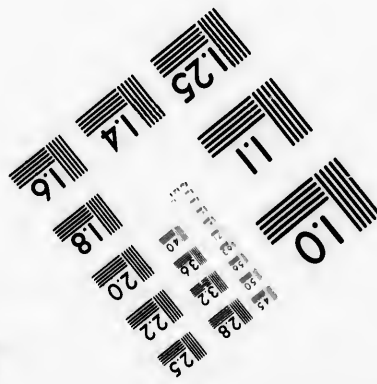
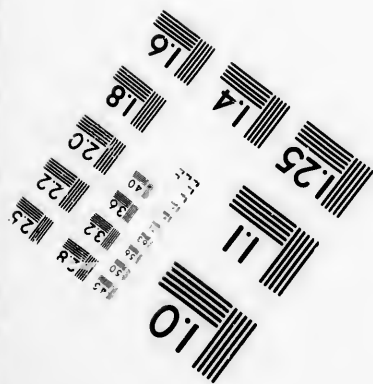
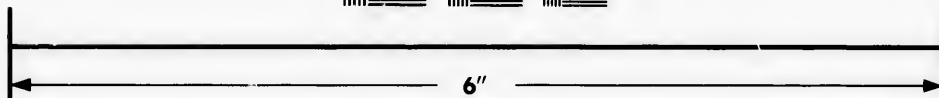
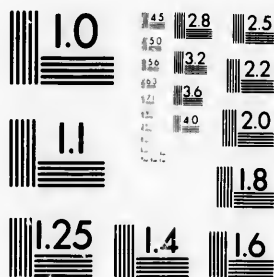


**IMAGE EVALUATION
TEST TARGET (MT-3)**



**Photographic
Sciences
Corporation**

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503



**CIHM/ICMH
Microfiche
Series.**

**CIHM/ICMH
Collection de
microfiches.**



Canadian Institute for Historical Microreproductions

Institut canadien de microreproductions historiques

1980

Technical and Bibliographic Notes/Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- Coloured covers/
Couverture de couleur
- Covers damaged/
Couverture endommagée
- Covers restored and/or laminated/
Couverture restaurée et/ou pelliculée
- Cover title missing/
Le titre de couverture manque
- Coloured maps/
Cartes géographiques en couleur
- Coloured ink (i.e. other than blue or black)/
Encre de couleur (i.e. autre que bleue ou noire)
- Coloured plates and/or illustrations/
Planches et/ou illustrations en couleur
- Bound with other material/
Relié avec d'autres documents
- Tight binding may cause shadows or distortion along interior margin/
La reliure serrée peut causer de l'ombre ou de la distortion le long de la marge intérieure
- Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/
Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- Additional comments:/
Commentaires supplémentaires:

- Coloured pages/
Pages de couleur
- Pages damaged/
Pages endommagées
- Pages restored and/or laminated/
Pages restaurées et/ou pelliculées
- Pages discoloured, stained or foxed/
Pages décolorées, tachetées ou piquées
- Pages detached/
Pages détachées
- Showthrough/
Transparence
- Quality of print varies/
Qualité inégale de l'impression
- Includes supplementary material/
Comprend du matériel supplémentaire
- Only edition available/
Seule édition disponible
- Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image/
Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	14X	18X	22X	26X	30X
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12X	16X	20X	24X	28X	32X

The copy filmed here has been reproduced thanks to the generosity of:

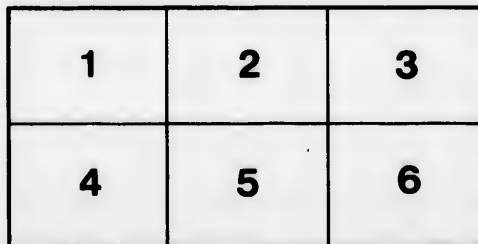
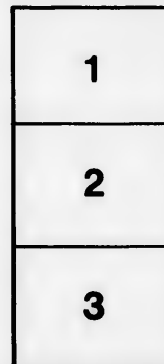
National Library of Canada

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol \rightarrow (meaning "CONTINUED"), or the symbol ∇ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

Bibliothèque nationale du Canada

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaît sur la dernière image de chaque microfiche, selon le cas: le symbole \rightarrow signifie "A SUIVRE", le symbole ∇ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.

errata
to

pelure,
on à



GEOLOGICAL

AND

OR

TO

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR.

REPORT
ON THE
SURFACE GEOLOGY
OF
NORTH-EASTERN NEW BRUNSWICK

TO ACCOMPANY QUARTER-SHEET MAPS 2 N.E. AND 6 S.W.

BY
R. CHALMERS.



PUBLISHED BY AUTHORITY OF PARLIAMENT.

MONTREAL:
DAWSON BROTHERS.
1888.

ALPH

geolo
E., an
detail
colour
will a
My
O'Bri
the Ca
Smith
late G
furnish
gical s

OTTA

ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., Etc.,

Director of the Geological and Natural History Survey of Canada.

SIR,—Herewith I beg to submit to you my report on the surface geology of the district embraced in the two quarter-sheet maps, 2 N. E., and 6 S. W., north-eastern New Brunswick, being the result of a detailed examination of it made during the season of 1886. These sheets, coloured to show the character and distribution of the surface deposits, will accompany this report.

My grateful acknowledgments are due to K. F. Burns, M.P., W. J. O'Brien, Collector of Customs and W. H. Chisholm, Superintendent of the Caraquette Railway, Bathurst; also to Chas. E. Fish and Dr. A. C. Smith, Newcastle, for information and various acts of kindness. The late G. A. Blair, Chatham, and Miss Andrews, Bathurst, likewise kindly furnished me with lists of barometric readings taken at the meteorological stations under their charge.

I have the honour to be,

Sir,

Your obedient servant,

R. CHALMERS.

OTTAWA, April, 1887.

Th
were
in th
exam
time
on bo
lands
also t
River
this n
descri
the in
ed by
the g
sults a
guous
made
pre-gl
pying
Carbon
difficul
they a
coastal
Carbon
glaciat
Cambri
neath, a

REPORT
ON THE
SURFACE GEOLOGY
OF
NORTH-EASTERN NEW BRUNSWICK,

TO ACCOMPANY QUARTER-SHEET MAPS 2 N.E. AND 6 S.W.

The detailed investigations of the surface geology of New Brunswick Area explored were continued during the past season (1886) and the areas embraced in the two quarter-sheet maps, 2 N.E. and 6 S.W., adjoining the district examined during the previous season, were explored as carefully as time and circumstances would permit. These areas include the country on both sides of Miramichi Bay as far east as Shippegan and Miscou islands on the north, and Point Esecuminac and Point Sapin on the south; also the chief part of the district drained by the North-West Miramichi River and its affluents, and by the Nepisiguit River. A large portion of this region is still forest-clad however, and consequently the present description, so far as it relates to topography and surface geology in the interior, is only of a general character. The chief points elucidated by the season's investigations are of much interest, both as regards the glaciation and the distribution of the surface deposits, and the results are confirmatory of previous observations made in this and contiguous areas, as will be shown in the sequel. Reference will here be made to the main facts noted:—Chief among these is the existence of pre-glacial or pre-quaternary rock debris, or gravels and sands, occupying considerable tracts, especially upon the Pre-Cambrian and Middle Carboniferous areas. The distribution of this debris and gravel is very difficult to trace, as they are usually masked by later deposits; but they appear, so far as they have been observed, to be thickest in the coastal districts and thin out irregularly towards the limits of the Carboniferous rocks to the west, re-appearing however, in the unglaciated areas of the interior, upon the Cambro-Silurian and Pre-Cambrian belts. The relations of these materials to the rocks underneath, as well as to the overlying surface deposits, have been carefully

Summary of
main facts
noted.

noted wherever exposures occurred, and a description of them will be given further on. Another subject of consideration was the enormous quantities of boulders strewn over all parts of the area under discussion, apparently derived from the more crystalline portions of the Cambro-Silurian and Pre-Cambrian rocks referred to. The absence of marine terraces in all places higher than the 150 to 175 feet contour line above sea level, indicating that the early Post-Tertiary subsidence did not exceed that limit, also afforded a question for study. Not less important perhaps, was the investigation with reference to the extensive peat bogs and sand dunes occurring here. The great development of the former near the coast, especially on Miscou and Shippegan islands, at the mouth of Tabusintac River, and at Point Cheval and Point Escuminac was noted; and the extensive accumulations of blown sand skirting the shores, forming beaches, islands, etc., also came under review. These peat bogs and dunes are still in process of formation. The intervals and terraces along rivers, which on the North-West Miramichi and its tributaries have a considerable breadth, were likewise examined and their peculiar features investigated. Aneroid measurements of the heights were made at all accessible points, and surface contours, generally, carefully observed. The limits of the forest-covered tracts and of those portions overrun by fires, especially the great Miramichi fire of 1825, were traced out approximately and mapped. The old Indian camping grounds at Tabusintac and Derby were also visited and a few relics found. Special attention was given to the character of the soil and its relation to the underlying rock formations. Details regarding each of the above topics will be found in the following pages.

TOPOGRAPHIC FEATURES.

Chief
topographic
features.

