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THE SIMARD MAP-AREA, CHICOUTIMI COUNTY, PART D

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PROVINCE OF QUEBEC, CANADA

**BUREAU OF MINES**

Honourable J. E. PERRAULT, Minister of Mines

J. L. BOULANGER, Deputy-Minister

A. O. DUFRESNE, Director

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ANNUAL REPORT  
OF THE  
QUEBEC BUREAU OF MINES  
FOR THE CALENDAR YEAR  
1932

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# THE SIMARD MAP-AREA

## CHICOUTIMI COUNTY

*by Bertrand T. Denis*

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## THE SIMARD MAP-AREA

### CHICOUTIMI COUNTY

by Bertrand T. Denis

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#### INTRODUCTION

Since the publication, in 1884, of a report on geological observations in the Saguenay region, by Monseigneur J. C. K. Laflamme ①, it has been known that outliers of Palæozoic rocks exist in the vicinity of Chicoutimi, especially to the north of the Saguenay river. The extent of the area underlain by these sedimentary rocks was, however, uncertain, and their possible economic value was unknown. In view of the enormous present and potential development of hydro-electric power in the Lake St. John-Saguenay region, it is important that information as complete as possible on the local natural resources should be made available, and it was therefore decided that a geological study of these outliers be made, particularly from an economic viewpoint.

The occurrence of Palæozoic strata in the Lake St. John district had been noted by Major-General Baddeley as long ago as 1828, and subsequently by James Richardson in 1857. In the *Geology of Canada*, 1863, a summary of information acquired up to that date is given on pages 164-5, 220, and 923.

The particular outlier of these formations which lies to north of the Saguenay, near Chicoutimi, was first brought to notice by Mgr. Laflamme, whose general report in 1884② described the results of his geological studies in the district. No map was issued to accompany this report, but the probable limits of the area underlain by these sediments were indicated.

Dr. J. A. Dresser visited the area while he was gathering data for his report on *Part of the District of Lake St. John, Quebec*③. He noted the essential similarity in mode of occurrence of the Palæozoic rocks at this locality and near lake St. John.

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① Geol. Surv. Can., Report of Progress, 1882-83-84, part D.

② *Op. cit.*

③ Geol. Surv. Can., Memoir 92, 1916, page 30.

In 1929, Dr. Wm. A. Parks, professor of geology at the University of Toronto, while investigating the oil and gas resources of the Province for the Quebec Bureau of Mines<sup>①</sup>, visited both the Lake St. John region and the Simard area, and drew attention to the occurrence of Utica shale in both districts.

During the field season of 1932, the present writer spent three months on the district, chiefly studying the limestone formation in Simard, Tremblay, and the adjoining townships. The outcrops were tied-in by pace-and-compass surveys along the roads and across country, and the observations plotted on the scale of one inch to half a mile. Two limestone occurrences on the south side of the Saguenay river, in Bagot township, were also visited, and at the end of the season a few days were spent in the Lake St. John district in order to compare the formations described by Dresser with those studied during the summer.

The choice of Dr. H. W. McGerrigle, of Dartmouth University, as senior assistant proved most fortunate. His notes on the stratigraphy of the sedimentary formations appear as an Appendix to the present report. Efficient services were also rendered by René Dallaire and Georges Vaillancourt, of Chicoutimi, students at Queen's University. During the month of August, the Abbé J. W. Laverdière, professor of geology at Laval University, at Quebec, who is undertaking a palæontological survey of the Province of Quebec, for the Bureau of Mines, joined the party, together with Maurice Boulanger, of Quebec, as temporary assistant.

The area mapped lies entirely to the north of the Saguenay river, in the county of Chicoutimi, and is in the vicinity of longitude 71°00' and latitude 48°30'. It is bounded on the east by the Valin river, in Tremblay and Gagné townships, and extends beyond the west side of the rivière à l'Ours in Bégin and Bourget townships. The northern boundary crosses Bégin, Falardeau, and Gagné townships, following a line approximately parallel to, and about four miles to the north of, the southern boundaries of these townships. Thus, Simard is the only whole township included in the map-sheet.

The area may be reached from Chicoutimi, on the Canadian National railway. The Saguenay river is crossed by ferry (pending

<sup>①</sup> Que. Bur. Mines, Ann. Rept., 1929, part B.

the completion of a bridge now under construction), from Chicoutimi to Ste. Anne de Chicoutimi on the north shore, and by means of a network of roads, shown on the map, it is possible to get within a mile or two of practically any point within the area. This is, of course, particularly true of the southern portion, which has been colonized for many years. To the north, the extensive lumber operations carried on by Messrs. Price Bros. necessitated the construction and upkeep of lumbering-roads, and, more recently, the progressive colonization of the land, greatly accelerated by the 'back-to-the-land' policy of the present provincial government, has been accompanied by the provision of suitable transportation facilities. As a result, with the exception of the northeast corner, where there are only lumbering trails, the district is open to automobile traffic, and many of the roads are of the 'improved rural road' type.

#### PHYSIOGRAPHY

The area lies within the peneplaned Laurentian plateau of northern Canada, whose general topographic features are well known to those familiar with Canadian geological literature. The plateau as a whole is a region of moderate relief and of immature drainage. It has been subjected to heavy glaciation. It does not exhibit the features of a plain but is characterized by a rather even skyline from 800 to 1,200 feet above sea-level, above which protrude a few rounded, more resistant hills. In detail, however—and this is, of course, more marked on the margins of the plateau—moderate relief is afforded by the valleys of the rivers and the streams which, since the Glacial period, have renewed their attack and dissection of the plateau. The flow of the streams has been impeded, and frequently their direction has been changed, by the accumulation of glacial débris, so that their course is marked by a succession of lakes, waterfalls, and rapids.

In the Lake St. John-Saguenay region, the relative uniformity of the Laurentian plateau gives place to the very different topography of a lowland area which lies five hundred to eight hundred feet below the general level of the peneplain. This lowland region is bounded on the north and south by conspicuous fault-scarps which, to the southeast, are represented by two trench-valleys, between which the country has the same general altitude as the Laurentian plateau.

