.	Greenish-gray conglomerate with occasionally a tinge of red; pebbles six inches and downward, the matrix always of coarse grit; small lenticular masses of finer rock	15	0
3.	Red argillaceous sandstone with greenish streaks	1	6
4.	Dark-gray, fine, flaggy sandstone with layers of dark argillaceous shale, in part almost carbonaceous shale	5	0
5.	Reddish fine sandstone mixed with conglomerate and in part replaced by the dark sandstone; streaks of coal at the bottom	5	0
6.	Reddish conglomerate with lenticular layers of reddish shaly sandstone	10	0
7.	Reddish sandstone, with lenticular layers of dark bluish-gray shale	5	0
8.	Reddish somewhat finer conglomerate	6	0
9.	Reddish and dark-gray and greenish argillaceous sandstone and shale, in lenticular irregular beds, all of which pass into conglomerate	8	0
10.	Reddish nut-and-egg conglomerate	7	0
11.	Reddish and greenish-gray, rubbly, very fine sandstone and argillaceous shale	12	0
12.	Reddish and gray conglomerate	5	0
13.	Greenish-gray and reddish sandstone and argillaceous flags	10	0
14.	Gray, fine, flaggy sandstone	3	0
15.	Reddish and gray sandstone with beds of bluish-gray argillaceous shale	2	6

		Ft.	In.
16.	Reddish, coarse, thick-bedded sandstone	4	6
17.	Greenish argillaceous shale	1	0
18.	Reddish, coarse sandstone, with partings of argillaceous shale	7	6
19.	Greenish-gray argillaceous shale	3	0
20.	Greenish-gray and rusty conglomerate, replaced by No. 19 and again passing into reddish conglomerate; thin layers of reddish sandstone. The bottom is at water-level on the beach at a pillar-rock	11	0
21.	Reddish and greenish sandstone and argillaceous shale in a lenticular layer	4	6
22.	Reddish conglomerate with thin layers of arenaceous shale and sandstone	7	0
23.	Rusty arenaceous shale with reddish argillaceous and arenaceous shale	6	0
24.	Red argillaceous shale with layers and blotches of reddish and greenish mottled sandstone	11	0
25.	Reddish pea-conglomerate, with finer layers; passes into greenish conglomerate	10	0
26.	Greenish and reddish flaggy argillaceous sandstone; lenticular	4	0
27.	Reddish conglomerate with thin layers of reddish arenaceous shale and sandstone; passes into greenish conglomerate	7	0
28.	Brick or triassic-red sandstone, of very coarse grit, in thick beds; changes into conglomerate	5	0
29.	Reddish and greenish flaggy fine sandstone and argillaceous shale	5	6
30.	Light gray, pebbly sandstone, changing into greenish gray arenaceous shale, spotted with plants	4	0
31.	Measures concealed. Dip S. 31° E. $< 8°$. Reefs of greenish-gray arenaceous shale in place at intervals	21	6
32.	Greenish-gray arenaceous shale and sandstone, of fine texture, seen on the reefs but not in the cliff	10	0

	Ft.	In.
33. Gray flaggy sandstone and arenaceous shale with a few pebbles	4	6
34. Greenish-gray conglomerate	5	0
35. Greenish-gray argillaceous shale and sandstone	4	0
36. Greenish conglomerate, with pebbles more than six inches in diameter	5	0
37. Greenish and reddish argillaceous shale and sandstone	5	0
38. Greenish, pebbly sandstone in one bed; changes into conglomerate	2	0
39. Greenish conglomerate	4	0
40. Greenish and dark-gray argillaceous shale and sandstone	5	0
41. Greenish-gray fine conglomerate	4	6
42. Greenish-gray arenaceous and argillaceous shale	5	0
43. Rusty, knobby sandstone and greenish, pebbly sandstone and conglomerate, full of rusty concretions	12	0
44. Red argillaceous shale with greenish and bluish-gray layers	7	0
45. Measures concealed	5	0
46. Light gray sandstone of fine grindstone grit; some flaggy layers; has been quarried on Pudsey Point.	14	0
47. Rusty and cream-colored and gray conglomerate and sandstone in irregular beds	12	0
48. Gray shale and flaggy sandstone	6	6
49. Gray fine sandstone in part fit for grindstones, but in places of coarse grit	5	0
50. Light gray and rusty arenaceous shale, in part pebbly. Dip S. 83° to 65° E. < 8° to 11°	6	0
51. Measures concealed by a sand beach, but showing on the reefs rocks similar to the above, a reddish grit about 48 ft. 6 inches from the top, and a band of greenish-gray conglomerate immediately overlying No. 52.	74	0

		Ft	In.
52.	Greenish arenaceous shale and sandstone with patches of fine grit. Dip S. 83° E.< 7°	5	0
53.	Bluish-gray argillaceous shale full of plants	0	6
54.	Greenish-gray argillaceous sandstone with a few plants	2	0
55.	Red argillaceous shale with green spots. These shale beds change to the westward	1	6
56.	Greenish-gray, very fine massive sandstone, passing into red and green argillaceous shale on the strike	1	6
57.	Reddish and greenish mottled argillaceous shale	1	10
58.	Greenish-gray fine sandstone with reddish spots and layers of arenaceous shale, passing into greenish conglomerate. These rocks are all regularly bedded. A fault throws them down five feet on the south side	7	0
59.	Dark gray, rubbly, argillaceous shale	3	0
60.	Greenish-gray sandstone with small patches of fine conglomerate; becomes finer on the strike. On the whole the beds are argillaceous	7	4
61.	Dark gray argillaceous shale	1	6
62.	Greenish-gray, fine, flaggy, argillaceous sandstone	6	0
63.	Greenish and dark-gray argillaceous shale	2	4
64.	Clay with an eighth of an inch of coal	0	6
65.	Greenish argillaceous shale	3	0
66.	Greenish-gray, coarse, pebbly sandstone with patches of conglomerate; replaced by lenticular argillaceous shale	10	0
67.	Red argillaceous shale with layers of reddish and mottled sandstone. An upthrow of four feet six inches on the south side	15	0
68.	Greenish-grav fine conglomerate and pebbly sandstone, with coarser layers at the base	10	0
69.	Greenish and gray, rubbly argillaceous shale and flags	10	0