The chief topographic features of the region under examination were given in report G G (Annual Report, 1885), and are comparatively simple when viewed in their general aspect. They consist of a highland region in the west, underlaid by the Pre-Cambrian and Cambro-Silurian rocks, and a level, or gently sloping plain in the east occupied by Carboniferous sediments. Minor irregularities diversify the surface of the central and eastern portions of the district however, many of which, as for example, that part of the low valley of the main South-West Miramichi River included in the map, the valley of the North-West Miramichi from Red bank to Portage River, and that of the North-West Millstream, etc., extend transversely to the main slope. The larger river valleys are all of pre-glacial origin. Where they pass through Carboniferous rocks these valleys are comparatively shallow, having been largely filled with fluvial and marine deposits. During

CHALME
the l
prese
and l
then
(see
North
have
rema
tract
rugged
feet.
with v
erous
an ext
sea of
fires, a
sterile
and ir
countl
such it
erosion
cuvatin
been et
the slop
the orig
every y
The
less el
as rugg
outlines
region h
general
lying be
occasion
these ro
and less
graphic
of Progr
In the
than 500
the map
tract ha
* The elev

the later Tertiary period, the region stood at a higher level than at present; for there is evidence that at the confluence of the North-West and South-West Miramichi rivers they flowed along channel bottoms then which are upwards of 100 feet below the existing sea level now, (see p. 14 *Annual Report*, 1885). The upper portion of the main North-West Miramichi and of its chief affluents, and also the Nepisiguit have all cut deep trenches into the older rocks, and produced some remarkable topographic features in the area drained by them. The tract of country occupied by the Pre-Cambrian here is high and rugged, the general level above the sea being not less than 1200 to 1400 feet. Mountains loom up on every hand, 1500 to 2000 feet high,* with valleys between them extending in all directions. In these lie numerous small lakes. Viewing the country from some crowning peak, it has an extremely mammillated appearance, and may be said to resemble a sea of hills. Much of it having been denuded of its forest-covering by fires, and presenting only bare, boulder-strewn acclivities and peaks, its sterile features are thus brought prominently into relief. So varied and irregular, indeed, are these that no adequate description of their countless diversities of form can be given. The original table land, if such it ever was, has been intersected in every direction by valleys of erosion. No traces of glaciation were observed, apparently all the excavating and sculpturing which fashioned these ancient hills having been effected by subaerial disintegration. In the valleys and on some of the slopes of this Pre-Cambrian area, especially along the Nepisiguit, the original forest still remains, but fires and the lumberman's axe are every year making further encroachments on it.

The areas occupied by Cambro-Silurian rocks are of somewhat less elevation than the Pre-Cambrian, and have by no means as rugged a surface, being rolling and the hills having long sweeping outlines. In the vicinity of the Nepisiguit, and, indeed, in the whole region between that river and the Little South-West Miramichi the general elevation of the Cambro-Silurian, especially of that portion lying between the two Pre-Cambrian belts, is 900 to 1000 feet, with occasional summits rising to 1500 feet. The south-western band of these rocks bordering the Carboniferous area is, however, much lower and less rugged, and contains many tracts of good land. (For a graphic description of this interior region, see Dr. Ells' report (*Report of Progress* 1879-80).

In the Carboniferous area the surface does not anywhere rise higher than 500 or 600 feet above the sea, and the larger portion included in the maps only from 150 to 200 feet (see 200 feet contour line). This tract has likewise been subjected to prolonged denudation. Wide,

Evidence regarding elevation of region in later Tertiary period.

General elevation and description of Pre-Cambrian area.

Non-glaciated character.

Description and height of Cambro-Silurian belts.

General features and elevation of Carboniferous area.

* The elevations are all above sea-level, unless otherwise stated.

low, east-and-west valleys are characteristic features, especially in the area between the Baie des Chalours and Miramichi, and undoubtedly owe their origin to subaerial and glacial erosion. Most of these are traversed and drained by the rivers and streams of the district. In the areas between river valleys and also about the heads of the small streams, where the drainage is insufficient, shallow peat bogs are of common occurrence.

Rivers and Lakes.

Character
and age of
principal
rivers.

The two principal rivers of the district, viz., the Nepisiguit and North-West Miramichi exhibit somewhat different features. The latter has numerous branches ramifying to the west and north, and drains, in proportion to its size, a much larger area than the Nepisiguit. Its wide, drift-filled valley in the lower part, and its silted-up estuary (see Annual Report, 1885, p. 14 a a) afford evidence of its being the older of the two. It is probably of pre-Carboniferous date. The Little South-West, its chief affluent, and the swiftest river in northern New Brunswick, appears, from the large quantities of drift material occupying its valley, to have been at one time a larger river than the main North-West. A noticeable feature of the North-West Miramichi, probably due to peculiarities in the mode of drainage, is its wide shallow channel, especially in that part of its course traversing the eastern belt of the Cambro-Silurian and the Carboniferous rocks. The region around the head-waters of this river being mountainous, and largely denuded of forest, the snow every spring is more rapidly melted there than farther down where it passes through a forest-clad tract. Hence floods from the upper part of the river are precipitated into the lower reaches, widening the channel, and often overflowing the flats bordering it. Summer and autumn floods act similarly when they occur, as they occasionally do, the rainfall of the region about the head waters of the river being then likewise more rapidly drained off. Hence large quantities of detritus from above are deposited along the lower part of the river's course, where the country is comparatively low and flat, partially filling its channel, and causing the waters to spread and erode the banks and intervalles bordering it.

Singular
features of
N. W.
Miramichi.

These peculiarities in the North-West Miramichi seem to be the result of the disappearance of the forest in the region about its head waters. During the melting of each winter's snow, or during other floods, it thus rises above the normal height and soon runs out, so to speak, very little of the precipitation being held in the lakes and tributaries there as a reserve supply. The summer level of this river is consequently very low, considerably lower I am informed now than previous to the devastation of the forests.

In
appear
Report
Narrow
from a
the Po
The
mentio
leys w
viums.
subside
partly
boulder
posits l
that riv
since by

The fo
quarter-s

1 I

2 I

3 I

4 F

1 R

2 St

In reference to the Nepisiguit, the observations of the past season appear to confirm the conclusions arrived at in report *α α* (Annual Report, 1885), viz., that in the lower part of its course, *i.e.*, from the Narrows downwards, its present channel is of modern date, regarded from a geological point of view, and may have been formed chiefly in the Post-Tertiary period.

The other rivers of the district exhibit no features requiring special mention, except, perhaps, Napan and Black rivers, which have valleys widely and deeply filled with marine deposits capped with alluviums. During the emergence of the land from the early Post-Tertiary subsidence, the waters of the main South-West Miramichi must have partly flowed out in this direction carrying sediment and probably boulders thither, as much of the material constituting the surface deposits here seems to have been derived from the region drained by that river. The finer material has, however, been partially remodelled since by the sea.

Nepisiguit probably of Post-Tertiary age in lower part.

CLASSIFICATION OF THE SURFACE DEPOSITS.

The following deposits were met with in the district included in the quarter-sheets 2 N E, and 6 S W, the series being in descending order:

Classification of deposits.

M 3

Alluviums, or Recent Deposits.

Fresh-water.

Marine.

- | | |
|--|---|
| <p>(a)</p> <ol style="list-style-type: none"> 1 Decayed vegetable matter, or vegetable mould, 2 Peat bogs, 3 Lacustrine and fluviatile marshes, 4 River flats (intervales) | <p>(b)</p> <ol style="list-style-type: none"> 1 Estuarine flats, 2 Salt marshes, 3 Sand dunes, |
|--|---|

M 2

Stratified Sands, Gravels and Clays.

- | | |
|---|--|
| <p>(a)</p> <ol style="list-style-type: none"> 1 River terraces and kames of river valleys. 2 Stratified inland gravel, sand and clay. | <p>(b)</p> <ol style="list-style-type: none"> 1 Saxicava sand and Leda clay |
|---|--|

M 1

Glacial Deposits.

- 1 Boulder-clay or till, boulders and erratic blocks.

Pre-glacial.

- 1 Rock-debris *in situ* (gravel, sand, etc.)

PRE-GLACIAL ROCK DEBRIS, GRAVELS, ETC.

Pre-glacial
rock debris, &c.,
character and
mode of
occurrence of.

Among the more remarkable phenomena characterizing the surface deposits of the district are beds of rotted rock *in situ*, chiefly in the form of gravel and sand. These are most abundant in the tracts bordering the Gulf shores, but are found also on the higher grounds of the interior. The materials consist of gravel, containing pebbles and boulders wholly of local rock, and occasionally beds of sand, and are unstratified except where they have not been sufficiently decomposed to obliterate the stratification of the original rock. They rest upon the surface of the unabrased rock beneath, which is generally uneven and covered with fragments of the underlying strata in process of decay. Usually these gravels do not exceed a foot or two in thickness, often less; but sometimes they are five feet or more. They are, however, for the most part overlain by stratified deposits of subaerial or aqueous origin. The included pebbles and angular debris are largest and most numerous in the bottom and become smaller and more intermixed with gravel and sand towards the surface, *i.e.*, have apparently undergone greater decomposition, the further they are from the solid rock beneath. In some of the sections examined near the coast the rock surface had a sort of mammillated appearance, showing that the corroding action had penetrated more deeply in some spots than in others. No foreign boulders exist among this debris or gravel, those which occur being angular and lying longitudinally parallel to the rock strata beneath, even when embedded in loose material, thus showing that they are really portions of the original rock *in situ* not yet decomposed. Indeed, in every instance they were found to belong to the underlying rocks. The following sections will illustrate the actual position of these gravels in the series and their relation to the other deposits, especially on the coastal area.*

1. On the main post road between Chatham and Richibucto, about two miles south of Black River bridge, a section of the surface beds is exposed in a gravel pit. The series is as follows in descending order:—

Sections showing
relations to
other deposits.