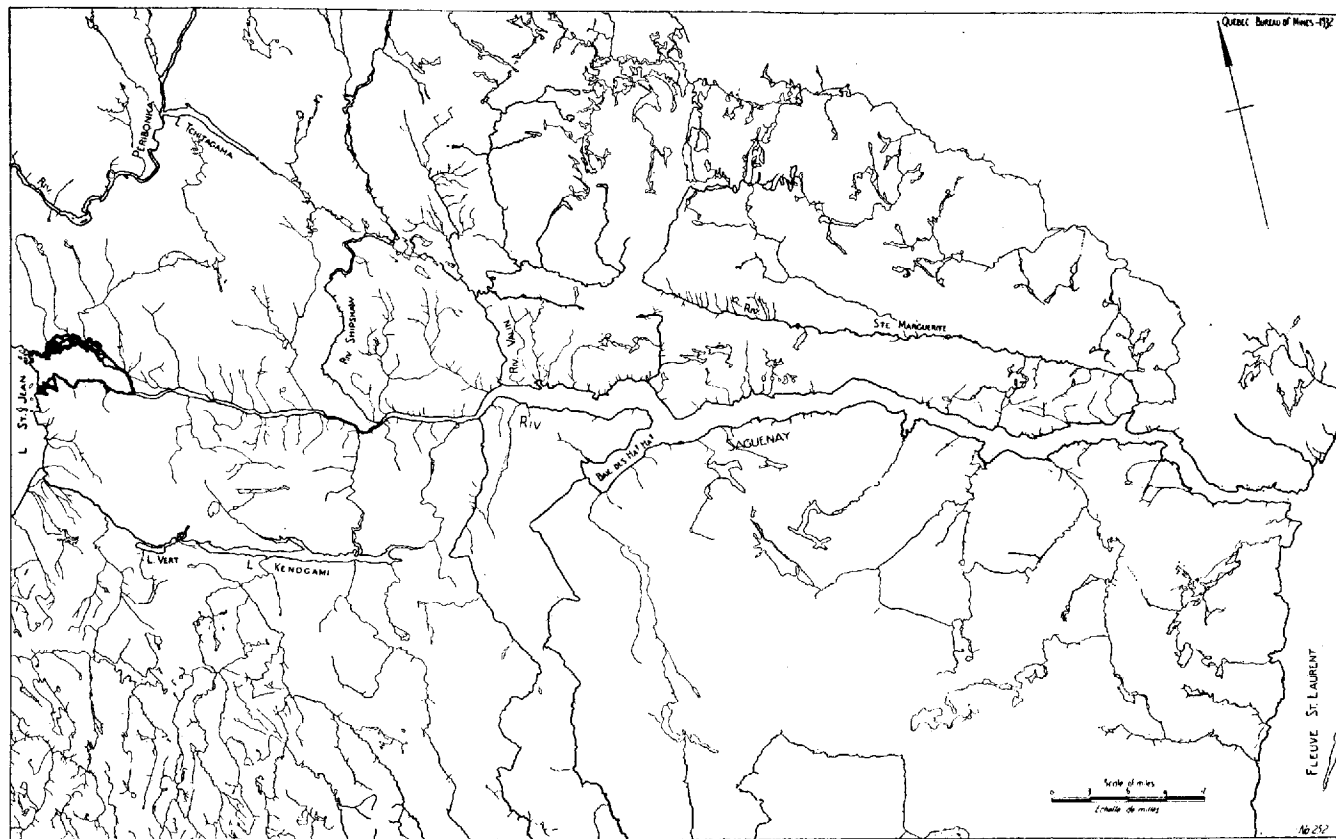


Figure 1.—Sketch map of hydrographic system of Saguenay river, from mouth to lake St. John.

The northern trench-valley is occupied by the Ste. Marguerite river for the greater part of its length and also by the rivière du Moulin and a branch of the Valin. The southern trench is the gorge of the Saguenay river, justly famed for the scenic beauty of its course through nearly vertical walls.

The northern wall of the Ste. Marguerite trench and the southern wall of the Saguenay trench gradually diverge and, near the entrance to Ha Ha bay on the Saguenay river, at a distance of nearly 70 miles from its confluence with the St. Lawrence, the area between these two walls forms the lowland region which extends to the Lake St. John basin. Above Ha Ha bay, the southern escarpment and the Saguenay river no longer follow the same course, but lakes Kenogami and Vert, which are shown on the map (Figure 1), lie near the southern boundary and may mark the pre-glacial bed of the Saguenay. Similarly, near the north boundary of the lowland, there is a series of lakes, the alignment of which is striking, particularly if the direction of flow of the streams as soon as they leave the escarpment be taken into account.

The width of the depression, measured on a line passing the middle of Simard township, is about 25 miles, and the local topography of the Simard area is therefore essentially of the lowland type. The channel of the Saguenay river is between 200 and 300 feet below the general level of the area, but once that valley has been left behind, the Valin hills, which mark the north escarpment of the lowlands, are readily visible, although they are from 12 to 18 miles distant. The general view towards these hills is illustrated in Plate I-B.

The uniformity of the intervening country is broken here and there by occasional outcrops which rise a few feet above the general level (Plate II-A). The Valin, Caribou, aux Vases, and Shipshaw rivers, as they wind their course towards the Saguenay, have already cut deep channels through the thick mantle of post-glacial deposits which covers the area and, indeed, the depth of the valleys of some of the smaller tributary streams is a remarkable, though normal, feature of the local topography.

The present land surface is essentially of marine origin and formed the floor of the Champlain sea during the submergence which followed the retreat of the ice of the Pleistocene glacial period. During this time, the glacial débris which had accumulated in the depressed area was reworked and increased by the addition of the material

washed down from the neighbouring highlands, so that the original land surface is marked by these unconsolidated recent deposits which, at places, attain the thickness of 200 feet. As the land re-emerged, well marked terraces were formed in the valleys of the streams which emptied into the retreating sea.