	Ft.	In.
70. Gray and rusty and greenish nut-and-egg conglomerate	8	0
71. Red argillaceous shale	3	0
72. Gray and greenish flaggy sandstone	9	0
73. Gray and greenish and rusty, pebbly sandstone and grit	5	0
74. Reddish argillaceous shale with greenish layers, but essentially red	14	0
75. Greenish sandstone in one bed, replaced on the strike by shales and flags	1	4
76. Red argillaceous shale ,with layers of reddish sandstone	17	0
77. Greenish wavy sandstone and arenaceous shale	3	6
78. Cream-colored or rusty very fine sandstone, somewhat concretionary, like certain layers seen on Pudsey Point and also on Hetty Point; irregularly jointed and all fine. A vein of coal at the bottom, one inch thick, in an irregular joint	11	0
79. Nut-and-egg conglomerate	5	0
80. Gray, pebbly sandstone	2	4
81. Measures concealed. Reefs and broken banks of gray and greenish fine sandstone occasionally seen, from which, about the middle of the gap, grindstones have been cut; dip S. 56° E. < 7°	148	0
82. Greenish arenaceous shale	5	0
83. Rusty-gray pebbly sandstone, with concretionary "bulls-eyes" at the top. Very like certain rocks of Hetty Point	12	0
84. Dark or Indian-red pebbly sandstone, like that of Hetty Point; contains small patches of conglomerate	6	0
85. Greenish-gray, wavy, arenaceous shale, blackened in the bedding by plants, sometimes of large size	6	0
86. Red argillaceous shale	5	0

		Ft.	In.
87.	Reddish or pinkish sandstone like that of Hetty Point; patches of conglomerate; in thick layers, sometimes flaggy	25	0
88.	Indian-red argillaceous shale and flaggy fine sandstone	7	0
89.	Greenish-gray, wavy arenaceous shale, passing into fine sandstone	5	0
90.	Rusty or cream-colored fine, thick-bedded sandstone	4	6
91.	Greenish-gray and dark-gray argillaceous shale, mottled with red	7	0
92.	Reddish-gray and greenish, very fine argillaceous sandstone, changing at the bottom into gray sandstone in flaggy layers and on the strike into massive sandstone	15	0
93.	Red argillaceous shale with bands of greenish and gray sandstone	15	0
94.	Dark-gray argillaceous shale with films and streaks of coal	1	0
95.	Light-gray underclay with *Stigmaria* rootlets	1	6
96.	Red argillaceous shale changing into sandstone	1	0
97.	Gray and dark-gray fine sandstone and arenaceous shale, full of plants	12	0
98.	Dark-greenish-gray argillaceous shale	4	6
99.	Red argillaceous shale changing into red sandstone	4	6
100.	Dark-gray and greenish argillaceous shale	2	0
101.	Reddish-gray and mottled, arenaceous flags and sandstone	6	6
102.	Greenish and dark-gray argillaceous shale	1	6
103.	Red argillaceous shale with greenish layers and lenticular bands of fine sandstone	10	0
104.	Gray and pinkish, fine and coarse sandstone, in thick, irregular, jointed beds; pebbly patches, the pebbles being nearly all of syenite	25	0

	Ft.	In.
105. Reddish-gray nut-and-egg conglomerate, among the pebbles of which are some of gray sandstone, containing plants and perhaps Carboniferous, although the greater number are of red syenite, porphyritic felsite and various Devonian quartzites. Gray patches show carbonized markings of stems of plants	14	0
106. Pinkish and triassic-red, coarse sandstone, with pebbly patches; forms the great cape north of Spicer Cove. Dip S. 41° E.< 12°. The strike would apparently run the rocks against the conglomerate cliffs of the opposite side of the cove, which they appear to represent. Fine reddish sandstone and grit almost entirely replace the coarser beds on the strike. The lower 33 feet are repeated and the measures are then concealed by the beach of Spicer Cove	55	0
107. Measures concealed		
Total thickness	974	2

On the low shore northeast of the mill at Spicer Cove, several good reefs seem to indicate a continuity of low southerly dips between the cliff exposures and, consequently, an absence of faults. If there is no important fault, the measures of the following section may be a repetition of the rocks below No. 80 of Section X.

Section XI.

AT SPICER COVE,

In descending order.