1. Loamy material, partly composed of decayed vegetable matter with lenticular seams of whitish or greyish sands in the bottom..... 3 to 6 inches

* Sir J. W. Dawson recognized thick beds of decayed rock at Les Eboulements (Notes on the Post-Pliocene Geology of Canada, *Can. Naturalist*, 1872). Dr. G. M. Dawson has observed beds of quartzite shingle in the Bow and Belly River country which appear to be pre-glacial (Report of Progress, 1882-83-84). R. G. McConnell also describes deposits under the name of the "South Saskatchewan gravels," which are probably of similar origin (Annual Report, 1885). Pumpelly, Hunt, Whitney, Winchell and others have directed attention to similar beds in different parts of the United States, and Darwin, Selwyn and Hartt have referred to them as occurring in Brazil. In Europe like phenomena have been observed; and in Australia Dr. Selwyn recognized the subaerial decay of the rocks there, and noted the absence of lakes in non-glaciated regions.

2. Gravel and sand, unstratified, containing flat, angular pieces of rock embedded therein, apparently *in situ*. 1 ft. 6 inches
3. Rotted rock, with loose pieces of the underlying sandstone in their natural situation, but with a little gravel and sand in the interstices. 4 to 5 feet
4. Grey sandstone showing still less decomposition and apparently passing into the usual stratified or bedded Middle Carboniferous rocks beneath. 1 to 2 "

The height of these beds above sea level is about 80 feet.

2. Behind the village of Nelson, on the road leading to the back settlements, the following series appears in a cutting :—

1. Stratified sand and gravel. 12 to 15 inches
2. Boulder-clay, chiefly gravel, but with sufficient clay to cause it to bake hard on exposure. 6 to 12 "
3. Decomposed or rotted rock, chiefly gravel, unstratified, the fragments of rock 1 to 3 inches long and mostly *in situ*. 12 to 18 "
4. Grey sandstone (Middle Carboniferous), crumbling and decaying, *in situ*.

Height of these beds about 100 feet above the sea.

3. At Nepisiguit bridge, near the town of Bathurst, another section of these deposits exhibits the following series (descending) :—

1. Sandy or gravelly soil, loamy in places, containing pebbles of foreign as well as of local rocks. 3 to 6 inches
2. Stratified gravel, including pebbles and boulders. Among these are travelled boulders, 1 to 2 feet in diameter, glaciated. Bulk of material, however, belonging to local rocks 12 to 15 "
3. Till, or debris of local rocks, which appears to have been shifted and acted upon by ice. It contains angular pebbles and boulders apparently transported some distance. Pieces of the Lower Carboniferous (underlying) rock, 3 to 9 inches in length, lie under and also enclosed in the lower part of the till with more or less gravel and clay in the interstices. 2 to 3 feet
4. Decomposing Lower Carboniferous rocks *in situ*.

Evidently the ice of the glacial period, in its eastward passage over the surface of the Middle Carboniferous area here, thinned out and was not of sufficient thickness or weight to displace or remove the whole of the pre-existing decayed rock material. The loose shales or pieces of rotted rock underneath what appears to be boulder-clay are one to two feet deep in places, below which they become more solid, *i.e.*, contain less gravel and sand in the interstices, until they gradually change into the usual Carboniferous rock of the district.

c.
 ng the surface
 chiefly in the
 in the tracts
 higher grounds
 aining pebbles
 ls of sand, and
 ciently decom-
 k. They rest
 h is generally
 trata in process
 or two in thick-
 ore. They are,
 sits of suberial
 ular debris are
 maller and more
 rface, *i.e.*, have
 er they are from
 examined near
 ted appearance,
 e deeply in some
 ong this debris
 g longitudinally
 bedded in loose
 s of the original
 tance they were
 llowing sections
 e series and their
 area.*
 Richibucto, about
 e surface beds is
 cending order:—

3 to 6 inches

ements (Notes on the
 n has observed beds of
 pre-glacial (Report of
 name of the "South
 port, 1885). Pumpelly,
 ds in different parts of
 occurring in Brazil. In
 recognized the suberial
 regions.

M I. GLACIAL DEPOSITS.

Boulder-Clay or Till.

Boulder-clay. Boulder-clay is abundant in river valleys and on slopes in the interior of this district, but is seldom met with near the coast. The North-West Miramichi valley, from where the Intercolonial Railway crosses it, up as far as Portage River and probably further, is lined almost continuously on both sides with till, and it was also seen on the slopes of the minor valleys in numerous localities. Apart from its occurrence in these, however, it does not anywhere form an unbroken sheet, usually appearing in lenticular masses. In a number of places it rests upon pre-glacial rock-debris, as shown in the foregoing sections, and is almost invariably overlain by stratified deposits. It is evident also that till in considerable quantities was thrown into the river valleys and depressions during or at the close of the ice age, partly filling them and producing changes in the drainage. This partial blocking up of the water courses held up the waters of even the larger rivers in many places, especially those of the North-West Miramichi and its affluents, to a height of 80 to 100 feet above their present level. In the vicinity of Redbank a drift-dam of this kind existed in the Post-Tertiary period, causing the formation of terraces which will be described on a following page.

Whence derived.

In all cases, the till, wherever observed, seems to be largely derived from pre-existing rotted rock belonging chiefly to the underlying formations in each particular locality, but somewhat changed in mechanical consistency and appearance by glacial action. In certain places upon the Carboniferous area this change was seen to be only partially effected, and the flat pebbles and pieces of sandstone or slabs were sometimes only partly turned over or disturbed, while the intermixed clay had, in its bluish-grey, unoxidized aspect, every resemblance to boulder-clay.

Localities where observed

A few of the more noteworthy localities where till was observed may here be specified.

On Miscou Island, on the north-east side of Miscou harbour, and on the east side of Shippegan Island till occurs. It is overlain in both places by Leda clay and Saxicava sand. If the till here is ductile and ice, the land has probably been as high, if not higher, than at present when it was laid down. A slight subsidence would submerge these islands, scarcely any part of them at present rising more than 25 to 30 feet above sea level. This till is constituted chiefly of boulders and debris of local rocks.

Hospital and Sheldrake islands, in Miramichi estuary, are largely covered with till.

A bed of till occurs at the mouth of Black River, also another on the west side of the mouth of Bay du Vin River. These contain glaciated boulders.

On the road leading from Upper Chatham to Napan River, and on the main Chatham and Richibucto road just south of Black River bridge, also on the road going through the back settlements from Nelson to Barnaby River station, till was seen in several places with glaciated boulders embedded in its upper part. Some of these boulders seem to have been striated while in their present position by ice which moved over them from west to east. They lie longitudinally in this direction with the upper glaciated side sloping gently to the west as in Fig. 1. Pre-glacial debris was observed to underlie them in two of these places.*



FIG. 1. SECTION SHOWING POSITION OF STRIATED BOULDERS IN DRIFT.

Till is found in the South-West Miramichi valley in numerous places within the limits of the map. Heavy banks, chiefly of till, occur near Derby Junction and at the confluence of the South-West and North-West rivers, rising above the general level of the valley, (referred to on page 28 a a, Annual Report, 1885).

At the mouth of North-West Millstream, till, partly filling the valley of that tributary, was seen resting on glaciated rock surfaces (see List of Striae No. 7).

Till was observed in several places along the road leading up the south side of the Little South-West Miramichi; and just above Red-bank to the east of the main North-West a bed of till, abundantly intermixed with boulders, was seen.

In reference to the glaciated boulders embedded in the upper part of the till or pre-existing rock debris, referred to above, the question arises were their upper surfaces really striated while they were held in their present position by the enveloping material (boulder clay, gravel, etc.) as the ice passed over the district. The parallelism of the striae upon them with those on the rock surface of the district in which they occur, as also the attitude of the boulders themselves with respect to the abrading agent, tends to support this view, rendering it probable that the phenomena are similar to those described by Mr. Hugh Miller as observed in Scotland. There is abundant evidence in the presence of

* Phenomena of this kind were first observed in Canada by Sir J. W. Dawson, see The Post-Pliocene Geology of Canada, *Canadian Naturalist*, 1872.

striae on rocks *in situ* and till and other transported boulders from the interior that ice passed over the country here from west to east; but it would seem that even when the glaciers had attained their maximum thickness they must have thinned out on the particular district where these boulders were thus left, and perhaps disappeared altogether before reaching the present coast line, except in the valleys. Pre-glacial debris of subaerial origin occurs in sheets under them in most places where sections are exposed, affording proof that the ice cannot have been thick or of great weight. It seems reasonable to infer, therefore, that the ice moved over the surface of the decayed rock material, eroding and displacing only its upper part, striating the rocks where they were nearest the surface or most exposed, and also the upper surface of these boulders at the same time.

