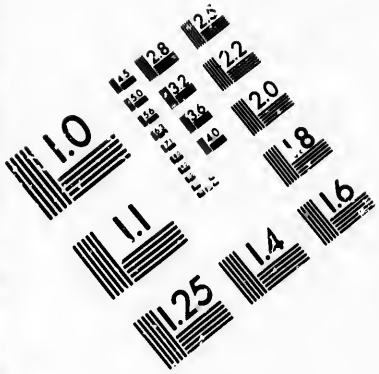

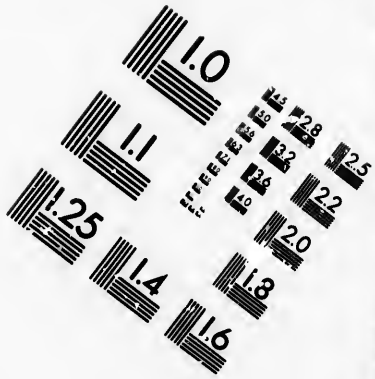

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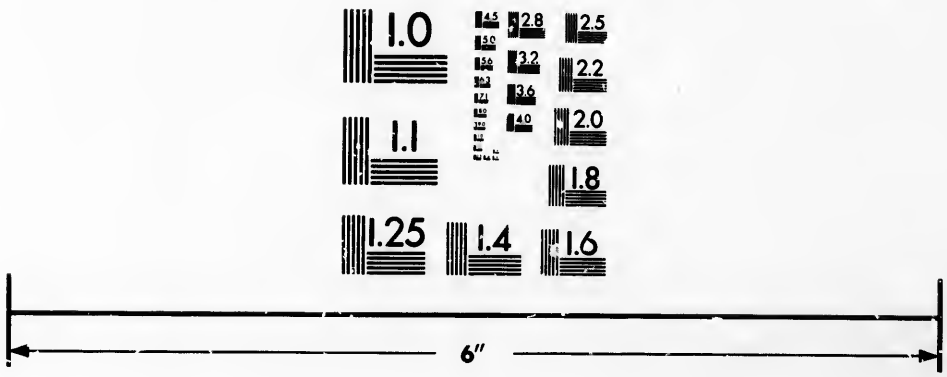

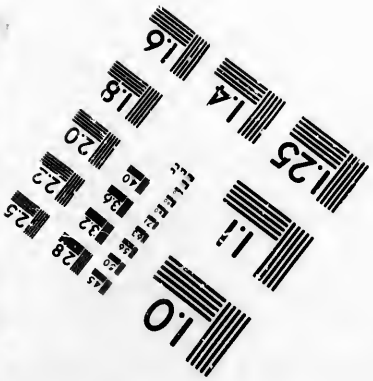

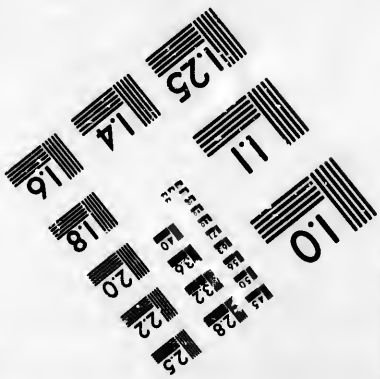

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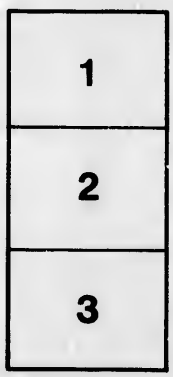

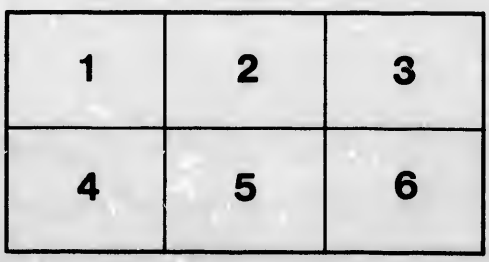

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REPORT

ON THE

COUNTRY BETWEEN THE UPPER ASSINEBOINE RIVER

AND

LAKES WINNIPEGOSIS AND MANITOBA,

BY

JOSEPH WILLIAM SPENCER, Bac. App. Sc.