1. Gray sandstone	7	0
2. Greenish, reddish and dark-gray argillaceous shale, not well seen	6	0
3. Bluish-gray, coherent, argillaceous shale	1	6

		Ft.	In.
4.	Dark-bluish-gray, coaly shale	0	6
5.	Bluish, greenish and reddish argillaceous flags	6	0
6.	Dark-greenish-gray, rubbly argillaceous flags	3	0
7.	Blackish coaly shale	0	4
8.	Greenish argillaceous sandstone	1	0
9.	Greenish argillaceous shale	0	6
10.	Greenish argillaceous sandstone in flaggy layers	8	0
11.	Coal, lenticular, with an underclay. A fault with an upthrow of two feet on the south side	0	1
12.	Red and green mottled fine sandstone	1	6
13.	Reddish and greenish mottled argillaceous shale. An upthrow of five feet on the south side	0	8
14.	Greenish, fine, flaggy sandstone	8	6
15.	Dark-gray argillaceous shale and flag, almost a coal at the top	0	10
16.	Black coaly shale	0	2
17.	Greenish and reddish, mottled argillaceous shale	7	0
18.	Light gray fine sandstone	3	0
19.	Greenish argillaceous flags and shales	1	6
20.	Dark gray shale, coaly in places	1	0
21.	Black coaly shale yielding a dark streak	0	4
22.	Bluish-gray argillaceous shale	0	8
23.	Black coaly shale	0	1
24.	Dark, greenish-gray and rusty argillaceous underclay	1	0
25.	Gray and greenish, very fine sandstone, broken in the bank and perhaps faulted	1	6
26.	Reddish and greenish, mottled, somewhat coherent argillaceous rock	2	0
27.	Dark-greenish argillaceous shale with coaly layers	1	0
28.	Light gray wavy arenaceous shale and sandstone; an underclay with fine *Stigmaria*	2	0

The rocks are now obscured by a broken, faulted bank on a northeast and southwest roll

or anticline. About 60 yards to the westward there is the following section:

1. Olive-green massive sandstone	3	6
2. Dark argillaceous shale and bands of sanstone with large erect trees....	8	0
3. Dark argillaceous sandstone	5	0
4. Dark coaly shale	0	3
5. Dark-gray fine sandstone	0	6
6. Black coaly shale, in part clean coal.	0	4
7. Dark-gray argillaceous underclay....	1	4
8. Black coaly shale, passing into greenish argillaceous shale	0	6
9. Greenish arenaceous underclay passing into sandstone	2	0
10. Dark-green argillaceous shale	3	0
11. Measures concealed	1	10
12. Greenish-gray coherent arenaceous shale	3	0
Total thickness	29	3

About 55 yards to the westward and perhaps separated from the foregoing by a fault, the following beds occur:

1. Greenish and reddish argillaceous shale with layers of sandstone	14	0
2. Coaly band	0	3
3. Dark greenish shale with veins of coal.	1	6
4. Greenish coherent sandstone	0	4
5. Red argillaceous shale. Perhaps No. 26 of Section XI.	2	0
Total thickness	18	1

At 70 yards farther west these broken sections end at a great cliff of conglomerate. They are perhaps a repetition of the beds of Section XI

	Ft.	In.
below No. 13, and No. 28 may rest directly upon the conglomerate, in which case that section may be continued as follows:		
29. Red conglomerate with veins of barite and celestite near the top; its material is for the most part of syenite, and it is associated with red, thick, fine layers. The thickness here given is taken from the boring drilled by Mr. J. A. Johnson. (See Section XII.)	811	6
30. Red syenite of Devonian age, or more generally an obscurely granular and compact felsite and quartz-felsite, hornblende being scarce except in dykes and blotches of dark diorite, seldom more than ten to fifteen feet wide. An epidote breccia occurs near the contact of the conglomerate, and the felsite is so much brecciated as to resemble the conglomerate. These rocks in great cliffs occupy the coast south past Eatonville to Cape Chignecto, as shown on Sheet No. 100 (and 101) of the Geological Survey series of maps. A line of fault at the first beds of red conglomerate is indicated by the grooves as dipping N. 45° E.< 63°. First a little piece of the conglomerate is thrown on edge; then, further inland near a little brook from the south, the dark rocks with the black shale and coaly layers of No. 28 rest upon the conglomerate at a low angle apparently conformably. The thickness of the latter as given above is much greater than the height of conglomerate in the cliffs, overlying the syenite, and thus measures the downthrow of the fault at about 500 feet.		
Total thickness	878	2

The section of the boring referred to on page 545, is as follows:

Section XII.

J. A. Johnson's borehole at Spicer Cove,

In descending order.

		Ft.	In.
1.	Surface: reddish gravel and clay	8	0
2.	Light-gray fine sandstone	1	0
3.	Reddish coarse and fine rock	1	0
4.	Light greenish-grey fine compact sandstone	6	0
5.	Dark gray argillaceous shale with fossil plants	1	0
6.	Light grey and reddish mottled argillaceous shale	28	0
7.	Reddish sandstone	1	6
8.	Reddish nut-and-egg conglomerate	3	0
9.	Reddish fine micaceous sandstone	5	6
10.	Reddish conglomerate, coarse grit and sandstone	13	0
11.	Reddish micaceous sandstone	2	0
12.	Reddish conglomerate	1	0
13.	Reddish-grey argillaceous shale	0	8
14.	Black coaly shale and coal	0	8
15.	Greenish argillaceous shale with *Stigmaria* and rootlets	0	6
16.	Greenish-gray argillaceous shale	2	0
17.	Greenish-gray and reddish shale showing graphite	4	2
18.	Reddish argillacous shale with greenish blotches showing fossil plants	2	0
19.	Reddish-gray very hard sandstone	1	0
20.	Reddish conglomerate with thin bands of reddish and greenish coarse grit, fine sandstone and argillaceous shale, of gray sandstone and shale, and dark gray argillaceous shale with streaks of coal	811	6
21.	Reddish granitic rocks	50	3
	Total depth	943	9

A correlation of these sections seems to show that only about 498 feet of the base of Section IX at Hetty Point extend beyond the base of Section I (and II); that Sections IV, V and VI are wholly repeated in Section I, the general similarity of the strata of these four sections being evident.