Boulders and Erratic Blocks.

Boulders and
erratics whence
derived.

Boulders, derived from the Cambro-Silurian and Pre-Cambrian rocks of the interior, consisting chiefly of granite, gneiss, felsite, trap, etc., from five feet in diameter downwards, are found profusely scattered over the surface of the whole Middle Carboniferous area and also embedded in the deposits. Associated therewith, and in certain places largely predominating in numbers, occur others derived from the underlying rocks. Upon the surface of the Pre-Carboniferous rocks of the interior, boulders are likewise strewn in immense profusion, and bear evidence, so far as observations have extended, of having, in some places, been transported limited distances from the parent rocks to the west.

How trans-
ported.

Near the coast, especially below the 200 feet contour line, the present distribution of boulders seems to have been effected by floating and shore ice, etc., as well as by glaciers. A greater number of those properly called erratics are seen upon the surface here, and apparently they have been subjected to greater wear, being, as a rule, more rounded and with the striae in most instances defaced. Planed sides are still however, characteristic features of these. Sparingly interspersed among them are a few which seem not to belong to this district, and the parent rock of which is unknown. These are always found on or near the present shores.

Greater abun-
dance on north
side of
Miramichi
estuary.

Boulders of crystalline rocks seem to be more abundant on the southern than on the northern side of the Miramichi estuary. The cause of this is difficult to explain, but it is probably due, in part at least, to the fact that during the Post-Tertiary submergence, river and coast ice carrying boulders would be more likely to be driven against the shores of the southern side of Miramichi Bay by the prevailing north-east and north-west winds than in any other direction, and thus deposit them.

Along the shore to the east of Escuminac Point, granite boulders Boulders on
three to five feet in diameter were seen on the top of the peat bog and top of peat.
sand beaches there. They appear to have been recently pushed up by
the impact of coast ice, or, perhaps, thrown up by the waves during
heavy storms.

Glacial Striæ.

The following striæ were observed during the past summer in the List of striæ.
areas mapped. The courses are referred to the true meridian and the
elevations to sea level.

No.	LOCALITIES.	COURSES.	GENERAL SLOPE OF SURFACE.	APPROXIMATE HEIGHT.
GASPE PENINSULA, QUE.				
1	On a ridge at Newport, half a mile from the shore, occur glaciated rocks, but no distinct striæ. Stoss-side to the N.W.	S.E.	S.E.	165
2	Along main road east of bye-road leading to Point Maquereau Light House. Striæ (These are on the eastern slope of a ridge running out to form Point Maquereau).	S. 85° E.	S.E.	250
GLOUCESTER COUNTY, N.B.				
3	At E. Smith's, Middle River settlement. Striæ	N. 46° E.	E.	250
NORTHUMBERLAND COUNTY, N.B.				
4	Behind Nelson village, on second concession lots. Striæ	S. 83° E.	E.	150
5	Behind Upper Chatham, about half way between the Miramichi and Napan rivers. Striæ	S. 83° E.	E.	125
	(These correspond with the striæ noted at Beaver Brook station, Intercolonial Railway, and at Rogersville station; also with those seen in the valley of the South-West Miramichi at Indian-town (see report G G, p. 22, Annual Report, 1885, Striæ Nos. 64 and 66).)			
6	At North-West Millstream, near bridge on road along main river. Striæ, covered with a thick bed of till. (These striæ agree in direction with others at the head of this stream, (Nos. 60 and 61, report G G just cited,) and show that a small local glacier moved down the North-West Millstream valley, debouching into the estuary of the main North-West).	S. 22° W.	S.	25

General Conclusions respecting Glaciation, Boulder Distribution, Etc.

The conclusions deducible from the foregoing facts may be briefly stated as follows:—

General
glaciation of
district.

1. The ice of the glacial period moved from the west down the main slope of the district towards the Gulf of St. Lawrence, carrying large quantities of debris from the Cambro-Silurian and Pre-Cambrian rocks of the interior and strewing it over the whole surface, as pointed out in report GG (Annual Report, 1885). The glacier or glaciers were guided in their movements by the more prominent topographical features and especially by the river valleys, but thinned out or finally disappeared before reaching the present coast line, no evidence being afforded that they debouched into the sea anywhere, except, perhaps, in estuaries. And the undisturbed pre-glacial debris met with on the low coastal tracts shows either that the ice did not reach these, except in a very thin sheet passing very lightly over them, or that these tracts were submerged during the greatest extension of the ice. The boulder-clay overlying the pre-glacial debris and the striated boulders over which the ice has apparently moved, may also be cited as proofs of its diminished power and weight when moving over this particular district.

Secondary
systems of
glaciers.

2. A minor or secondary system of local glaciers followed the smaller valleys at a later stage, as indicated by the striae and till found along the North-West Millstream (see List of Striae, No. 6). The glacier producing these seems to have flowed into the open estuary of the North-West Miramichi. To render this possible it is evident that the land must have then stood at a somewhat lower level than at present, and the estuary referred to would consequently be wider. Glaciers of this kind probably belonged to the close of the glacial period and may have been contemporaneous with the deposition of the Leda clay.

Boulder
distribution.

3. The distribution of boulders near the coast, especially below the 175 feet contour line, is the result of two causes which may thus be stated:—First, these boulders, or the majority of them, were carried down to the coastal area, more especially along the valleys, by glaciers and river ice during or at the close of the ice age. On the submergence of this coastal tract, coast and floating ice acted upon these and the till, the sea washing away more or less of the finer and lighter materials, leaving the boulders exposed. These were then rolled about or carried hither and thither by pan or shore ice. Erratics from foreign parts may occasionally have been landed on these shores by the same agencies. Other causes no doubt super-vened, but these will serve to explain the occurrence and anomalous distribution of so many boulders from the interior on the surface near the coast.

Dep
contour
and C
almos
which
the su
1. A
cayed
from s
the sur
ferous
The pe
the dec
rain-wa
vation,
disappe
matter,
under t
2. Str
usually
pebbles
river va
colour o
clay also
dation a
weather
3. Bou
tribution
velled bo
4. Pre-
upon the
pebbly b
North-W
* * The org
to a protoxide
being soluble
gravel colour
moves the iron
peroxide of i
This is comm
lity. (Geikie
of the humus
for the Advan

M 2. STRATIFIED SANDS, GRAVELS AND CLAYS.

Stratified Inland Gravel, Sand and Clay (fresh-water).

Deposits of this kind are of considerable thickness above the 200 feet contour line, more especially upon the Lower and Middle Carboniferous and Cumbro-Silurian rocks. Those overlying the former constitute an almost unbroken sheet, the general characteristics and composition of which have been given in previous reports. The whole series covering the surface in the district is, in descending order, essentially as follows:

1. A thin, somewhat irregular layer of loam, or more generally decayed vegetable matter, together with more or less material formed from subaerial erosion. Underneath this, or constituting a portion of the same stratum, especially upon the surface of the Middle Carboniferous area, occur lenticular seams of fine-grained grey or white sands.

The peculiar character and colour of these sands are probably due to the deoxidation of the iron in them through the chemical action of the rain-water and the decayed vegetable matter overlying them.* Cultivation, by mixing these sands with the soil or subsoil, causes them to disappear. Land shells are sometimes found in the layer of vegetable matter. A fuller description of this deposit will be given in the sequel, under the head of *Vegetable Mould*.

2. Stratified sand, gravel and clay of varied thickness, the clay usually forming the lowest member and often in lenticular sheets. The pebbles in the gravel are almost always of local rock, although along river valleys they have been transported considerable distances. The colour of these sands and gravels, and of the upper portion of the clay also, is generally of a brownish or yellowish tint, due to the oxidation and hydration of the original materials. The lower limit of the weathered zone is often sharply defined in the clay beds.

3. Boulder-clay or till in patches on hillsides and in valleys, the distribution being irregular and the thickness variable. It includes travelled boulders from the west and south-west.

4. Pre-glacial debris, or gravels and sands. These occur irregularly upon the higher grounds of the interior, thinning out to mere loose pebbly beds, as observed in the tract about the head-waters of the North-West Miramichi.

* "The organic matter carried down by the rain-water reduces the iron salt from a peroxide to a protoxide, which the free carbonic acid present converts into a carbonate: and this salt being soluble is removed by the same surface waters, leaving the upper part of the sand or gravel colourless or often white. Or, it may sometimes be that the humic acid in the soil reduces the iron as a soluble humate." "When the humous acids can freely attack the hydrated peroxide of iron they remove it in solution and the decomposed rock or soil is thereby bleached. This is common where pine trees grow on ferruginous sand."—(Prestwich's *Geology*, Vol. 1, p. 163.) (Geikie's *Text-book of Geology*, p. 438.) (For further information on the geological action of the humus acids upon sands, gravels, etc., see paper by A. A. Julien, *Proc. Am. Association for the Advancement of Science*, 1879, pp. 339-350.)

How derived. The origin of these inland fresh-water deposits was briefly discussed in preceding reports. They appear to be derived in the first place from the decomposed materials of the underlying or subjacent rocks. Afterwards, glacial erosion, river and atmospheric action, combined with that of an organic nature, have produced such changes in them, more especially in the uppermost portion, as to partially stratify them, and give them their present character and composition.