### GEOLOGY

The Laurentian peneplain of northern Canada is underlain by a complex of igneous and metamorphic rocks which form the pre-Cambrian shield of the North American continent. Within this vast area of ancient rocks there are found comparatively small outliers of later sedimentary rocks of Palæozoic age, and while the area occupied by these outliers is insignificant when compared with that of the great pre-Cambrian protaxis, their widespread distribution indicates that the extent of these formations was originally much greater than at present; and although the distances between the known individual outliers is far too great to permit detailed palæogeographical deductions, their very existence must necessarily arouse the interest of students of the early geological history of the continent. Two of these isolated outliers are known within the Laurentian plateau, one to the north of lake Témiscamingue, where Silurian strata are found, and one in the Saguenay-Lake St. John region, where upper Ordovician and Silurian beds have been recognized. In addition to these, however, there are a number of other marginal outliers which penetrate several miles into the pre-Cambrian protaxis. Thus, for instance, there is a large area underlain by Silurian rocks to the southwest of James bay; and on the southeast margin of the shield, smaller areas of Palæozoic rocks of Upper Ordovician age are similarly partially surrounded by rocks of the pre-Cambrian system.

Within the Simard area, the rocks encountered include the ancient crystalline rocks of the pre-Cambrian system—granites, syenites, gneiss, and the anorthosites and allied rocks. Laid down unconformably upon these are sedimentary rocks, limestones and shales of Ordovician age. The Quaternary, unconsolidated formations include glacial débris and the sands and clays which were laid down in the Champlain sea. This succession is indicated in the following table, and in the subsequent pages the lithology and areal distribution of each formation is described.

*Table of Formations*

QUATERNARY	Recent swamp and alluvial deposits Stratified sands and clays Glacial débris—boulder clay				
<i>Unconformity</i>					
PALÆOZOIC	<table border="0" style="width: 100%;"> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">UTICA.....</td> <td>Black shales</td> </tr> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">TRENTON.....</td> <td>Limestone</td> </tr> </table>	UTICA.....	Black shales	TRENTON.....	Limestone
UTICA.....	Black shales				
TRENTON.....	Limestone				
<i>Unconformity</i>					
PRE-CAMBRIAN	Anorthosite, syenite, granite Gneiss				

## PRE-CAMBRIAN

It has already been stated that the principal object of this study was the determination of the extent and utility of the Palæozoic rocks, so that particular attention was naturally devoted to them. The basement, or floor, upon which they repose is of pre-Cambrian age, and consists of gneisses and granitoid rocks. It is difficult, however, both on account of the paucity of outcrops and of the complexity of the mutual relations of these rocks, to satisfactorily separate them.

## ANORTHOSITE:

The western and northern portions of the area are underlain by the southeastern margin of the great Saguenay anorthosite mass, which comes to the surface towards the east end of lake St. John and extends in a long irregular band for a length of 1,500 miles to the northeast, with a width which varies from ten to five miles. The typical anorthosite is a massive, rather coarse, grey rock, composed of plagioclase feldspar of the composition of labradorite. Locally, however, and this is particularly true of the margins of the mass, the intrusion is represented by gabbroic and dioritic phases, which frequently exhibit foliation, banding, and sudden variations in texture and in composition.

Chief among the minerals of economic value which are found in the anorthosites is titaniferous magnetite. There is, just outside of the Simard area, at St. Charles Borromée in Bourget township, a large deposit of the mineral<sup>①</sup>.

A variety of the anorthosite mass quarried at St. Gédéon, near lake St. John, is used as monument stone. It is marketed under the name of 'black granite'.

Although the predominating feldspar of the anorthosite is labradorite, the semi-precious ornamental variety of that mineral, well known for the beautiful play of colours it exhibits, is rare in the region, and at no point has the rock as a whole been found to possess any value in this respect.

Nickeliferous pyrrhotite, pyrite, and very minor amounts of chalcopyrite have been found in these rocks, and in Labarre and Labrecque townships some prospecting has been carried out in the hope of discovering economic bodies of these minerals: hitherto, however, without success.

The anorthosite mass is cut by pegmatitic and aplitic dykes, whose frequency of occurrence appears to increase markedly as the margins of the mass are approached. They probably separated from the same magma as the main mass, being injected during the last stages of its solidification.

#### GRANITE, SYENITE, GNEISS:

In the greater part of the Simard area, however, the rocks upon which the limestones were laid down are more acidic in composition—granite, syenite, and granite-gneiss. Certain of the latter rocks have the appearance of typical 'Laurentian' gneiss, being made up of alternating bands of quartz and feldspar, accompanied by varying amounts of biotite and hornblende. The rock is pink and passes to

<sup>①</sup> For information on this deposit the reader is referred to:

Dulieux, P. E., *Les Minerais de Fer de la Province de Québec*; Que. Bur. Mines, 1915.

Stansfield, A., *Geol. Surv. Can., Mem. 92, 1916, chap. 6.*

Robinson, A. H. A., *Titanium*; Mines Branch, Dept. of Mines, Ottawa, Rept. No. 579, 1922, pp. 58-59.

*Investigations of Mineral Resources and the Mining Industry, 1924*; Mines Branch, Dept. of Mines, Ottawa, 1926.

Que. Bur. Mines, *Ann. Rept.*, 1924, pp. 84-88; 1925, pp. 46-64.

grey with increasing proportions of the dark minerals. On the other hand, pink, coarse to medium, equigranular rocks are also found within the area, whose composition ranges from granite to syenite, with predominance of the latter. These rocks have every appearance of later age than the 'Laurentian' gneisses. In places, however, the massive rock grades over to one with a more or less clearly developed gneissic structure which is only distinguished with difficulty from the older gneisses. No outcrops were encountered during the field season where the relations of the several pre-Cambrian formations to one another were clearly exhibited.

On the south shore of the Saguenay, in the vicinity of Chicoutimi, these granites are quarried for building stone, for monument stone, and for general construction. The granites in the Simard area have equally pleasing appearance and good qualities, but as a result of their comparative remoteness they have not so far been exploited.

#### PALÆOZOIC

The close of the pre-Cambrian era in eastern Canada was a period of emergence, during which the shield suffered prolonged erosion; and when, subsequently, the land was again submerged, Palæozoic sediments were deposited upon the slight relief of the peneplaned surface.

#### TRENTON LIMESTONE:

In the Simard area, this Palæozoic submergence started during the Trenton period, and limestone of this age rests almost directly upon the underlying pre-Cambrian rocks. The term 'almost directly' is used because, at those places where the contact was studied, it was found that at the base of the sedimentary rocks there is, normally, a zone of feldspathic sandstone, or of limestone enclosing occasional grains of feldspar and of quartz. This zone usually has a thickness of less than three inches, but at one point, on the west bank of the Shipshaw river, about two miles below Chute aux Galets, it attains a thickness of four or five feet; this last measurement is, however, quite exceptional, so that, in general, the noteworthy characteristic of the transgression is its relative rapidity, and the consequent limited development of beds of detrital material from the sinking land surface.