Office of the Geological Survey,
Montreal, *March 13th*, 1875.

Robt. Bell, Esq., C.E., F.G.S.

Sir,—I have now completed the maps of the regions which you detailed me to explore as your assistant while in the North-west Territory last season; also the chemical analyses of some specimens collected in the course of these explorations; and I would now beg you to submit them, together with the following report, to the Director of the Survey.

Your obedient servant,
JOSEPH WILLIAM SPENCER.

Journey.

Having received your instructions to proceed to Winnipeg, I started about the middle of last May, going by way of Lakes Huron and Superior as far as Duluth. At Thunder Bay I had an opportunity of examining several of the mining locations. From Duluth I went by rail to Fargo, and thence by Red River steamer to Winnipeg. After having travelled along with you from Winnipeg to a point about fifty miles north of Fort Ellice, I proceeded, in compliance with your orders, to make an exploration of Shell River and the adjacent parts of the Assiniboine River; being assisted by Mr. William Hagar and one or two workmen. I chose a site near the junction of the two rivers for a camp, and proceeded to make the explorations on foot, which was the only practicable way.

Assineboine valley.

The valley of the Assineboine, adjacent to that of the Shell River, is about a mile wide, and some 200 feet deep. The alluvial flat at the bottom of the valley is three-quarters of a mile wide, and the banks rise steeply on either side. Through this level flat the river pursues a meandering course from side to side, occasionally leaping a small rapid caused by the obstruction of Laurentian boulders. Twenty miles farther up, the valley is nearly three miles wide, but at this place in the bottom, and following the valley longitudinally, there are four or five series of hills rising irregularly, one above the other, till the highest reaches nearly to the level of the plain above. Between these hills there are small deep valleys. The western bank is often strewn with gravel and boulders, while the flats below are nearly free from them, excepting in places along the bed of the river. The sides of the valley are often deeply gorged, but the ravines do not extend to any great distance back from the valley. Many of them appear to have been cut out by the waters from springs. These springs usually hold a considerable quantity of iron in solution, and I observed several places where yellow ochre was being deposited around them. In several localities on the banks of the Assineboine, extensive landslides are to be met with, sometimes showing stratified deposits of clay or sand. The general course of the Assineboine valley at the influx of the Shell River is nearly south, but above it has a more westerly direction.

Shell River.

I explored the Shell River valley upward for thirty miles, and Mr. Hagar continued the exploration for ten miles farther. Along the upper part of this distance the country on either side has usually a rolling prairie character, while in the lower portion the river flows in a valley nearly as wide and deep as that of the Assineboine. The general course is nearly from the north. At the bends of the valley, the river usually winds its way to the outer side, and on the inner side of the curve there is left a terrace, or series of terraces, rising from the alluvial flat to the plain above. The country is generally wooded, except here and there where fires have swept over small areas. The Shell River is much more rapid than the Assineboine, and the sides of the valley are much more deeply gorged than those of the latter river. At the landslides along the Shell River, I observed a few stratified deposits, but they generally showed only a heterogeneous mixture of gravelly earth with boulders. The bottom of the river often abounds with fresh-water mollusca, and hence, perhaps, the origin of the name of the stream. Returning to Fort Pelly, I received your instructions for the rest of the season, in compliance with which I proceeded to explore Swan River.

Fort Pelly.

The Assineboine valley in the vicinity of Fort Pelly is not sharply defined, as it is further south, by a limited breadth and steep escarpments. North-east of Fort Pelly the land gradually rises for six or eight miles to the water-shed, between the Assineboine and the Swan River, and then descends to the latter.

Swan River.