A provisonal summary of the total thickness of strata from the uppermost Permian beds at Shulie River—the top of Logan's section—to the base at the Devonian syenite, south of Spicer Cove, may be given as follows:

	Feet.
Strata of Section I (Shulie to Sand Cove)	1769
" Section IX (Birch Cove to Hetty Point)	498
" Section X (Apple River to Spicer Cove)	793
" Section XI (Spicer Cove)	811
Total thickness exposed in coast section	3871

This conclusion, arrived at from comparison of the columnar sections, does not contradict the evidence obtained from a study of the dips, faults, etc., as may be seen on the accompanying maps, on which the position of the various sections has been laid down; but before accepting it, further comparison of the beds supposed to be equivalent might be made.

Of the rocks of the Upper Coal Formation on the opposite side of the basin, from Shulie toward Ragged Reef, Sir J. Wm. Dawson says:* "Fossils are not abundant; but *Calamites, Stigmaria, Lepidodendra* and large petrified trunks of the pine trees of the Coal Formation still appear. The general aspect of these beds is, to a great extent, similar to that of the Millstone Grit series."

And in regard to the strata of the base of the section the same writer observes: "At Mill Brook, southeast of Apple River, there is a bed of coal one inch in thickness, and dipping to the north at a small angle. It is associated with coarse sand-

*Acadian Geology, p. 155.

stones and conglomerate, and probably belongs to the Lower Coal Measures or Millstone Grit series, the marine limestones being apparently absent. At least this is the interpretation I should be inclined to put upon the appearances in connection with the fact that along the north side of the Cobequids, the marine Lower Carboniferous is either absent or overlapped by the higher beds of the series in all the localities which I have explored."

Note.—Besides the map accompanying these sections, the reader is referred to the Geological Survey's map sheets of Nova Scotia, Nos. 100 and 101, as well as to the forthcoming Nos. 81 and 102, with the bibliographies thereon given. The reader may also consult Sir William Dawson's *Acadian Geology*, pages 150-178, which treats of Logan's section.

ERRATA.

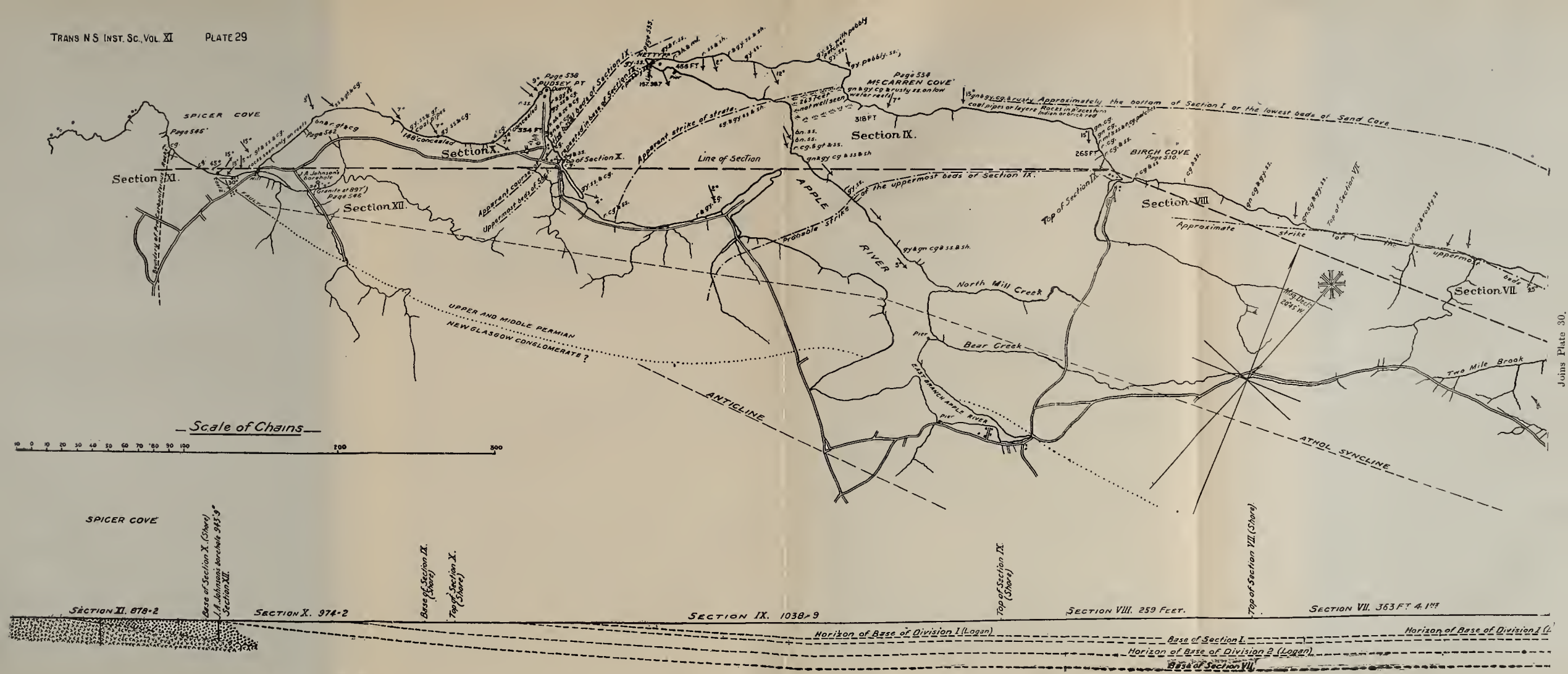
Page 420, lines 17 and 28, for "darb" read *drab*; p. 421, l. 21, for "reek" read *rock*; p. 426, last line, for "calamities" read *calamites*; p. 427, line 30, for "grav" read *gray*; p. 441, last line, "earbonaceous shale" should be in italics; p. 451, l. 27, for "carbonaceous shale 0·4" read *Carbonaceous shale 1·0*; p. 451, l. 28, for "witht" read *with*; p. 452, omit line 1, "Gray argillo-arenaceous shale, with *stigmariæ* (under-"; p. 452, l. 15, for "the turns" read *then turns*; p. 452, l. 19, for "groved" read *grooved*; p. 455, l. 23, indent "Gray" one "em"; p. 473, l 23, for "grenish" read *greenish*; p. 481, l. 22, for "no less 10" read *no less than 10*; p. 487, l. 2, for "desseminated" read *disseminated*; p. 489, l. 14, "Dark green limestone" should be in italics; p. 502, last line, add to "with sometimes large" the omitted word *trunks*, and carry out 5 ft. 6 in in column of figures; p. 505, l. 31, omit comma after "flaggy sandstone"; p. 514, l. 13, to make sense more clear, place full stop after word "section," and for "which" read *It*; p. 530, l. 1, for "al" read *all*; p. 531, l. 7, for "fin" read *fine*; p. 535, l. 22, for "concertionary" read *concretionary*; p. 543, l. 32, for "Stigmaria" read *Stigmariæ*; p. 546, l. 24, for "argillaeous" read *argillaceous*.