*Distribution:*

The scattered limestone outcrops, shown on the map, are contained within an area of about 15 miles square, but it is impossible, owing to the heavy mantle of drift, to determine whether the formation continuously underlies the whole of this area. This will depend on the sub-soil or bedrock topography, which is effectively masked over the greater portion of the area. As, however, the maximum observed thickness of the sediments is of the order of only about 100 feet, it seems probable that erosion and glaciation may have so completely accomplished their work that only remnants of the formation remain.

The most southerly exposure of the limestone may be seen on the road leading north from the village of Sainte Anne, and from here, exposures are almost continuous over an area two miles long from east to west by one mile wide, in ranges III and IV of Simard and Tremblay townships. The township line, whose direction is N.36°E., runs through this limestone area. To the east of this line, the limestone can be traced continuously for a distance of about a mile and a half, beyond which no outcrops of the rock are seen. To the west, the beds are continuously exposed for three-quarters of a mile, but as limestone again outcrops in the bed of the river aux Vases, 2½ miles beyond the main exposure, the total extension to the west is presumably greater than to the east. Other outcrops which are probably a continuation of the same beds are to be found on lots 18-22, range VI, Simard township, where a narrow band of the limestone is exposed, and in the bed of the Caribou river, in range VI of Tremblay township. To the immediate northeast of the narrow band in range VI, Simard township, there is a large rounded granite outcrop rising above the level of the plain.

On ranges VII and VIII, Simard township, near the road which follows the range line, and three miles from St. Honoré church, there are two small limestone outcrops, and nearby is a large exposure of the overlying Utica shale, which will be described under that heading.

A quarter of a mile below the road between ranges VII and VIII, Simard township, to the west of St. Honoré church, there is a small outcrop of limestone in the bed of the Caribou river.

Near the northeast end of range IX of Simard township, between lots 18 and 20, there is a narrow band of limestone at the foot of the southwest slope of the large, low hill which covers the central portion of the first two ranges of Falardeau township and a narrow strip of the adjoining Simard township. The rocks exposed on this hill, which is known as the Montagne Charles, are various phases of anorthosite and syenite, and the altitude of the small remnant of limestone suggests local faulting. Its contact with the adjoining pre-Cambrian rocks is not exposed, however.

On the northeast side of the same hill, the limestone outcrops on the road which leads from St. Honoré to Chute aux Galets, at a point about a mile and a half before the road reaches lake Charles. The limestone can be traced over a length of 4,000 feet in a north-south direction, and for a slightly lesser width.

The best and most extensive exposure of limestone in the district is along the Shipshaw river, in Falardeau township. From the falls at Chute aux Galets for a distance of more than a mile and a half down stream, the limestone outcrops almost continuously on both banks and in the bed of the river; and to the southeast, where the range-line between ranges II and III of Falardeau township reaches the river, the limestone outcrops almost continuously for a distance of more than two miles.

To the west and northwest of the Shipshaw, a flat drift-covered plain stretches as far as the rivière à l'Ours, and no rocks are exposed in this portion of the area.

Half a mile below the range-line between range II and range III of Falardeau township, the Shipshaw has cut through the base of the limestone into the underlying anorthosite, and at this point the unconformity between the pre-Cambrian and the Palæozoic rocks is strikingly exposed. In the accompanying photograph, Plate III, of the section on the southeast side of the river, the base of the horizontal limestone beds is 20 to 22 feet above the water level; the limestone formation is 25 to 30 feet thick, and above the limestone the mantle of drift is 35 feet thick. Below this point in the river, all the outcrops are of rocks of the anorthosite mass.

At, and above, the falls in the Shipshaw at Chute aux Galets, a vertical section of 75 feet of limestone is exposed, together with about 15 feet of the overlying Utica shale. It is estimated that, from the foot of the falls to the unconformity just described, there is probably an additional 15 feet of limestone, so that the total thickness of the complete section is 105 feet, of which 90 feet are of Trenton limestone.

Two and a half miles northwest of Chute aux Galets there is another small exposure of limestone, on the west side of rivière à l'Ours, in Bégin township. The limestone here lies near the foot, on the southeast side, of a range of low hills of rocks of the anorthosite mass, but the contact between the two is not exposed. The limestone band is between three hundred and four hundred feet in length, and one hundred feet wide. Between this outcrop and the falls at Chute aux Galets, no outcrops rise above the level of the plain.

The report of Mgr. Laflamme mentions that the Ours river flows for more than a mile upon limestone beds, but with the exception of the small outcrop described, no limestone was found in the vicinity of this stream, nor at any point to the west.

The same report mentions the occurrence of limestone in the bed of the Valin river near the northern limit of Tremblay township. The search for these outcrops was unsuccessful, and the only rocks found in that immediate vicinity were pre-Cambrian.

The limestones as a whole are flat-lying, and were laid down upon a land surface which was characterized by very low relief. Where the beds are not horizontal, the slight dips appear to be original dips of the beds as they slope gently away from the minor topographic irregularities in the underlying pre-Cambrian rocks. Locally, also, the beds have been disturbed by slight faults, those adjacent to the fault plane being tilted. An excellent example of this is shown in the photograph, Plate I-C, taken at the Shipshaw river, near the line between ranges II and III of Falardeau township. These small faults are probably contemporaneous with the major faults, which were a result of the depression of the lowland area.

Where the limestones outcrop over large areas, the early stages of a 'karst' topography are apparent. Joints have been widened by the circulation of surface waters, and in places the resulting fissures are as much as twelve feet deep and more than twelve inches in width. That these fissures are a recent development is clear, for they have not been filled by the superficial deposits of the Champlain age.

Everywhere in the area, the limestones are highly fossiliferous, and, in fact, in certain exposures, such as the section at the falls on the Shipshaw river, the abundance of well preserved fossils is quite exceptional.

The base of the limestone formation, it has already been stated, consists of a narrow zone of feldspathic sandstone and conglomerate, or of limestone carrying occasional grains or pebbles of quartz or of feldspar. It may be stated, however, that the most notable feature of the 'basal conglomerate' is its restricted development, from which it may be inferred that the Ordovician sea must have rather rapidly invaded an almost bare land surface.