From the Swan River Crossing (where we started to descend the river) the distance to Swan Lake, by the stream, is 130 miles, although by the trail it is only about half as great. In descending the river I noted no less than 446 rapids. These are generally caused by the descent of the water over Laurentian boulders, but sometimes over the country-rock. The whole descent of the river, from a point abreast of Thunder Hill, was estimated at from 450 to 500 feet, and Thunder Hill rises 300 to 350 feet over this point. The average width of the river is about 100 feet, but sometimes it becomes very much wider, enclosing picturesque islands, while in other places it is quite narrow, but deep. The river for the last thirty-five miles before reaching Swan Lake is free from rapids and is navigable for boats drawing two feet of water. In the spring of the year the Hudson's Bay Company send down some of the returns of their inland trade in flat boats, but of course these cannot return. Swan River enters the lake of the same name through a swampy projection of land, extending several miles into the lake. Indeed, all the country for some distance west of this lake is low, but it is generally wooded.

Thunder Hill.

Thunder Hill is an isolated elevation situated about four miles north-westward of Swan River, and about ten miles below the Crossing. It rises from 200 to 250 feet above the plain, which gradually slopes up from the river. The hill slopes gently to the north-westward, while to the south-eastward there is an abrupt escarpment broken by successive landslides, which are now separated from each other by small valleys. Near the summit the landslides have exposed some calcareo-arenaceous shales, holding fossils of Cretaceous age. At the base of Thunder Hill I noticed several depressions, almost round, measuring from sixty to 200 feet in diameter, and having a depth of twenty feet or more. Some of them contained water, while others were quite dry.

Sander's River.

Sander's River is a branch of Swan River, flowing from the south, and emptying itself into the latter about fifty miles from its mouth. The country through which it passes is similar to the Swan River valley. One day was devoted to the exploration of this branch, and eight or ten miles of its course were examined. Pieces of lignite were found in the bed of the stream, and afterwards along the Swan River, below its influx. After I arrived at Shoal River House, I was informed by a half-breed

Lignite.

that the lignite (called coal) was found in beds from a few inches to two feet in thickness on Sander's River, a few miles above the point I had reached.

Swan Lake.

Swan Lake is about twenty miles in length. Besides the Swan River, it receives two or three smaller streams. The shores are all low and swampy, except at a few points which are made up of gneiss boulders and slabs of limestone. On one of these points in particular, an ice-formed beach occurs, on which boulders, weighing from half a ton to twenty tons, have been piled up with as much apparent ease as if they had been small pebbles. The lake contains several islands, on which the country rocks are exposed. These consist of limestones, and are best seen on two of the largest islands situated in the northern part of the lake, viz., Warren and Lafavorita Islands. The whole lake is very shallow, not averaging more than six feet in depth. The bottom consists of soft loose silt..

Ice-formed beaches.

Shoal River.

Shoal River discharges Swan Lake into Lake Winnipegosis. The Hudson's Bay Company's post, Shoal River House, is situated at the outlet of Swan Lake. Shoal River is only from two to four feet deep, and has a width of from 150 to 250 feet. The banks are low on both sides. The current is of considerable velocity, the fall being about thirty feet in its course of eight miles. It empties itself into the southern extremity of Dawson Bay, which forms the north-western part of Lake Winnipegosis.

Porcupine Mountain.

Porcupine Mountain forms a continuation of the chain of high ground which marks the eastern limit of the second of the three great prairie steppes of the North-West Territory. It rises to the height of about 800 feet above Swan Lake. Between the base of the mountain and the lake is a belt of about twelve miles of low ground, consisting of open marshes, or "muskegs," tamarac swamps, &c., while the remainder of the interval is densely wooded with aspen, balsam-poplar, spruce and willow. On the slope of the mountain I saw balsam-poplars six feet in diameter, while in some cases the spruces reached a thickness of nearly four feet. This forest is more ancient looking, and bears fewer evidences of fire than any other that came under my observation in the North-West Territory. The region is little frequented, even by the Indians, being difficult of access. Although fire has not visited the slopes of the mountain or the level ground below for a very great length of time, yet the whole of the forest on the summit was swept away a few years since, and in its place a young growth of poplars has sprung up.