River Terraces and Kames of River Valleys.

River terraces. River terraces of varied width are developed along the North-West Miramichi and Nepisiguit rivers, and, indeed, skirt all the streams of any size in the district. Their general features and relation to the rivers which they accompany have been discussed in former reports. Along the streams traversing the low flat Carboniferous area, none worthy of note were observed; but as we pass up the river valleys into the older series of rocks they become more noticeable. The localities and elevations of a few of the principal ones met with along the North-West Miramichi and Nepisiguit rivers may here be mentioned. The heights given have reference to the rivers at the nearest point.

Commencing with the Nepisiguit we find:—

Heights and localities where they occur.

1. At Middle Landing Narrows a terrace on the north bank 45 to 50 feet high, or 95 feet above sea level.

2. At Grand Falls a wide one occurs also on the north side 60 to 70 feet higher than the river above the falls, or about 315 feet above the sea. It is composed of water-worn gravel and sand with a covering of loam.

3. Just above the mouth of Nine Mile Brook a terrace lies on the north bank 50 to 65 feet high. It has probably been formed by a damming of the river at the Narrows five miles below, the intervening valley having then been a post-glacial lake into which the gravels, etc., composing the terrace were thrown.

4. Near Taylor's Brook there is a long terrace, or high narrow interval on the north side of the river 6 to 10 feet above it.

Other terraces occur at numerous places, especially wherever the banks jut out opposite re-entrant angles or bends of the river, but most of them are narrow and irregular. Viewing them correlatively, however, they indicate that the Nepisiguit flowed 50 to 75 feet above its present bed in early post-glacial times.

The North-West Miramichi, and more especially its tributary the Little South-West, exhibits a number of beautiful terraces, some of which may here be briefly described.

CH
op
rac
abc
all
6
the
fron
abo
Fir
the
New
mat
river
10 fe
A
river
Squa
here
straig
anoth

A
Fig. 2.

The
and ha
ward,
to the p
a wide,
which
valley
excava

5. On the south side of the main North-West, in the triangular tract opposite the mouths of Portage and Tomogonops rivers, wide terraces border the valley above the 200 feet contour line. Their height above the river is 50 feet and upwards. The materials are, however, all detrital. A capping of loam upon them forms good soil.

6. High terraces, probably of marine or estuarine formation, skirt the Little South-West as far up as the head of the settlement, 12 miles from its mouth. At the latter point the river bed is 150 to 175 feet above sea level, and many of the terraces are 50 to 75 feet higher. Further up they become less conspicuous, but are, nevertheless, above the usual height of the terraces found along other rivers in northern New Brunswick. They are all composed of very coarse, well-worn material, the result, no doubt, of erosion from the rapid flow of this river, the descent in the lower part of its course alone being not less than 10 feet per mile, further up being much greater.

A remarkable illustration of the post-glacial erosion effected by rivers and accompanied by the formation of terraces may be seen at the Square Forks of the Big Sevogle. The two main branches of this river here unite in a rocky gorge about 30 feet deep, which is almost in a straight line. At right angles to this the river runs off below through another rocky gorge somewhat as shown in the diagram (Fig. 2.)

Remarkable
erosion and
terraces at
Square Forks.

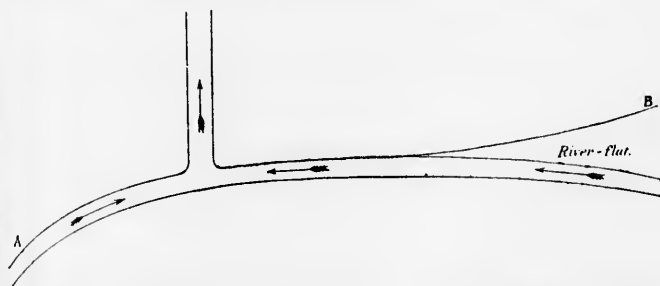


FIG. 2. PLAN SHOWING PORTIONS OF ROCK GORGES AT CONFLUENCE OF THE TWO BRANCHES OF BIG SEVOGLE RIVER.

The two branches of the Sevogle have either met at a different point and had a different pre-glacial channel from their confluence downward, or existed as separate streams. From the point B in Fig. 2 down to the present confluence of the river with the North-West there is a wide, terraced valley (see map) strewn with water-worn gravel, which may have been its former course. A damming of this pre-glacial valley at B by drift during the ice age would probably cause the excavation of the gorge below the Forks.

Kames.

River-valley kames are but poorly developed in this region. Small ones were noted in several places however, and a marked one at the confluence of the Little South-West and main river. It appears to be the residual portion of a terrace eroded on both sides by these two rivers.

Leda Clay and Saxicava Sand (marine).

Leda clay and Saxicava sand, mode of occurrence of.

The Leda clay is rather poorly represented in the district under consideration, the detrital material resulting from the erosion of the Carboniferous sandstones being chiefly in the form of sand and gravel. In consequence of this, marine fossils are rarely found in the surface deposits here. The Saxicava sand is very widely distributed and of considerable thickness in the areas skirting the coasts and river estuaries. From the elevation of the terraces composed of it (marine terraces) in the Miramichi valley the extent of the earliest Post-Tertiary subsidence can be approximately estimated. A few of the more noteworthy of these may be described. The elevations are in all cases above sea-level:—

Terraces occur on both sides of the mouth of Little South-West Miramichi River at a height of 85 feet above sea level. They cover an area of several square miles, and are composed chiefly of Saxicava sand. No fossils.

At the confluence of the Big Sevogle and main North-West River a terrace 118 feet high was observed. It appears to be entirely formed of sand and gravel.

One to two miles up Big Sevogle River another was seen on the south side, 160 to 179 feet high, which is also composed of sand and gravel and without fossils.

Opposite the mouth of Portage River a terrace skirts the main North-West on the south side; height 150 feet.

On the road leading from Chatham to Richibucto, near upper Bay du Vin P. O., terraces appear at heights of 120 and 140 feet.

A number of others were noted which it seems unnecessary here to enumerate. Co-ordinating all the facts relating to the marine terraces they show a Post-Tertiary subsidence of 165 to 175 feet in this district.

Sections showing character of materials.

To illustrate still further the composition of the terraces about the mouths of rivers, and in estuaries, as well as the general character of the deposits below the 175 to 200 feet contour line, the following sections will here be given. One examined behind Nelson village is described under the head of PRE-GLACIAL GRAVELS, ETC. Another exposed at Tracadie River is as follows, in descending order:—

CHAL
T
sand
pebb
depo
larg
N
desc
2
3
4
The
section
and m
mixed
veget
sandy
rock
mouth
deposit
under
but thi
resting
stated,
beds, o
which
As a
feet, oft
gravels

1. Gravel and sand, with a few pebbles of local rocks.
When these are flat and uniform they lie with their longest axes in a horizontal position Thickness.... 15 to 18 inches.
2. Grey sandy clay..... 1 to 3 "
3. Sand and clay in irregular, alternating bands; clay seams 1 to 6 inches thick. Whole thickness..... 1 to 2 feet.
4. Clay and sand, clay predominating; seams regular... 2 to 3 "
5. Sandy band, with a few thin strata of clay. Total thickness not known. Exposed in bottom of pit..... 3 "

The clay in this section is of a reddish-gray colour, and in all cases sandy, *i.e.*, nearly a loam. Both sand and clay are invariably free from pebbles. From their situation with respect to the Tracadie River these deposits are undoubtedly estuarine, although deriving the materials largely from the river. No fossils were found in them.

Near Caraquette the succession was also found to be as follows in descending order:—

1. Gravel, coarse and angular, and packed with sandstone pebbles and small boulders, also mostly angular, and lying with their longest axes in a horizontal position, the whole irregularly stratified and resembling rotted rock *in situ*. Thickness variable..... 1 to 3 or 4 feet.
2. Sand, fine and without pebbles or gravel and comparatively loose. Thickness likewise variable 1 to 3 "
3. Clay, sand and gravel, forming a hard-pan, containing fragments of the underlying rock but little removed from their original position. Thickness variable.
4. Rubbly, broken up, decomposing rock.

The succession of these deposits as observed in a great number of sections below the 200 feet contour line is closely similar to the above, and may be generally stated as follows, in descending order: (1) Gravel mixed with sand, overlain in uncleared and uncultivated ground by vegetable mould; (2) sand of varied consistency with clayey, or mixed sandy and clayey strata; (3) clay, with sandy seams, and (4) rotted rock *in situ*, or boulder-clay. On the slopes near the coast between the mouths of rivers, where little or no detrital material from these was deposited, the series consists of (1) loam, or decayed vegetable matter, under which are sand, gravel and occasionally clay; (2) boulder clay, but this member usually absent, and (3) pre-glacial debris, or gravel resting on decomposing Middle Carboniferous sandstones. As already stated, very little pure clay occurs in the stratified portion of these beds, owing no doubt to the arenaceous character of the rocks from which they are derived.

As a rule the thickness of these deposits does not exceed five to ten feet, often less, and the surface is always even. The stratified sands, gravels and clay have been pretty fully described in preceding reports.

General succession of marine deposits.

M 3. FRESH-WATER ALLUVIUMS.