The lower limestone beds are normally fine grained and compact, grey to grey-buff in colour. The bedding is rather irregular and the beds are thin and separated by narrow argillaceous partings. The limestone appears to be quite pure, but irregularly distributed through it are nodules and irregular masses of dark flint or chert. These may measure as much as six inches, but they are usually much smaller than this. Owing to their irregular distribution, it is difficult to estimate what proportion they form of the rock as a whole. Although there are a few highly fossiliferous beds in this lower portion of the formation, the conditions for the preservation of fossils have not been favourable. The first quarries on the road leading northwest from Ste. Anne de Chicoutimi are in limestones of this horizon. The output has been used for making lime, and in part also for construction purposes.

As one continues northward along the boundary of Simard and Tremblay townships, flat outcrops of more fossiliferous coral limestone are encountered. The rock is grey in colour and is slightly more crystalline than that last described. The bedding is not very regular and argillaceous partings are common. At a distance of three-quarters of a mile from the first, or most southerly, quarries there is an extensive flat quarry from which the stone for the construction of the church of Ste. Anne de Chicoutimi was taken. Beds of the same horizon have been quarried in the exposure to the south of lake Charles and the stone used for the construction of the St. Honoré church.

The limestone in the bed of the Caribou river, and at the north end of Simard township, is rather thoroughly crystallized, and the abundant fossils are largely replaced by calcite.

In the upper portion of the section at Chute aux Galets, certain beds are very rich in crinoid stems, and the limestone is also somewhat crystalline.

The general section of the Trenton limestone in the Simard area is, then: 10 to 15 feet of compact, fine, grey to buff limestone with cherty nodules, overlain by 5 to 10 feet of grey limestone particularly rich in corals. Then follows a succession of 60 to 70 feet of beds, from 2 to 8 inches in thickness, of grey limestone with numerous argillaceous partings, in the upper 20 feet of which there are occasional beds very rich in crinoid stems. The crystallization of the limestone and replacement of fossils by calcite is a local phenomenon rather than a characteristic of a particular horizon.

The limestones as a whole are rather thin-bedded and fractured, but near the base and top of the formation certain of the more regular beds have some value for building purposes, and have been quarried for local use.

*Chemical Composition of the Limestones:*

Six samples of the limestone were sent to the Provincial Government Assay Laboratory, Montreal, for analysis. Determinations were made of the lime, magnesia, silica, and carbon dioxide, but as the samples did not appear to be ferruginous or argillaceous, iron and alumina were determined in one sample only.

Samples Nos. 1 and 2 were taken in the quarries to the north of Ste. Anne, No. 1. being representative of the compact, fine limestone in the more southerly quarries, and No. 2 of the overlying fossiliferous limestone exposed in the flat quarries farther to the north.

The remaining samples are from the Shipshaw river at and below Chute aux Galets: No. 3 is from the base of the limestone at the unconformity about  $2\frac{1}{2}$  miles below the falls; No. 4 is from the higher horizon which is exposed two hundred feet below the bridge that spans the river below the falls; No. 5 is from the overlying beds exposed near the power-house at the falls; and No. 6 is from the top of the limestone formation above the falls.

Sample No.....	1	2	3	4	5	6
CaCO <sub>3</sub> .....	91.32	90.08	93.28	84.60	86.57	84.90
MgCO <sub>3</sub> .....	1.40	1.30	0.91	2.40	1.25	1.30
SiO <sub>2</sub> .....	3.46	4.83	2.49	7.45	4.94	6.04
Fe <sub>2</sub> O <sub>3</sub> .....	0.75	n.d.	n.d.	n.d.	n.d.	n.d.
Al <sub>2</sub> O <sub>3</sub> .....	0.37	n.d.	n.d.	n.d.	n.d.	n.d.

## UTICA SHALE:

On the road between ranges VII and VIII of Simard township, at a distance of three miles west of St. Honoré church, there are flat exposures of thinly bedded black Utica shale, covering several acres on both sides of the road. The thickness of the formation does not appear to be great.

A representative sample of the shale, from lot 21, range VII, taken by Dr. Parks in 1929 and analysed by Professor O. Rolland, of the Provincial Government Assay Laboratories, Montreal, to determine its value as a source of gas or petroleum, gave the following result<sup>①</sup>:

Weight of sample.....	1,600 grams
Distillation up to 360° C.: Crude oil, gallons per ton.....	4½
Specific gravity of crude oil.....	0.9143
Ash.....	83.40 per cent
Volatile matter.....	16.85 “
Ammonium sulphate, pounds per ton.....	20

The shales do not yield sufficient oil to be of value under present economic conditions.

Above the falls of Chute aux Galets on the Shipshaw river, there is an exposure of Utica shale, which is only accessible under certain conditions of regulation of the water level behind the dam constructed for the development of the water-power. At this point the shales overlie the limestone and have a thickness of fifteen feet. There is a very slight unconformity at the contact, which is well exposed. The lower eight inches of shale is relatively coarse, somewhat arenaceous, and rusty, but the overlying beds are similar to those in Simard township.

Very well preserved graptolite and trilobite remains, occasionally partially pyritized, are numerous in these beds.

<sup>①</sup> *Op. cit.*, p. 81.

## QUATERNARY

Economically, the most important formations in the Simard area are the unconsolidated sediments which were laid down in the Champlain sea. They comprise the reworked glacial débris and the material carried into the sea from the adjoining highlands. It is this mantle of superficial deposits which is responsible for the present relatively even topography of the area, and which renders it, in parts at least, eminently suitable for agriculture.

The thickness of these deposits is frequently greater than 100 feet. In the southern portion of the area, stratified clays predominate; they are particularly well exposed in the Aux Vases and Caribou rivers, where sections showing a thickness of more than 100 feet are common. These clays contain a few sandy layers and boulders, but in some places they are remarkably uniform. Samples were taken on the banks of the Aux Vases and Caribou rivers in order to determine their economic value. It was later found, however, that these clays had already been investigated by Dresser, from whose report<sup>①</sup> the following particulars are quoted:

"This sample was taken from the upper portion of a bed of clay about 100 feet thick at Les Terres Rompues, near mouth of rivière aux Vases, Chicoutimi county.