Timber.

Bell River.

The Bell River rises in a lake on the summit of the mountain, and

running eastward, cuts its way down the escarpment, forming a series of rapids six or eight miles in length. After reaching the plain below, it turns north-eastward and empties itself into Dawson Bay. The bed of the river is filled with Laurentian boulders, over which the water descends at the rate of about 150 feet per mile. From the foot of the slope my guide and I followed this river to the summit. Along it there are great exposures of shales. Fragments of lignite were picked up along the river, but the beds from which they had been derived were not found. Lignite.

Looking back from the point which we reached at the summit of the mountain, the escarpment appears to descend rapidly. It is richly clothed with foliage, and through it the Bell River has cut its valley; the wooded plain stretches from its base, and further on is Swan Lake with its lovely islands. In the far east, Pelican Lake is just visible. To the north-eastward a long sheet of water (Dawson Bay) is seen, while further off the sight is lost in the main waters of Lake Winnipegosis. View of landscape.

Lake Winnipegosis is about 100 miles long. Its north-western portion, Dawson Bay (named in honour of Principal Dawson of McGill University) is nearly cut off from the main body of the lake by a long peninsula. This bay has an extreme length of about forty miles, and a breadth varying from five to twenty miles. Both shores are deeply indented with smaller bays. On some of the projecting points, cliffs of a light-coloured limestone occur. There are several islands, on which solid rock is also exposed, as well as many submerged reefs. The highest rocky promontory is Point Wilkins, on the west side of the lake. Most of the points have ice-formed beaches composed entirely of boulders and pebbles, and behind them there are extensive swamps. The north end of the lake is especially low, and the barrier between Winnipegosis and Cedar Lakes is little more than a swamp, from three to five miles across. The greatest elevation of the lowest traverse between them was ascertained by Mr. Bender of the Canadian Pacific Railway Survey, while I was in the neighbourhood, to be forty-four feet over the water at either end (the two lakes being on the same level.) The character of the main body of Lake Winnipegosis is the same as that of Dawson Bay, being studded with islands and reefs. On the east side, between Elm and Gun Points, there is a cliff of limestone of considerable extent. The beaches of almost every point and island are made up of Laurentian boulders and fragments of Devonian limestone, overgrown with trees, behind which are swamps, often of considerable extent, and small lakes. Lake Winnipegosis. Beaches. Cedar Lake. Beaches.

I visited the salt works at the south end of Lake Winnipegosis in company with Mr. J. H. Rowan, chief assistant engineer of the Canadian Pacific Salt-works.

Railway, who was returning to Winnipeg, and with whom I arranged for our passage to Oak Point, near the south end of Lake Manitoba. From

Mossy River.

the salt-works (which will be described further on) I went up Mossy River (the outlet of Dauphin Lake) for a few miles. Here also are limestone exposures. This river has a depth of from two to four feet for a distance of three or four miles from its mouth, where it is about 200 feet wide. An exploratory line of the Canadian Pacific Railway crosses the river three or four miles from its mouth, and runs north of the Duck Mountain, following up the course of the Swan River Valley. Lake Winnipegosis is of considerable depth, and has clear good water. Owing to sudden and frequent wind-storms, its navigation by small boats is attended with some danger. Lake Winnipegosis is connected with Lake Manitoba by Water-

Water-hen River.

hen River and Lake, both of which are shallow and muddy, and have extensive swamps around them. The river has a total length of twenty-five miles, and descends eighteen feet.

Lake Manitoba.

Lake Manitoba is 130 miles in extreme length. It is a shallow muddy lake with many reefs, which will endanger future navigation, and there are but few good harbours. The portion of the lake south of the Narrows, although considerably wider than that to the north, is still shallower. From Oak Point on this lake to the town of Winnipeg, the distance is about sixty miles, and the trail passes over open prairie, with only here and there a grove of trees.