CONTENTS.

In order to assist the reader in consulting the foregoing geological sections, there given below a list of those sections and the place-names that are mentioned therein, with the pages on which they occur.

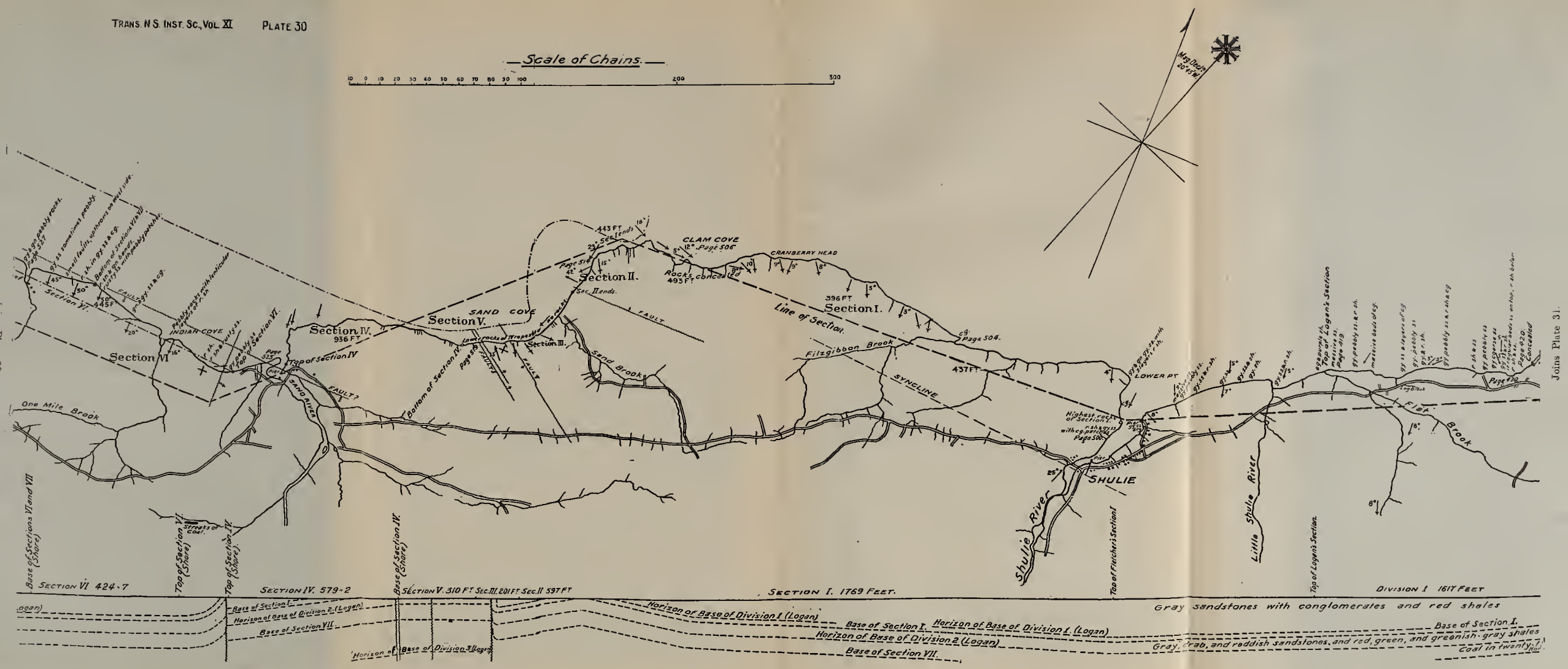
A. SECTIONS AT THE JOGGINS, FROM WEST RAGGED REEF TO MINUDIE (IN DESCENDING ORDER), BY SIR WILLIAM E. LOGAN.