River-flats, or Intercales.

Intercales. Along the main North-West Miramichi River and its affluent the Little South-West flats of considerable extent occur and form fine tracts of farming land. Between Redbank and Portage River large portions of these are cleared and cultivated, yielding hay in abundance. Nearly all the adjacent terraces are, however, still forest-clad.

The intercales along the Nepisiguit and other rivers of the district are narrow and of little value in an agricultural point of view. No clearings of any consequence have been made upon them.

In regard to the mode of origin and character of these intercales it may be remarked that the detailed descriptions of similar deposits given in preceding reports apply equally well to those observed in this district, and, therefore, it is unnecessary to dwell further on them.

Lacustrine and Fluvial Marshes.

Fresh-water marshes. Many of the small lakes of the interior are bordered by marshy tracts consisting of boggy or peaty matter, but of such limited width that they cannot be shown on the maps. Similar marshy selvages skirt the rivers in places where the flow is sluggish and permits the deposition of the finer particles of matter held in suspension by the waters. These marshes are usually covered with a dense growth of ericaceous plants, rushes, carices, marsh grasses, etc., and form retreats for the aquatic fur-bearing animals.

Peat Bogs.

**Peat bogs.
where formed.**

Formations of this kind are extensively developed near the coast of the Gulf of St. Lawrence, especially on Miscou and Shippegan islands and near the mouth of Tabusintac River; also at Point Cheval and Point Escuminac. In these localities they seem to owe their growth to the peculiar climatic conditions of the region bordering the Gulf. The proximity of the ocean modifies the extreme summer heat prevailing inland, rendering the air moister and more favourable to the continued existence of mosses and other plants peculiar to these deposits. In the interior there are also numerous peat bogs upon the Lower and Middle Carboniferous areas, but they are generally thin and of smaller extent. Usually the latter are found to occupy shallow lake basins which are bordered, and occasionally wholly covered, with a scrubby growth of haematac and black spruce. A remarkable feature of the bogs near the coast is the great number of small ponds dotting their surfaces. These ponds have perpendicular sides of peat, and vary

**Favorable
conditions for
their growth.**

CHAL
in s
mo
gro
face
arou
the
bela
two
and
Bric
1.
cove
Mid
as o
the
botte
seem
to re
all o
gees
Cran
2.
seen
pan o
is lik
it. 1
high
3.
bour
cribe
but u
of th
grow
4.
borde
5.
length
same
brant
6.
out o
secti

in size from a few square yards to a quarter of an acre or more. Their mode of origin is not apparent, but it is probably due to the continuous growth of mosses, etc., around little pools which occupied a former surface, the pools preventing the growth of mosses underneath them, while around them the height continued to increase year after year. For the most part these peat bogs are treeless, but are covered with plants belonging chiefly to the following species,—rose-bay, Labrador tea, two species of *vaccinium*, the huckle-berry, leather-leaf, andromeda, and along the shores overhauling the drier banks, the crowberry, etc. Brief descriptions of the largest of these bogs will now be given.

Ponds in peat bogs, how originating.

Descriptions and localities. Miscou bog.

1. The principal peat bog in the district occurs on Miscou Island and covers fully half of its entire area. It occupies a shallow basin in the Middle Carboniferous rocks here, portions of the rim of which, as well as of the sand and peat, are being eroded by the sea. The surface of the bog is 15 to 20 feet above high tide level in the centre, while the bottom, which is full of the roots of shrubs and small trees *in situ*, seems to be below that of the lowest tides and wherever visible appears to rest on gravel and sand. The bog, as already mentioned, is dotted all over with ponds, which form favourite resting places for the wild geese and brant in their passage over the region every spring and fall. Cranberries abound on it.

2. A peat bog about three miles long and one and a half wide was seen on the eastern side of Shippegan Island, which also rests on a hardpan of gravel and clay. The surface is 10 to 15 feet above the sea and is likewise destitute of trees. Numerous ponds were also observed on it. In the bank the peat is 10 feet thick, the bottom descending below high tide level.

3. The neck of land between St. Simon inlet and Pokemouche harbour (see map) is formed of peat. Similarly to the two beds just described it is considerably higher in the central part than at the margin, but nowhere is more than 10 to 15 feet above high tide level. A part of this bog is on sheet 3 S E. Immense quantities of cranberries grow upon it.

4. South of Tracadie River, near Point Barreau, (see map) a peat bog borders a lake, both being surrounded by a tamarac swamp.

5. An extensive bog occurs on the west side of Tabusintac River; length about three miles, width two miles. Its general features are the same as those described. It is also a favourite resort for wild geese, brant, etc., every spring and autumn.

6. On the east side of Point Cheval a bog was also seen which extends out on the northern margin over an old sand beach. The following section of the beds, in descending series, may be instructive:—

1. Peat, dark brown in colour, containing a few roots of small trees and shrubs and abundant remains of mosses, 5 to 7 feet.
2. Dark, almost black peat, filled with stems, roots and rootlets of small birch, cedar and haematac trees, and heath plants. Numerous stumps of trees *in situ* occur in the bottom of the peat, and the roots penetrate, or more generally spread out over, the underlying sand. Some of these stumps are a foot in diameter. 2 to 3 "
3. Pure, fine-grained sand, rusty and dark in upper part, into which the roots referred to sometimes penetrate a few inches. Apparently continuous with and forming part of present beach, but must be older, as it descends below sea level in places. A sharp line of demarkation between this and last member of the series. Drift-wood and sticks three to six inches in diameter appear to have been strewn over the old beach before it became covered with peat.

The surface of this bog is 10 to 15 feet above high tide level, and the bottom of the central part, so far as could be observed, sinks below the lowest ebb tides.

Point
Escuminac.

7. Another large and interesting peat deposit was found at Point Escuminac (see map), referred to in Dr. Ellis' report (Report of Progress, 1879-80). It is highest in the middle and likewise dotted over with numerous small ponds. From the examination made around its margin it seems to occupy a basin also, the central part of which is below high tide level. This gives it a thickness of 20 feet or upwards. Mr. Philips, light-house keeper, Point Escuminac, informed me that he found it 24 feet deep in one place. Like those already described it is almost treeless, but covered with heath plants. A section of the peat and underlying beds, taken near the Light-House, is as follows, the series being descending :—

1. Peat 7 to 8 feet.
2. Sand, coarse and gravelly, chiefly derived from the underlying gravel, but with more or less beach sand and foreign pebbles ; the whole partially stratified 6 to 9 inches.
3. Gravel *in situ*, derived wholly from underlying sandstones or shales. Thickness variable.
4. Grey, Middle Carboniferous sandstones or shales.

Burnt log in
peat.

Among the numerous stumps, trunks of trees and sticks in the bottom layers of the peat, or between divisions 1 and 2, a log partially burnt was observed. It is part of the trunk of a spruce tree, and has been split and shattered before it was thrown up here by the sea. About seven feet of it project out of the bottom of the peat. Three spots on one side were charred and hollowed out slightly by fire. The stumps and roots in the peat bottom around it are *in situ*.

CHALMERS
The
the c
the p
away
the o
the p
A
to the
distrib
these
in sou
pied b
levels
now.
more,
of the
stumps
the com
same v
around
stumps.
grew o
much g
These
sea has
enclosed
places t
banks r
farther
Upon
lands, a
constit
plants, e
humus.
* There a
New Brunsw
meeted in th
works. The
over Leida
during which
movement o
ring level w
low subsid

This burnt stick is similar to many other shattered ones lying upon the existing beaches and seems to have reached its present site before the peat began to grow. Its exposure now is caused by the wearing away of the edge of the peat by the sea. Whether it is any proof of the occupancy of these shores by human beings before the growth of the peat beds, remains to be considered.

A study of all the phenomena connected with these peat beds leads to the conclusion that a slight subsidence must have taken place in this district since the commencement of their growth. The bottom of these deposits seems to be at least 10 to 15 feet below high tide level in some places, and from their proximity to the coast the basins occupied by them, if emptied of peat, would be inundated. were the relative levels of the sea and land the same when the peat began to grow as now. Hence this coast area must have been 10 to 15 feet higher, if not more, with respect to the sea then. Moreover, the fact that the bottom of these peat bogs, wherever exposed, is invariably found to contain stumps of trees *in situ* of species now growing in swampy tracts near the coast, at a height of 10 to 25 feet above sea level, corroborates the same view. On the other hand the sand beaches now covered by peat around the borders of the basins enclosing it, upon which logs, sticks, stumps, etc., have apparently been strewn by the tides before the peat grew on them, indicate that the change of level cannot have been much greater than that stated above.*

These bogs appear to be still increasing in height and breadth. The sea has, however, broken through the barriers of sand and earth which enclosed the peat basins originally, exposing their margins in certain places to its erosive action. Elsewhere they are protected by sand banks recently formed. Their economic value will be referred to further on.

Vegetable Mould, or Decayed Vegetable Matter.

Upon the surface of the forest-clad areas and also on newly-cleared lands, a layer of material occurs often two inches or more in thickness, consisting largely of dead leaves, rotten wood, remains of herbaceous plants, etc., the lower portion of which, at least, is decomposed into humus. This was referred to on a previous page. As the soil undergoes

Vegetable
mould, how
formed.