The most noticeable feature between these places is Shoal Lake, forty

Winnipeg.

miles from Winnipeg. It has no outlet, and its waters are consequently saline. The soil in the neighbourhood of the lakes is mixed with much gravel, but when within twenty miles of Winnipeg town it begins to assume a black loamy character. For the first thirty or forty miles south of Lake Manitoba the drift deposits do not appear to cover the country rock to a greater depth than from ten to twenty feet.

General Description of the Geology of the Region Explored.

Deposits of Neozoic Age.

Junction of formations.

Over large tracts of the North-West Territory it is almost impossible, owing to the rarity of exposures and to the similarity in lithological character of the strata, to tell where the Post Pliocene deposits begin to overlie those of Tertiary age on the one hand, or the deposits of the Tertiary to overlie those of the Cretaceous period on the other. Along parts of the Assiniboine and Shell Rivers the valleys are worn out to a

depth of 200 feet, and from one to four miles in width. If the rivers which now flow through them have excavated these valleys, the former must be of great antiquity. The valleys are yearly becoming larger by the spring floods bearing away great quantities of r terial. Everywhere along the river banks there are evidences of former land-slides. Notwithstanding the great depth of the valley, only a few sections of the deposits composing the banks are to be seen. This is owing to the fact that the surface material brought down by the land-slides always covers up the sections, which might otherwise be exposed. Along the Assineboine valley, stratified clays, or weathered shales *in situ*, are sometimes exposed. These shales may possibly belong to the Tertiary series, but I found similar rocks of Cretaceous age at a higher level in Thunder Hill. The deposits of the Shell River valley frequently consist of irregular beds of clay with boulders, while along the alluvial flat of the Assineboine they consist of regularly stratified clays. The summits and sides of the banks of both streams are generally covered with boulders. River valleys.

In the more recent deposits of the Shell River valley, an Indian is said to have found, a few years ago, some large bones, which were, at the time, sent to Fort Ellice, and afterwards to England. These remains were described to me by a man who had seen them, and also the place whence they came. They appear to have been large enough to have belonged to *Elephas primigenius*, and, in fact, they were called mammoth's bones by the white men of the country. Large bones.

On Thunder Hill, and in many exposures along Swan River, there is but a thin covering of drift over the underlying Cretaceous rocks. Between the foot of the eastern slopes of the Duck and Porcupine mountains and the lakes, the Devonian limestones are covered by only a few feet of drift. The following is a section, in descending order, of these deposits as they occur in the Swan River opposite Thunder Hill:— Rocks in the vicinity of Thunder Hill.

	FT.	INS.
Surface soil	3	0
Bed of Laurentian boulders and pebbles	2	0
Stratified coarse sand	0	6
Bed of Laurentian boulders and pebbles	2	0
Stratified coarse sand	0	6
Laminated clay	1	0
Homogeneous clay with pebbles	3	0
	12	0

Fifty miles farther down the river the following beds, in descending order, were observed for a considerable distance along the river:—

	FEET.
Surface soil	6 to 0
Stratified clay in layers 4 to 6 inches thick, variously coloured	4 to 8
Small boulders and gravel	1 to 4

These were underlaid by compact clay, with small boulders and gravel, to an unknown depth. In the Porcupine Mountain, the drift overlies shales, probably of Cretaceous age, which are exposed on Bell River, and elsewhere along the escarpment.

Deposits of Mesozoic Age.

In the region, covered by the title of this report, rocks of the Cretaceous period were observed on Thunder Hill, at a height of nearly 800 feet above Swan Lake; or, at about 1,600 feet above the ocean. Near the summit of this hill, are indurated calcareo-arenaceous shales, containing fragments of selenite. They contain fossils, of which the most abundant are *Inoceramus* and *foraminifera*. Mr. J. F. Whiteaves, who has kindly examined the specimens, finds the latter to be principally *Globigerinæ*.