B. SECTIONS FROM SHULIE TO SPICER COVE (IN DESCENDING ORDER), BY HUGH FLETCHER.



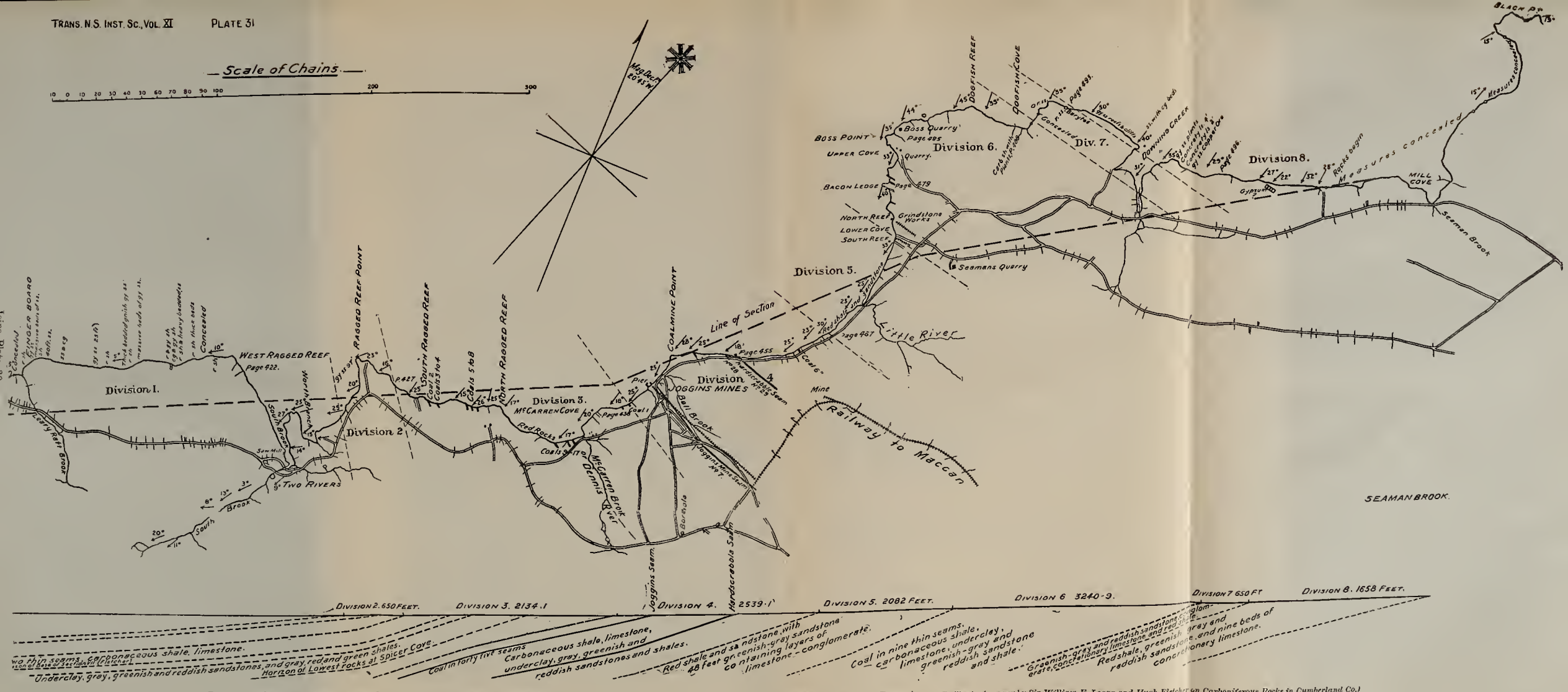
PLAN AND SECTION FROM SPICER COVE TO SEAMAN BROOK, CUMBERLAND CO., NOVA SCOTIA.—No. 1 (SPICER COVE TO TWO MILE BROOK). *(To illustrate paper by Sir William E. Logan and Hugh Fletcher on Carboniferous Rocks in Cumberland Co.)*

Joins Plate 30.



PLAN AND SECTION FROM SPICER COVE TO SEAMAN BROOK, CUMBERLAND CO., NOVA SCOTIA.—NO. 2 (TWO MILE BROOK TO LEARY RAFT BROOK). (To illustrate paper by Sir William E. Logan and Hugh Fletcher on Carboniferous Rocks in Cumberland County.)

Joins Plate 31.



PLAN AND SECTION FROM SPICER COVE TO SEAMAN BROOK, CUMBERLAND CO., NOVA SCOTIA.—No. 3 (LEARY RAFT BROOK TO SEAMAN BROOK) *(To illustrate paper by Sir William E. Logan and Hugh Fletcher on Carboniferous Rocks in Cumberland Co.)*

Supplementary Note to a Paper on "The Sunken Land of Bus."*—By H. S. Poole, D. Sc.

Having otherwise failed to obtain information respecting the origin of the above title, an enquiry was inserted in *Notes and Queries* and the following reply was shortly afterwards obtained :

"'Sunken Land of Bus' (10 s, v. 509) is named after one of Sir Martin Frobisher's ships in his third voyage in 1578. The relation of the pretended discovery, given by Hakluyt (*Voyages of the English Nation*, vol. iii, 160 e, p. 93), runs thus : 'The Busse of Bridgewater, as she came homeward to the southeastward of Frieseland, discovered a great island in the latitude of 57 degrees and an half, which was never yet found before, and sailed three dayes alongst the coast, the land seeming to be fruitfull, full of woods and a Campion Country.'

"John Barrow in his *Chronological History of Vogages into the Arctic Regions* (Lond., 1818, p. 94) says that 'a bank has recently been sounded upon, which has revived the idea of the Frieseland of Zeno and the Busse of Bridgewater having been swallowed up by an earthquake.'

"A full summary of the subject of the Land of Bus is given by Mr. Miller Christy as appendix B to C. C. A. Gosch's *Danish Arctic Expeditions, 1605 to 1620*, Hakluyt Soc., Book I, 1897. See also *The Annals of the Voyages of the Brothers Nicolo and Antonio Zeno*, by Fred. W. Lucas, Lond., 1898."

Royal Library, Stockholm. (Signed) E. W. Dahlgren.

* See *Transactions of N. S. Institute of Science*, vol. xi, p. 193.

APPENDIX III.

LIST OF MEMBERS, 1904-05.

ORDINARY MEMBERS.