* There are evidences of one upward and two downward movements of the land in northern New Brunswick during the Post-Tertiary period. First, a subsidence which apparently commenced in the glacial period, the maximum of which was reached about its close or soon afterwards. The land then stood about 20 feet below its present level relatively to the sea. The lower Leda clay appears to have been laid down at this stage. An upward movement followed, during which the upper portion of the Leda clay and the Saxieava sands were deposited, this movement continuing till the land had again risen 10 to 25 feet, or perhaps more, above its existing level with respect to the sea. The peat and marl beds were then formed, and a second slow subsidence began which has probably been in progress until recently.

Causing
fertility.

cultivation, this matter becomes disseminated through it and disappears to a large extent. The fertility of newly-cleared lands, especially uplands, depends almost wholly on its presence.* These often yield crops for three years in succession without manure of any kind; but on undergoing cultivation by the plough they deteriorate and without the application of fertilizers, become, in a short time, comparatively valueless. These remarks have reference more particularly to tracts which are underlain by sand and gravel, as wherever clay beds or alluviums occur, the original fertility of the soil is much longer retained. This decayed vegetable matter seems to be more abundant in the soils of river-flats, owing to the quantities carried down by the rivers and deposited thereon from time to time as they were in process of formation. Accordingly these soils contain a considerable proportion of humus. In the interior of the district under consideration most of the hills and mountains are devoid of any organic matter in the scanty soil covering them, and often exhibit only bare rocks or shingly slopes which support a thin dwarfed growth of trees.

M 3. MARINE ALLUVIUMS.

Sand Dunes.

Sand dunes,
why abundant
in the district.

Sand dunes are of unusual extent in this district, considering that they are merely marginal deposits. This is no doubt due to the fact that the sandstones of the Middle Carboniferous area, along the coast of which the dunes occur, have, in the process of disintegration, supplied greater quantities of arenaceous material than other rocks. From the immense beds of sand forming islands and beaches, in the Miramichi Bay, it is evident the denudation of the estuarine borders and coast has been enormous. The Miramichi River appears to have been the chief instrument in effecting this, but every stream flowing into this part of the Gulf of St. Lawrence has, no doubt, carried down greater or less quantities of sandy detritus.

Localities
where dunes
occur.

The character of these sand dunes was described in preceding reports. It will be sufficient therefore to briefly mention the localities of such as are known to occur in the district.

* The existence of this superficial layer has hitherto been overlooked; but in the study of the surface deposits of this district it became evident, from its thickness in many places and its relation to the seams of whitish or greyish sands underneath or associated therewith, that it was necessary to recognize it as a member of the series. In the natural forest-clad condition of the country it forms an almost universal layer, continuous with the peat beds, which indeed may be considered as a thickening of this vegetable layer in particular localities by the additional growth of mosses, etc. For the present therefore it is classed provisionally with the fresh-water alluviums.

At
on th
paralle
ordina
are no
nine in
becom
formed
no cha
bones o
in adja

Dunc
its har
Shippe

At th
along th
ing Pok

All th
Vin are

roek in
which th
winds ar

seems to
these du
in the ec

Salt m
Tabusint

seen on
River, al

hay in
Dennison

well as in
descripti

* Settleme
purpose of c
marine anim
still be seen
for the pros
The island tu
date by the J
Brunswick n

At the north point of Miscou Island, and extending half its length on the north-west side, a wide beach occurs, consisting of ridges parallel to the shore line, the surface being five to eight feet above ordinary high tide level (see map). The inner, or first-formed ridges, are now clothed with trees (white spruce, white birch, etc.) Spruces nine inches to a foot in diameter and 20 to 30 feet high are common, becoming smaller and more scattered towards the more recently formed portion of the beach. The ridges are all about the same height, no change of level being indicated during their formation. Walrus bones occur in the oldest of these, although the living animal is not seen in adjacent waters now.*

Dunes skirt the whole eastern coast of Miscou Island, almost closing its harbour on that side, and stretching along the north-east part of Shippegan Island nearly to Pigeon Hill.

At the entrance to Shippegan harbour (east side) sand dunes extend along the shore, and thence nearly to Barreau Point (see map), enclosing Pokemoucho and Tracadie lagoons.

All the islands in Miramichi Bay, except Hospital, Sheldrake and Vin are formed of sand. They have each a nucleus of dry gravel or rock ^{Nuclei of gravel or rock} *in situ* similar to that of the adjacent mainland, however, around ^{in some dunes.} which the sands have collected. Ridges and mounds formed by the winds and waves are characteristic features of these dunes. Their area seems to be increasing, and extensive shoals surround them. Most of these dunes are clothed with a dwarfed growth of trees or shrubbery in the central or nucleal part.

Salt Marshes.

Salt marshes occur in small patches at Tracadie lagoon, also at ^{Salt marshes, where found.} Tabusintac, Neguac, etc. The only ones large enough to map were seen on the western side of Point Cheval and at the mouth of Black River, also on the inner side of Vin Island (see map). On all these bays in considerable quantities is annually cut. At the mouth of Dennison's Brook, and inside of Huckloberry lagoon (east side), as well as in other localities, small marshes were also noted. For previous descriptions of salt marshes see reports of 1885 and 1886.

* Settlements are said to have been founded here in the 17th century by the French for the purpose of capturing the walrus or sea-cow. Such an exterminating war was waged against this marine animal that it soon became extinct in this part of the Gulf. It is claimed that there may still be seen the ruins of the post of the Royal Company of Miscou, which was founded in 1635 for the prosecution of walrus fishing etc., and for a time derived a great revenue therefrom. The island takes its name from the mission of St. Charles de Miscou, established here at an early date by the Jesuits. For further information see Perley's Reports on the Fisheries of New Brunswick and Wind's Preliminary Report on the Geology of New Brunswick, 1865.

Estuarine Flats.

Estuarine flats,
great breadth
of.

Estuarine flats occupy areas of greater or less breadth in Miscou and Shippegan harbours and in Pokemouche and Tracadie lagoons. In the mouths of the several rivers debouching into Miramichi Bay, and also among the islands which occupy it, wide expanses of sand, called "sandbars", are either laid bare at ebb tides, or covered only with a few inches of water. These usually support a dense growth of marine plants.

The general character of these formations was discussed in previous reports, and it is therefore unnecessary to go into further details regarding them.

AGRICULTURAL CHARACTER, SYLVA, ETC.

General
agricultural
character of
the district.

The agricultural character of the district under consideration presents no new features, except such as have been incidentally mentioned in previous pages of this report. The soils and subsoils bear, perhaps, a closer relation to the underlying rocks than in the coastal areas of the Baie des Chaleurs basin, and are likewise deeper, usually masking the strata completely everywhere, except on the Pre-Cambrian belts. Even where the surface is strewn with boulders foreign to the particular locality, the great bulk of the deposits belongs to the underlying rocks. The denudation which the region has undergone has carried away much of the finer material from the higher grounds and slopes, however, often leaving only a coarse gravelly or shingly soil. In the valleys there is usually a thick deposit of clay, gravel and loam, and wherever the latter is found, the soil is rich and productive.

Soils upon the Middle and Lower Carboniferous Rocks.

Soil of Carbon-
iferous area
above 200 feet
contour lines.

The general character of these soils as met with in the Baie des Chaleurs district was described in some detail in my last report (Annual Report, 1886), and the remarks therein respecting them, especially as occurring in eastern Gloucester, are also applicable to those of the district now under discussion. On that part of it above the 200 feet contour line, the soil, more especially on the drier grounds (leaving out of consideration the vegetable layer usually occupying the surface), is a dry stony gravel or sand with an admixture of clay in certain localities. Where the sand and gravel predominate, it is exceedingly porous and light, but where clay prevails it generally has a hardpan underneath, and, if flat, is often wet and swampy. This hardpan, which is almost impervious to water, consists of fine sand and clay, with more

or less
true ti
is often
page,
sufficie
but as
frequen
The low
system
product
Below
superior
the Gul
many of
and Nap
quality,
consisten
castle to
seems to
east th
bogue an
contains
located u
sandy pla
at St. Isid
Shippeg
most of th
and wet.
Return
occupied
Carbonife
The slopes
being rais
For the
lime appe
it are now
along the
able, whic
valuable f
limited ex
The flor
closely sim
as occurin

or less gravel intermixed, and is in some places stratified, in others a true till. It is found in flat districts or in low inland valleys where it is often covered only by the vegetable layer referred to on a previous page, which is here thicker than upon the ridges. Where there is sufficient slope to afford good drainage, the clay soils are usually fertile, but as they are wanting in organic and calcareous matter they require frequent applications of fertilizing material to render them productive. The low flat or undulating tracts, however, need, besides this, a proper system of draining. Without it, except in very dry seasons, their productiveness is much less than that of the drier grounds.

Below the 200 feet contour line the soil is, generally speaking, much superior to that inland. The surface has usually a gentle slope towards the Gulf shores and on this account is better drained, while along many of the river valleys, alluviums prevail. Bay du Vin, Black River and Napan valleys, more especially the latter, contain land of excellent quality, the upper portion of the soil partaking somewhat of a loamy consistency. On the north side of the Miramichi estuary, from Newcastle to Bartibogue, the coarser material of the surface deposits only seems to be left upon the slopes, although immediately bordering the coast there are strips of good land. Further north, between Bartibogue and Tabusintac, the coastal area is generally low and wet, but contains some arable tracts. The back settlements here are, however, located upon good dry soil. Between Tabusintac and Tracadie a wide sandy plain occurs, mostly unsettled, but around the latter place and at St. Isidore, excellent tracts of farming land are found.