Fossils.

Following the course of the Swan River, below Thunder Hill, there are numerous exposures of Cretaceous rocks. They are mostly shales, with some limestones. The general dip is to the west, at an angle of only about two degrees. The following descending section is the first of undoubted Cretaceous rocks that I observed on the river itself. It occurs a little below Thunder Hill:—

Cretaceous rocks.

	FEET.
Soft crumbling shales of a drab color	8
Compact shales of the same color	3
Alternate reddish and bluish shales	3
Soft drab-colored shales	3
	17

Some of these shales contain traces of fossils. These beds are stratagraphically between 300 and 350 feet lower than the fossiliferous exposures on Thunder Hill. A short distance farther down the river I noted the following section of a bank, in descending order:—

	FEET.
Concealed by a land-slide	49
Laminated shales (drab)	5
Concealed by clay which contains slabs of fossiliferous limestones.	15
Laminated drab shales	5
Fossiliferous limestone forming the base, of which are exposed	4
	69

Near this section are springs depositing yellow ochre. A little further down I observed other springs at which the process of petrifying wood, moss and leaves was going on. Here there were also blocks of calcareous tufa, sometimes measuring several cubic yards, which had been formed at the place where they are found. Numerous large pieces of calcified wood are enclosed in them. Tufa.

The thickest vertical section of limestone beds which I observed on the river amounted to about fifteen feet. The river, often for long distances, has washed away the shales underlying the limestones, thus causing the overlying beds to sink irregularly. The exposures in this vicinity are found in places extending for about twelve miles along the river. Several miles farther down, or when still about thirty miles from Swan Lake, I found some thin beds of soft micaceous sandstones in thin flags. The whole section between the summit of Thunder Hill and these sandstones (which are the lowest Cretaceous beds exposed) is from 550 to 650 feet thick. Between these last rocks and the underlying Devonian limestones, which are exposed on the islands of Swan Lake, there would be a space of 100 to 150 feet, of which no section was observed along Swan River. Probably some of these concealed measures are a continuation downwards of the Cretaceous formation, while the Devonian may perhaps be continued upwards to meet them. Limestones and shales.

Almost all the Cretaceous limestones are fossiliferous, as well as some of the shales. The most common fossils are one or two species of *Inoceramus*, and numerous small shells, which, according to Mr. Whiteaves, belong to a species of *Ostrea*. In the lower beds I found the remains of a Cestraciont Selachian, which, from the form of the teeth, Mr. Whiteaves considers to belong to the genus *Ptychodus*, or one allied to it. He also recognizes fragments of scales of other fishes in the same rocks. Some remains of plants were also found. Fossils.

Along Bell River, in the Porcupine Mountains, there are large exposures of Cretaceous shale; but the clayey matter predominating so largely, landslides are frequent, and cover with clay many beds, which, if exposed, might be of great interest. At one of these exposures of shale, which is now weathering into clay, an immense slide has occured. The shales here contain much iron pyrites, and on weathering, a whole section will become blackened by the formation of ferrous sulphide, whilst the remainder of the sulphur is partly deposited in the crevices, where it is sometimes found in considerable quantities. Much heat is at the same time evolved, and there is a strong sulphurous smell while the process is going on. The Indians know this place by the name of Shale.

Burning Mountain.

Burning Mountain; and my guide informed me that for several winters it had smoked, but not in summer. This was probably the vapor generated by the heat of decomposition condensing in the cold atmosphere of the winter, but which became invisible at the summer temperature.

Sections of the limestones of Swan River, and of the marls of Thunder Hill, having been prepared for microscopic examination, they were handed to Mr. George M. Dawson, who reports as follows:—

Mr. G. M Dawson's notes.