"The clay is similar in character to many other deposits found near water level along the banks of Saguenay river. It is greyish in colour, and contains rather a high percentage of lime, but appears to be free from pebbles or stone. When worked up with the proper amount of water, it forms a fairly plastic mixture, but is inclined to be rather flabby in the wet state. After being moulded into shape, this clay can be dried quickly provided the temperature of the drier does not exceed 150 degrees F.; otherwise it may crack. The clay burns to a porous body of light red colour at the ordinary temperature obtained in burning common building brick.

"Its use, as far as manufacture of burned clay products is concerned, is confined to making common brick by the soft-mud process. It might be used for making the smaller sizes of field drain tile, but owing to its poor working properties in the raw state, it does not appear to be suitable for making large-size tile or hollow-ware. The clay would not be suitable for the manufacture of vitrified ware".

<sup>①</sup> *Op. cit.*, p. 49.

To the north, however, as the Valin hills, which mark the limits of the lowland, are approached, the plain is underlain by sand, and the land is much less suitable for farming than that underlain by clay. Colonization is progressing even in these portions of the area, but the scanty vegetation does not appear encouraging. The gravel layers are more numerous and the boulders larger as the highlands are reached.

It is interesting to note that, in the Lake St. John region, the same conditions prevail and that the clay plains are succeeded towards the north, nearer the margin of the lowland depression, by sandy plains whose fertility is distinctly inferior to that of the former. The post-glacial geology of both the Lake St. John region and the Simard area offers an interesting field for further and more detailed investigation.

#### COMPARISON WITH LAKE ST. JOHN REGION

The few days spent in the Lake St. John region sufficed to establish the lithological similarity of the Ordovician sediments in that field with those of the Simard area. The palæontological evidence confirms the identity of the formations of the two fields, excepting, of course, that beds of Richmond age occur in the Lake St. John district, but have not been found in the Simard area.

The elevation of the beds above sea-level at various points in the two districts is indicated below:

LAKE ST. JOHN DISTRICT	Elevation above sea-level
Base of limestone above Chambord station (remnant on highlands adjoining the Lake St. John depression).....	600 feet
Base of limestone in boring between Roberval and Ouiatchouan river.....	0 feet
Base of limestone in boring on lot 32, Range I, Roberval township.....	110 feet
Base of limestone in railway cutting between Roberval and Pointe Bleue (about four miles west of Roberval).....	345 feet
Base of Utica shale about one mile west of Pointe Bleue.....	340 feet
Base of Utica in boring between Roberval and Ouiatchouan river.....	250 feet
Base of Utica in boring on lot 32, Range I, Roberval.....	210 feet

SIMARD AREA	Elevation above sea-level
Base of limestone in Shipshaw river.....	440 feet
Base of limestone in quarries to north of Ste. Anne.....	290 feet
Base of Utica in Shipshaw river (Chute aux Galets).....	550 feet

The sediments in both fields are flat-lying and, as the figures show, they are at the same general elevation above sea-level. The concordance is indeed remarkable when it is remembered that these Palæozoic formations have been subjected to initial uplift, to depression by faulting, to the depression resulting in the transgression of the Champlain sea, and to the uplift which marked its retreat.

Between the two areas, no Ordovician sediments have been observed. The distance from the most easterly outcrop of these rocks in the Lake St. John region to the most westerly outcrop of limestone in the Simard area is about thirty miles, and the absence of the sediments in this interval must be explained by faulting or by warping which would raise (geologically) the area which separates the two. Detailed study of the region might lead to a definite interpretation, although it is possible that the uniformity of the intervening rock formation (anorthosite) would offer too great a handicap.

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## APPENDIX

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### FAUNAS OF THE LIMESTONE AND SHALE FORMATIONS OF THE SIMARD AREA

*by H. W. McGerrigle*

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#### INTRODUCTION

A lower limestone formation and an upper shale formation comprise the Palæozoic sedimentaries of the Simard area. The limestones rest directly upon the pre-Cambrian, the contact being observable in two or three places. They are an interbedded series of about 100 feet in maximum thickness. Individual beds range in thickness from an inch or so to four feet, and vary in composition from relatively pure crystalline limestone to argillaceous limestones that are very fine-grained. Thin argillaceous seams are common along bedding planes.

Fossils are fairly plentiful throughout, but there are no horizon markers that may be used safely to compare one locality with another while collecting in the field. Obviously this makes any attempt to define zones rather difficult, and, although at one locality, Chute aux Galets, an almost complete section is exposed, it is here impossible to make satisfactory zonal collections. Consequently, in this preliminary report, the writer has not attempted to set up zones but has merely endeavoured to establish a likely correlation for the entire limestone.

The limestones are overlain disconformably by black shales which are estimated to be twenty-five feet thick. At one place, Chute aux Galets, where the contact was observed, it is very sharp, there being no gradation from the limestones to the shales. The two units lie at the same angle, and there is very little evidence of erosion. The shales are, in the main, black muds, but at a few places thin, arenaceous shales occur interbedded with the shales of the normal type.

## FAUNAL LIST FROM LIMESTONES OF THE SIMARD AREA

## PORIFERA:

*Receptaculites occidentalis* (?) Salter r.

## STROMATOPOROIDEA:

Forms ranging in diameter from one inch to two feet.  
(Logan lists "*Stromatopora rugosa*")

## ANTHOZOA:

*Streptelasma corniculum* Hall c.  
*Streptelasma profundum* (?) Conrad r. (one specimen).  
*Halysites catenularia quebecensis* Lambe c., or *Halysites gracilis*  
*Columnaria halli* Nicholson r.  
*Protaræa vetusta* (Hall) r.  
Cf. *Tetradium columnare* (Hall) r.

## GRAPTOLITHIDA:

*Climacograptus typicalis* Hall r.

## CRINOIDEA:

Stems common; heads rare.