Shippegan and Miscou Islands have but few settlers, and these devote most of their time to fishing. The land is low, and most of it poor and wet.

Returning to the Miramichi River, we find many fine tracts of land occupied and in a good state of cultivation upon the Middle and Lower Carboniferous areas along the North-West and South-West branches. The slopes afford good drainage and the soil is deep and capable of being raised to a high state of fertility by judicious and careful tillage.

For the improvement of the soils overlying the Carboniferous area, lime appears to be the great *desideratum*. Considerable quantities of lime are now applied in a slaked state. Near the coast of the Gulf and along the estuaries, inexhaustible supplies of mussel-mud are obtainable, which contains a large percentage of lime and constitutes a valuable fertilizer. This material is, however, only used yet to a limited extent.

The flora of the district occupied by the Carboniferous rocks is closely similar to that described in report M (Annual Report, 1886) occurring in eastern Gloucester, the distribution of the species in

Soil of Carboniferous area below 200 feet contour line.

Improvement of soil.

Flora of sylvia.

New growth
since Miramichi
fire of 1825.

certain localities being, however, somewhat different, especially within the area burnt over by the great Miramichi fire of 1825. Outside of that area, hemlock, black and white spruce, fir, black, white and yellow birch, maple, beech, poplar, white and red pine, etc., are the principal trees on the drier grounds. On the swamps and inter-
vales, cedar, haematac (larch), ash, elm, balsam-poplar, etc., occur. There is, generally speaking, a heavy growth of wood, except where the original forest has been destroyed by fires. Within the area overrun by the great Miramichi fire referred to, a growth of trees has sprung up which is in some respects different from that destroyed. Large groves of poplar on the damp grounds, and white birch, maple and beech on the drier, were especially noticeable, each of these growing in spots to the almost entire exclusion of any other tree. Upon the sandy and gravelly tracts, however, groves of red pine and black spruce are the prevailing forms, while along dry river banks, white spruce is the most abundant tree. The latter has attained, since the fire, a thickness of 12 to 15 inches above the roots. Haematac (larch) is common in bogs. The hemlock does not seem to have grown again after its destruction. In general the young growth of trees forms a dense forest.

Character of Soil upon the Cambro-Silurian Belts.

Soil of Cambro-
Silurian area,
quality of.

Of the two belts of Cambro-Silurian rocks crossing the district, that adjoining the Carboniferous is the lowest and contains the best lands. Many parts of it are boulder-strewn, but along the Nepisiguit, the main North-West Miramichi and Big Sevogle (see Dr. Ells' reports, Reports of Progress, 1879-80 and 1880-81-82) there are some tracts containing excellent soil. North of the Nepisiguit, about the headwaters of Little and Pabineau rivers, there are also areas of fine land, well suited for agricultural purposes but still in a wilderness state.

Trees upon it.

On the north-western band of these rocks the land is higher and appears to be more boulder-strewn.* Both are still largely covered with a heavy growth of birch, maple, beech, spruce, pine, etc. The river valleys are generally pretty wide and contain flats with excellent soil.

The wide terraces along the Big Sevogle (see map) are clothed with a dwarfed growth of red and Banksian pine 10 to 20 feet in height. The flats support elms, poplars, etc. Strange to say, the last mentioned trees, even within the limits of the great fire of 1825, seem, in many places, to have escaped its ravages.

CHALVE
Ret
strew
rocks
summi
bould
Along
areas
skirt
by fore
replac
slopes
The
to the
especi
side, ir
along
map.
agricul

Old I
and tee
sintac
above D
rear of
kettle h
and oth
with th
were co
of Chat
Brunswi
pened
this Ind
Dr. Smi
ment is
washing
of the b

* The h
deep in the

Soil upon the Pre-Cambrian Rocks.

Reference has already been made to the great amount of rock debris ^{Soil of Pre-Cambrian rocks, general sterility of.} strewn over the surface of that part of the country occupied by these rocks, and its consequent general sterility noted. The mountain summits and flanks often exhibit little else than a mass of loose boulders and coarse shingle, the result of ages of disintegration. Along the foot-hills and in the valleys, however, there are limited areas of cultivable soil, while narrow intervalles and terraces usually skirt the rivers. A considerable part of this district has been overrun by forest fires, and the covering of trees thus destroyed has never been replaced. Isolated clumps still occupy the lower portions of the slopes in places, however, and shroud the valleys and ravines.

The settlements within the Miramichi district are chiefly confined ^{Settlements, where located.} to the tracts bordering the coasts and estuaries. This is more especially the case on the north side of the river, as on the south side, in addition to the coast settlements, there are a number of others along the tributaries and behind the towns, as will appear on the map. Many of the latter are in a thriving condition, the general agricultural character of the country here being very good.

INDIAN ENCAMPMENTS.

Old Indian camping grounds, in which flint arrow-heads, chips, bones ^{Indian camping grounds.} and teeth of animals, etc., occur, were observed at the mouth of Tabusintac River and on the banks of the South-West Miramichi a few miles above Derby Junction. There seems to have been a burial ground in rear of the camp site at Tabusintac, human remains and a copper kettle having been found there.* A leaden crucifix, an iron hatchet, ^{Relics found.} and other evidences of the intercourse of the early French settlers with the Indians were also discovered. A number of the relics were collected by Dr. A. C. Smith, of Newcastle, and Dr. Baxter, of Chatham, and forwarded to the Natural History Society of New Brunswick and a paper relating to these pre-historic remains appeared in *Bulletin* No. V. of that Society. An examination of this Indian camp site during the past summer, in company with Dr. Smith, elicited the following facts:—The site of the encampment is only three to five feet above high tide level, and the sea is washing away the bank. Fig. 3 represents a geological section of the beds—*a*, millstone grit; *b*, the same partially, and in the

* The human remains were supposed to be those of an Indian, and were buried three feet deep in the river's bank in rear of the camp-site.



a, Sandy loam. b, Rotted rock. c, Middle Carboniferous sandstone.

FIG. 3. SECTION AT INDIAN CAMP-SITE, TABUSINTAC RIVER.

upper part wholly, decomposed from suberial action; and c, a sandy loam apparently formed from the further oxidation of the underlying gravel or sand and mingled with more or less recent sand thrown up by the sea. Only in division c do the relics occur. Division b appears to have been undisturbed, and there is no evidence of a submergence since the deposition of the Saxicava sands, (of which in reality c may form a part) or from the commencement of its occupancy by the Indians, as inferred by the writer of the article in the *Bulletin* just cited.

How entombed.

The entombment of the relics in division c has been effected partly, perhaps, by the *rejectamenta* of the Indians, but principally by atmospheric action and tillage, none appearing deeper in the soil than the plough could cover them. From the numerous stone chips, unfinished arrow-heads and others of more perfect form, as well as the relics showing contact with the early European settlers just referred to, it seems probable that the Indians occupied this camp site continuously from a very early period until recently. About the year 1860 they are said to have left it never to return.

MATERIALS OF ECONOMIC IMPORTANCE.

Economic materials.

The materials of economic importance known to occur in this district have been incidentally referred to in preceding pages, and are brick-clay, fine sand, gravel suitable for roads, ballasting railways, etc., peat and bog iron-ore, the latter in small quantities.

Where found.

Brick-clay of marine formation (Leda clay) is found in great abundance along the estuary of the Miramichi, and brick-kilns are in operation at Chatham, Newcastle and Nelson. The one at the last mentioned place is the largest and the bricks manufactured there are reported to be of excellent quality. Sand beds (Saxicava sand) occur in proximity to these brick yards, affording supplies of sand suitable for brick and mortar. Both Saxicava and recent sands of the finest quality for the purposes mentioned are abundant almost everywhere along the coast of this district (see p. 26 N, this report,) for description of sand dunes).

Gravel adapted for the purposes referred to was met with in the vicinity of Chatham, Douglastown, Newcastle, Bartibogue and numerous other localities.

Peat is abundant and of great thickness and excellent quality. Should this article ever be required for fuel in northern New Brunswick, or for any other purpose, there is here an almost inexhaustible supply. The particular localities where the larger peat bogs occur, together with brief descriptions of them, are found on pp. 22-25 N, (this report.)

Bog iron-ore was observed on the south side of Tracadie River in small quantities. It was also noted on the North-West Miramichi in the vicinity of Chaplin Island. Clay associated with it and coloured therefrom is, at the latter place, used as a red paint for the outside of buildings.

Tide level.

sandstone.
RIVER.

and c, a sandy
no underlying
l thrown up by
n b appears to
submergence
reality c may
ey by the In-
letin just cited.
affected partly,
ally by atmos-
e soil than the
rips, unfinished
l as the relies
referred to, it
e continuously
year 1860 they

in this district
and are brick-
ways, etc., peat

in great abun-
ns are in oper-
last mentioned
e are reported
occur in prox-
table for brick
est quality for
ere along the
ription of sand