"The specimens from Swan River and Thunder Hill are essentially similar, and are almost entirely composed of separated prisms of shells of *Inoceramus*, with *Foraminifera*, and some scattered fragments of fish bones and scales, the latter being conspicuous from their bright brown color. The limestone, in microscopic character, much resembles that from Boyne River, Pembina Mountain, but is somewhat harder. Specimens of the latter were transmitted to me by Mr. A. L. Russel, and have been referred to the Niobrara division, or, Cretaceous No. 3, of Meek and Hayden. The *Foraminifera* appear to agree very closely with those of the Boyne River beds, and of the limestone of the Eau Qui Court, Nebraska; the genera *Globigerina*, *Textularia* and *Discorbina*, being represented in all three localities. All the forms represented by the specimens from Swan River and Thunder Hill bear a close resemblance to those of the more southern localities, and the *Textularia* is referable to *T. pygmæa*, one of the two species represented there. The prisms of *Inoceramus* are more abundant in proportion to the *Foraminifera*, than at Eau Qui Court, or at Boyne River, and in the relative abundance of *Globigerinæ* to other forms the specimens more nearly resemble those of the Nebraska deposit; such differences might, however, obtain between two contiguous beds. Small fragments of fish remains are common to the three localities. As most of the *Foraminifera* found in these deposits are still represented in the Atlantic, they do not form, in themselves, a very definite criterion of the age of the beds containing them. Their occurrence in such quantity, however, at least implies similarity of conditions in the different localities, and as the Niobrara period is the only one in which calcareous deposits of this kind are known to have been formed in the eastern region of the Cretaceous, a strong probability is established that the rocks represent that division. The specimens from Boyne River showed also, in some places, numerous valves of *Ostrea congesta*, a characteristic form of the Niobrara group. *Coccolites* are not evident in the Swan River and Thunder Hill specimens, while they occur in other localities, but are, perhaps, only masked by the superior induration of the

rock, a careful examination of some of the soft parts of which might lead to their discovery."

Deposits of Devonian Age.

Devonian limestones.

The rocks of this age which came under my notice consist entirely of limestones. The highest beds exposed, such as those on Warren Island and Point Wilkins, are made up of apparently concretionary nodules. These beds, on disintegrating under the action of the waves, leave at their base hard clean gravel, or nodules of limestone. Almost all the rocks on the western side of Lake Winnipegosis are of light yellowish colors, while those observed on the eastern and southern sides are greyish. At Point Wilkins, on Dawson Bay, a cliff rises to the height of sixty feet. The upper beds consist of the concretionary limestone just noticed, and the lowest are red indurated marls, while between them are forty feet of evenly-bedded whitish limestone. In many places on Swan Lake and Lake Winnipegosis, the exposed rocks appear to have been washed away along the water-level, leaving caverns of considerable size, or else the superincumbent beds have fallen down, owing to the sinking or dissolving away of the underlying strata, thus forming a broken and confused mass. This structure is particularly noticeable at Point

Confused portions.

Point Wilkins, Dawson Bay.

Wilkins, where the red marls at the base of the cliff have, apparently, been washed away for a considerable distance, leaving a long low cavern,

the roof of which has fallen in, and the superincumbent beds, afterwards sinking, have compressed the whole into a mass resembling a piece of rubble-work, as shewn at *b b* in the above sketch. The cliff may have once extended further into the lake, and its present appearance has probably resulted from the falling down and removal of the rock since the filling up of the supposed prëexisting cavern. Towards the limits of the confused portion, the beds gradually become distinct and assume the horizontal attitude represented at *c c*. In the sketch, *a* represents what appears to have been formerly a projecting portion of the upper bed, now fallen to a perpendicular position.

Distribution of Devonian rocks.