## BRYOZOA:

*Pachydictya* sp. r.  
*Rhinidictya* sp. r.  
*Batostoma* sp., genus common.  
(Logan lists "*Stenopora fibrosa*")

## BRACHIOPODA:

*Lingula* sp. r.  
*Platystrophia amoena* McEwan r.  
*Platystrophia amoena longicardinalis* McEwan c.  
*Platystrophia amoena robusta* (?) McEwan r.  
*Platystrophia acutilirata prolongata* McEwan r.  
*Platystrophia clarksvillensis*δ (?) Foerst r.  
*Platystrophia* sp. r.  
*Rhynchotrema increbescens* Hall c.  
*Zygospira recurvirostris* (Hall) c.  
*Orthis laurentina* Billings r.  
*Dalmanella rogata* (Sardesson) c.  
*Dalmanella cf. testudinaria* group c.  
*Plectambonites "sericeus"* (Hall)—a great variety of forms referable to this species as at present understood.  
*Rafinesquina alternata* (Emmons) r.  
*Rafinesquina praecursor* Raymond r.  
*Rafinesquina deltoidea* (Conrad), r.  
*Rafinesquina camerata* (Conrad) r.  
*Strophomena filitexta* Hall r.  
*Strophomena* spp.

Raymond's list<sup>①</sup> would add:

*Rafinesquina minnesolensis* Winchell r.  
*Strophomena emaciata* Winchell and Schubert r.

① The fossils in 'Raymond's list' come from limestone at lake St. John, as do the additions quoted from Logan.

## PELECYPODA:

*Ctenodonta* cf. *abrupta* (Billings) r.  
*Ctenodonta nasuta* (Hall) c.  
*Vanuxemia* cf. *terminalis* Ulrich r.  
*Cyrtodonta subangulata* (Hall) r.

Raymond's list would add:

*Cyrtodonta parva* (?) Ulrich and Schofield r.  
*Vanuxemia rotundata* Hall r.  
*Vanuxemia dixonensis* Meek and Worthen r.

## GASTROPODA:

*Scenella* sp. r.  
*Bucania* spp.  
*Raphistoma rotulcides* (?) (Hall) r.  
*Liospira vitruvia* (Billings) r.  
*Liospira* cf. *L. progae* (Billings) r.  
*Liospira* sp., close to *L. obtusa* Ulrich and Schofield r.  
*Oxydiscus disculus* (Billings) r.  
*Fusispira nobilis* Ulrich and Schofield r.  
*Fusispira subfusiformis* (Hall) r.  
*Subulites elongatus* Conrad r.  
*Hormotoma gracilis* (Hall) typus r.  
*Hormotoma gracilis angustata* (Hall) r.  
*Hormotoma gracilis* cf. *goodhuensis* Ulrich and Schofield r.  
*Hormotoma bellicincta* (Hall) r.  
*Hormotoma trentonensis* Ulrich and Schofield r.  
*Hormotoma salteri canadensis* Ulrich c.  
*Omospira alexandra* (Billings) r.  
*Trochonema umbilicatum* (Hall) c.  
*Trochonema umbilicatum canadensis* (Hall) r.  
*Trochonema subcrassum* Ulrich and Schofield r.  
*Trochonema fragile* (?) Ulrich and Schofield r.  
*Lophospira peracuta* Ulrich and Schofield r.  
*Lophospira bicincta* (Hall) r.  
*Lophospira perangulata* (Hall) r.  
*Lophospira* sp. r.  
*Holopea pyrene* Billings r.  
*Cyclonema montrealense* Billings r.  
Cf. *Maclurina cuneata* (Whitfield) r.

Raymond's list would add:

*Archinacella subrotundata* Ulrich and Schofield r.  
*Scenella affinis* Ulrich and Schofield r.  
*Bellerophon* cf. *B. subglobosus* Ulrich r.  
*Tetranota obsoleta* (Hall) r.  
*Phragmolites compressus* Conrad r.  
*Eccyliomphalus contiguus* Ulrich r.  
*Eotomaria dryope* (?) Billings r.  
*Trochonema beloitense* Whitfield r.  
*Trochonema rugosum* (?) Ulrich and Schofield r.

## CEPHALOPODA:

*Orthoceras*, several species  
*Deiroceras* (*Actinoceras*) close to *remotiseptum* (Hall) r.  
*Cameroceras* sp.; apparently closest to *C. duplicatum* (Hall) r.  
*Cycloceras olorus* (Hall) r.

*Cycloceras nicolleti* (?) (Clarke) r.  
*Cycloceras* sp., r.  
*Tripteroceceras planconvexum* (Hall) r.  
*Oncoceras* sp., r.

TRILOBITA:

*Pterygometopus achates* (Billings) r.  
*Pterygometopus callicephalus* (Hall) r.  
*Ceraurus pleurexanthemus* Green c.  
*Ceraurus dentatus* Raymond and Barton r.  
*Calymene meeki* Foerste c.  
*Goldius lunatus* (Billings) r.  
*Isotelys gigas* de Kay r.  
*Isotelys latus* (?) Raymond r.  
*Iliaenus americanus* (Billings) r.

Raymond's list would add:

*Thaleops ovatus* Conrad r.

AGE CONSIDERATIONS

It is the writer's opinion that the limestones of the Simard area and those of Lake St. John, fifty miles distant, are correlatives. This opinion, however, is based on a four day's review of the Lake St. John area, during which brief time it was observed that the limestones of the two areas are lithologically identical, that they lie in the same depositional area, and that the faunas of the two areas are at least superficially alike.

Two possibilities present themselves as to the age of these rocks: either that they are of Black River or Basal Trenton age, as they have been considered by Raymond and later by Foerste, or that they are of Trenton or Younger-than-Trenton age, which is the general thesis here presented.

1.—POSSIBLE BLACK RIVER OR BASAL TRENTON AGE:

From a study of a small suite of specimens collected by Dresser in a general survey of the district in 1916, Raymond<sup>①</sup> concluded that the limestones of Lake St. John were Black River or Basal Trenton, more probably the latter. In Raymond's list of twenty-three definitely identified species, five range, from present indications, in and above the Trenton—four of these are widespread in the Trenton and one is confined to the Prosser of Minnesota; eight range from Black

<sup>①</sup> Pages 38-40 of report by John A. Dresser on *Part of the District of Lake St. John, Quebec*; Geol. Surv. Can., Mem. 92, 1916.

River through the Trenton, although two of these are doubtful in their range above the Black River; four are Black River and Basal Trenton, with only one form widespread and that in the Black River; and six are Black River—two of these are found in Minnesota, two in Minnesota and Wisconsin, and two in Minnesota, Wisconsin and Illinois.