	Date of Admission.
Bayer, Rufus, Halifax	March 4, 1890
Bishop Watson L., Supt. of Water Works, Dartmouth, N. S.	Jan. 6, 1890
Bowman, Maynard, B. A., Public Analyst, Halifax	March 13, 1884
Brown, Richard H., Halifax	Feb. 2, 1903
Brown, R. Balfour, Saulnierville, N. S.	Jan. 10, 1891
Budge, D., General Supt. Halifax & Bermuda Cable Co., Halifax	Oct. 30, 1903
*Campbell, Donald A., M. D., Halifax	Jan. 31, 1890
Campbell, George Murray, M. D., Halifax	Nov. 10, 1884
Colpitt, Parker R., City Electrician, Halifax	Feb. 2, 1903
*Davis, Charles Henry, C. E., New York City, U. S. A.	Dec. 5, 1900
Dixon, Prof. Stephen Mitchell, B. A., B. A. I., University of Birmingham, Birmingham, England	April 8, 1902
Doane, F. W. W., City Engineer, Halifax	Nov. 3, 1886
Donkin, Hiram, C. E., Glace Bay, C. B.	Nov. 30. 1892
Egan, Thomas J., Halifax	Jan. 6. 1890
Fearon, James, Principal, Deaf and Dumb Institution, Halifax	May 8, 1894
*Forbes, John, Moncton, N. B.	March 14, 1883
*Fraser, C. Frederick, LL. D., Principal, School for the Blind, Halifax	March 31 1890
Gates, Herbert E., Architect, Halifax	April 17, 1899
*Gilpin, Edwin, M.A., LL.D., F.R.S.C., I.S.O., Inspector of Mines, Halifax	April 11, 1873
Hattie, William Harrop, M. D., Supt. N. S. Hospital, Dartmouth	Nov. 12, 1892
Irving, G. W. T., Education Dept., Halifax	Jan. 4, 1892
Johnston, Harry W., C. E., Asst City Engineer, Halifax	Dec. 31, 1894
*Laing, Rev. Robert, Halifax	Jan. 11, 1885
McCarthy, J. B., B. A., M. Sc., teacher of science, County Academy, Halifax	Dec. 4, 1901
McColl, Roderick, C. E., Provl. Engineer, Halifax	Jan. 4, 1892
Macdonald, Simon D., F. G. S., Halifax	March 14, 1881
*MacGregor, Prof. J. G., M. A., D. Sc., F. R. S., F. R. S. C., Edinburgh University, Edinburgh, Scotland	Jan. 11, 1877
McInnes, Hector, LL. B., Halifax	Nov. 27, 1889
*McKay, Alexander, Supervisor of Schools, Halifax	Feb. 5, 1872
*MacKay, A. H., B. A., B. Sc., LL. D., F R. S. C., Superintendent of Education, Halifax	Oct.. 11, 1885
MacKay, Prof. Ebenezer, PH. D., Dalhousie College, Halifax	Nov. 27, 1889
*MacKay, George M. Johnstone, Dartmouth, N. S	Dec. 18, 1903
McKerron, William, Halifax	Nov. 30, 1891

*Life Members.

Date of Admission.

Marshall, Gilford R., Principal, Compton Avenue School, Halifax .....April 4, 1894
Morton, S. A., M. A., County Academy, Halifax .....Jan. 27, 1893
Murphy, Martin, C. E., D. SC., I. S. O., Saskatoon, Sask .....Jan. 15, 1870
Murray, Prof. Daniel Alexander, Ph. D., Dalhousie College, Halifax ....Dec. 18, 1903
*Parker, Hon. Daniel McN., M. D., Dartmouth, N. S..... 1871
Piers, Harry, Curator Provincial Museum and Librarian Provincial Science Library, Halifax .....Nov. 2, 1888
*Poole, Henry Skeffington, A. M., ASSOC. R. S M, F. G. S, F. R. S. C, M. CAN. SOC. C. E., HON. MEM. INST. M. E., Halifax .....Nov. 11, 1872
Read, Herbert H., M. D., L. R. C. S., Halifax .....Nov. 27, 1889
*Robb, D. W., Amherst, N. S .....March 4, 1890
Rutherford, John, M. E., Halifax .....Jan. 8, 1865
Sexton, Prof. Frederic H., Dalhousie College, Halifax .....Dec. 18, 1903
*Smith, Prof. H. W, B. SC., Agricultural School, Truro, N. S.; Assoc. Memb., Jan. 6, 1890 .....Dec. 1900
*Stewart, John, M. B. C. M., Halifax .....Jan. 12, 1885
Tinling, Captain E. B., R. N., Marine & Fisheries Dept., Halifax .....Feb. 7, 1905
Wheaton, L. H., Chief Engineer, Coast Railway Co., Yarmouth, N. S....Nov. 29, 1894
Wilson, Robert J., Secretary, School Board, Halifax .....May 3, 1889
Winfield, James H., Manager, N. S. Telephone Co., Halifax.....Dec. 18, 1903
Woodman, Prof J. Edmund, M. A, D. SC., School of Mining and Metallurgy, Dalhousie College, Halifax .....Dec. 3, 1902
*Yorston, W. G., C.E., City Engineer, Sydney, C. B .....Nov. 12, 1892

ASSOCIATE MEMBERS.