The Devonian limestones appear to occupy the whole of the flat country between the foot of the Duck and Porcupine Mountains and Lakes Winnipegosis and Manitoba, and also the eastern shores of both these lakes. The best localities for fossils, so far as my observation extended, are Warren Island in Swan Lake, and Points Wilkins and Carrolida on Dawson Bay. The palæozoic fossils, which I collected, have been determined by Mr. Billings, who pronounces them all to be of Devonian age. The following were collected from rocks *in situ* at the above localities: *Athyris, Cyrtina, Atrypa aspera, A reticularis* (Devonian type), *Spirifera* and *Orthis*. The following were obtained on the western shore of Dawson Bay, from slabs apparently derived from the neighboring cliffs: *Receptaculites* (?), *Favosites* (2 species), *Syringopora Acervularia profunda* (this occurs in the Hamilton group in Iowa) *Heliophyllum* (like *H. Halli*), *Diphyphyllum, Stromatopora*, crinoidal columns, *Gypidula, Rhynchonella, Atrypa reticularis, Athyris, Strophomena*, a brachiopod resembling *Stringocephalus, Euomphalus, Pleurotomaria, Loxonema, Bellerophon* and *Phillipsia*. Among other specimens, which had evidently been transported from a greater or less distance, there were *Pentamerus, Atrypa reticularis, A. aspera, Strophomena, Chonetes, Euomphalus*, &c

Fossils.

Economic Minerals.

Economic minerals.

The minerals of economic value which came under my notice consist of clay iron-stone, lignite, peat and salt. In many places along Swan River, and in the Porcupine Mountains, clay iron-stones are abundant. They are of a concretionary character, contain a considerable quantity of calcareous matter, and belong to the limonite group of iron-stones. In two specimens which I analysed the proportion of iron is low, one of them yielding only 12·90 and the other 16·70 per cent. In the lignite, which I collected on Sander's River, already referred to, the woody structure is

Iron-stone.

Lignite.

apparent; the color is nearly black, with very dark streak: lustre sub-resinous on transverse sections, but dull when the mineral is broken longitudinally; fracture sub-conchoidal; tough. It does not disintegrate very readily. An assay gave the following results;—

	Slow coking.	Rapid coking.
Fixed carbon	50.700	49.000
Volatile matter	26.325	28.025
Ash	4.150	4.150
Hygroscopic water	18.825	18.825
	100.000	100.000
Ratio of volatile to combustible matter	1 : 1.93	1 : 1.81

The coke was pulverulent, and the ash light buff-colored.

Peat.

A few miles below The Crossing on Swan River, two beds of peat are exposed in the bank, the thickest of which measures eighteen inches. Above it is a foot of clay, and then nine inches more of peat, the latter being buried by a few feet of surface soil.

Salt.

Salt was formerly made from the brine springs near the mouth of Bell River. The salt springs at the south end of Lake Winnipegosis have been worked for a long time. At these springs the saline waters percolate through the drift, which in this region covers but thinly the Devonian limestones, and destroys vegetation for some distance around. The manufacture of the salt is conducted in a rude manner. Pits are dug four or five feet deep, and into them the waters infiltrate. Beside these temporary furnaces are erected, on which are placed evaporating pans made of iron plate one-eighth of an inch thick and five or six feet long, by about three feet wide and eight or ten inches deep. Beside the pans, are trays on to which the salt is raked. No pumps are used, the water being lifted into the pans directly from the pits by means of pails. The operation is conducted entirely in the open air. The manufactured salt is put into birch-bark boxes, or "mococks," holding about 100 pounds each, and is then ready for market. During the season Mr. McKay, the only person engaged in the business, made about 500 bushels, or less than half the quantity which had been manufactured in some previous years.

The following is an analysis, by myself, of a sample of the salt which I brought from the works:—

Sodium chloride	95.123
Magnesium chloride	0.600
Calcium sulphate	3.400
Sodium sulphate	0.394
Moisture	0.044
Residue	0.439
	100.000

The residue consists of silica, alumina, iron and lime. The salt has a light brown tint, and is very coarse-grained, owing to the manufacturer allowing the crystallization to go too far undisturbed.

JOSEPH WILLIAM SPENCER.