*Caie, Robert, Yarmouth, N. S .....Jan. 31, 1890
*Dickenson, S. S., Commercial Cable Co., New York, U. S. A.....March 4, 1895
Edwards, Arthur M., M. D., F. I., S, Newark, N. J .....Dec. 12, 1898
Gates, Reginald R., Mt. Allison University, Sackville, N. B .....Feb. 2, 1903
Haley, Prof. Frank R, Acadia College, Wolfville, N. S .....Nov. 5, 1901
Harlow, L. C., B. SC., Prov. Normal School, Truro, N. S .....March 23, 1905
Haycock, Prof. Ernest, Acadia College, Wolfville, N. S .....May 17, 1899
Hunton, Prof. S. W, M. A. Mount Allison College, Sackville, N. B .....Jan. 6, 1890
Jaggar, Miss A Louise, Cambridge, Mass .....Dec. 5, 1900
James, C. C., M. A., Depy. Min. of Agriculture, Toronto, Ontario .....Dec 3, 1896
Jennison, W. F., Sydney, C. B .....May 5, 1903
*Johns, Thomas W., Yarmouth, N. S .....Nov. 27, 1889
*Keating, E. H., C. E., Toronto, Ry. Co., Toronto, Ont.; Ord. Memb. April 12, 1882 .....April 11, 1900
*Kennedy, Prof. Geo. T., M. A., D. SC. F. G. S., Wolfville, N. S .....Nov. 9, 1882
Lawrence, H., D. D. S., Wolfville, N. S .....March 9, 1903
McIntosh, Kenneth, St George's Channel, C. B.; Ord. Memb., Jan. 4, 1892 .....June 1900
*MacKay, Hector H., M. D., New Glasgow, N. S .....Feb. 4, 1902
McKenzie, W. B., C. E., Moncton, N. B .....March 31, 1882
McLeod, R. R., Brookfield, N. S .....Dec. 3, 1897
Magee, W. H., PH. D., Annapolis, N. S .....Nov. 29, 1894
Matheson, W. G., New Glasgow, N. S .....Jan. 31, 1890
Payzant, E N., M. D., Wolfville, N. S .....April 8, 1902
Pineo, Avard V., LL. B., Kentville, N. S.....Nov. 5, 1901
*Reid, A. P., M. D., L. R. C. S., Middleton, Annapolis Co., N. S.....Jan. 31, 1890
*Robinson, C. B., B.A., New York Botanical Garden, New York, U. S. A.Dec. 3, 1902
*Rosborough, Rev. James, Musquodoboit Harbour, N. S.....Nov. 29, 1894

*Life Members.

Date of Admission.

Russell, Prof. Lee, B. S., Worcester, Mass. ..... Dec. 3, 1896
Sawyer, Prof. Everett W., Acadia College, Wolfville, N. S. ..... Feb. 6, 1901
Sears, Prof. F. C., Director N. S. School of Horticulture, Wolfvllle, N. S. Feb. 6, 1901

CORRESPONDING MEMBERS.

Ami, Henry M., D. Sc., F. G. S., F R. S. C., Geological Survey, Ottawa, Ontario ..... Jan. 2, 1892
Bailey, Prof. L. W., PH. D., LL. D., F. R. S. C., University of New Brunswick, Fredericton, N. B ..... Jan. 6, 1890
Ball, Rev. E. H., Tangier, N. S. ..... Nov. 29, 1871
Bethune, Rev. Charles J. S. M. A., D. C. L., F. R C. S., Ontario Agricultural College, Guelph, Ont ..... Dec. 29, 1868
Cox, Philip, B. Sc., PH. D., Chatham, N. B ..... Dec. 3, 1902
Davidson, Prof. John, PHIL. D ..... Dec. 12, 1898
Dobie, W. Henry, M. D., Chester, England ..... Dec. 3, 1897
Ells, R. W., LL. D., F. G. S. A., F. R. S. C., Geological Survey, Ottawa, Ont. Jan. 2, 1894
Faribault, E. Rodolphe, B. A., B. Sc., Geological Survey of Canada, Ottawa; Assoc. Memb., March 6, 1888 ..... Dec. 3, 1902
Fletcher, Hugh, B. A., Geological Survey, Ottawa, Ontario ..... March 3, 1891
Fletcher, James, LL. D., F. L. S, F. R. S. C., Entomologist and Botanist, Central Exp. Farm, Ottawa, Ontario ..... March 2, 1897
Ganong, Prof. W. F., B. A., PH. D., Smith College, Northampton, Mass., U. S. A ..... Jan. 6, 1890
Hardy, Maj.-General Campbell, R. A., Dover, England ..... Oct. 30, 1903
Harrington, W. Hague, F. R. S. C., Post Office Department, Ottawa ..... May 5, 1896
Hay, George U., D. Sc, F. R. S C., St. John, N. B ..... Dec. 3, 1902
Litton, Robert T., F. G. S., Melbourne, Australia ..... May 5, 1892
McClintock, Vice-Admiral Sir Leopold, Kt., F. R.S., London, Eng. ..... June 10, 1880
McSwain, John. Charlottetown, P. E. I ..... Dec. 3, 1902
Matthew, G. F., M. A., D. Sc., F. R. S. C., St. John, N. B ..... Jan. 6, 1890
Maury, Rev. Mytton, D. D., Ithaca, N. Y., U. S. A ..... Nov. 30, 1891
Peter, Rev. Brother Junian, Fall River, Mass., U. S. A ..... Dec. 12, 1898
Pickford, Charles, Halifax ..... March 2, 1900
Prest, Walter Henry, M. E., Bedford; Assoc. Memb., Nov. 29, 1894 ..... Nov. 2, 1900
Prichard, Arthur H. Cooper, Boston, Mass ..... Dec. 4, 1901
Prince. Prof. E. E., Commissioner and General Inspector of Fisheries, Ottawa, Ontario ..... Jan. 5, 1897
Smith, Hon. Everett, Portland, Maine, U. S. A ..... Mar. 31, 1890
Weston, Thomas C., F. G. S. A., Ottawa, Ontario ..... May 12, 1877

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* Life Members.

Stewart
Wallace
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