There is no question that these last six are Black River *indicators*, but their ranges are restricted horizontally. Opposed to this are four forms widespread in the Trenton.

There is also no question that the faunal list from the limestone of Lake St. John has more of a Black River or Basal Trenton cast than has that of the list from the limestones of the Simard area; but the difference is very probably due, in part, to the fact that only a small collection from the former locality was examined.

Foerste<sup>①</sup> has expressed the following views on this area:

“The Lowville member of the Black River group shows a remarkable similarity in its faunal elements over a wide area, extending from New York northward and westward to Lake St. John”, and through Ontario to Michigan, Wisconsin, and Minnesota, and thence southward to Missouri and Tennessee.

The following corals are mentioned by Foerste as suggesting the Richmond age of the Red River formation of Manitoba: *Calapœcia canadensis*, *Columnaria (Palæophyllum) stokesi*, *Halysites gracilis*, and *Palæofavosites prolificus*. It is then suggested that these corals do not indicate Richmond age, because “precursors” were cited by Lambe from the “Black River formation of Pointe Bleue, north of Roberval, on the west side of Lake St. John, Quebec, under the names *Calapoecia canadensis*, *Halysites catenularia quebecensis*, and *Columnaria rugosa*” . . .

The present writer suggests that the “Lowville member of the Black River group” may not be present at all at Lake St. John, for, unless faulting has intervened, the rocks at Pointe Bleue are above, or form the upper part of, those limestones which Foerste would correlate with Trenton-or-younger.

① Bull. Sci. Lab., Denison University, Vol. 27, 1932, pp. 54-56.

## 2.—POSSIBLE TRENTON OR YOUNGER-THAN-TRENTON AGE:

The list of definitely identified forms from the limestone of the Simard area contains but one species, *Lophospira perangulata*, which might have been considered a fairly definite index of Black River age, for it is widespread and hitherto has been regarded as restricted to that horizon.

Opposed to the above, seventeen, at least, definitely identified species are indices, following the above criteria, of Trenton-or-younger horizons.

In Raymond's discussion of the Trenton group in Ontario and Quebec<sup>①</sup>, the composite section of the Quebec City area is divided into seven zones. Zones Nos. 7 to 4 represent Pointe aux Trembles Trenton, while Nos. 3 to 1 are found at Montmorency Falls, Lorette, and Chateau Richer. According to the present findings, the limestone of the Simard area should be correlated with zone No. 6 of Raymond's succession, underlying the Utica shale (No. 7). Raymond describes zone No. 6 as follows: "Hard, thin-bedded limestone, light-coloured and granular near the top, blue-grey and fine-grained below. The characteristic fossil is *Rafinesquina deltoidea*. *Triplecia nuclea* is present in great numbers, and usual fossils of the Trenton such as *Plectambonites sericeus*, *Platystrophia lynx*, *Rafinesquina alternata*, *Calymene senaria*, and *Isotelus gigas* are common. Thickness 193 feet." The chief distinction between zones Nos. 6 and 5 is that in the latter (117 feet thick) *Prasopora simulatrix* is abundant. At Montreal and Quebec, a *Parastrophia* fauna characterizes the base of the Trenton, and *Cryptolithus tessellatus* is also found towards the base. For the composite Trenton Falls section, nine zones are established; No. 9 is Utica; Nos. 8 and 7, containing, among other fossils, *Rafinesquina deltoidea* and *Hormotoma trentonensis*, and bounded below by the *Prasopora* beds (No. 6), would be nearest our Simard limestone (but see Clark, below). For the Picton area, the closest correlation would be with zone No. 4, containing *Hormotoma trentonensis*, *Fusispira subfusiformis*, *Trochonema umbilicatum*, and *Rafinesquina deltoidea*.

Thus, from Raymond's review, the closest correlations are with the upper zones of the "Trenton" of Quebec, New York, and Ontario; these zones being in turn correlated by Raymond with the Cobourg (Picton).

<sup>①</sup> Geol. Surv. Can., Summ. Rept., 1912, pp. 342-350.

Comparison with the Martinsburg, New York, section<sup>②</sup> shows seventeen species in common with the Simard area; but comparison of specific names, only, merely indicates a general "Trenton" age relationship between the two localities. However, Clark states (p. 6) that, in the upper 85 feet (390 ft. to 475 ft.,) "*Strophomena trilobata*, *Rafinesquina alternata*, and *R. deltoidea* are the most common and characteristic fossils, while *Hormotoma trentonensis*, *Trochonema umbilicatum*, and *Streptelasma corniculum* are other abundant species", the latter forms also occurring in the lower twenty feet of the formation. This upper 85 feet is considered (p. 9) as younger than the Trenton Falls-Rathbone Brook section; and it is this upper 85 feet that seems to be the closest relative, in the areas considered by Clark, with the limestones of the Simard area.

Comparison with the Ontario sequence shows that, of the thirteen species in the Cobourg or Collingwood, and not younger, that are found in the Simard area, seven are found in the Cobourg alone and five in both the Cobourg and Collingwood, while one occurs in the Collingwood alone but in older strata elsewhere. Ten species of the total definitely identified list range to strata younger than the Collingwood. The list of common species follows:

## COBOURG-SIMARD

\**Rhynchotrema increbescens*  
*Rafinesquina alternata*  
*Rafinesquina deltoidea*  
 \**Rafinesquina camerata*  
*Liospira vitruvia*  
 \**Fusispira nobilis*  
 \**Fusispira subfusiformis* (?)  
 \**Subulites elongatus*  
 \**Hormotoma bellicincta*  
 \**Hormotoma trentonensis*  
*Trochonema umbilicatum*  
*Lophospira bicincta*  
*Pterygometopus achates* (?)  
*Ceraurus dentatus*  
*Isotelus gigas*  
*Iliaenus americanus*

## COLLINGWOOD-SIMARD

\**Zygospira recurvirostris*  
*Rafinesquina alternata*  
*Rafinesquina deltoidea*  
 \**Fusispira subfusiformis* (?)  
 \**Trochonema umbilicatum*  
*Lophospira bicincta*  
 \**Ceraurus dentatus*  
 \**Isotelus gigas*  
 \**Iliaenus americanus*

\*Signifies "not younger".

In this connection, grateful acknowledgment is made of personal communications from Dr. Ruedemann (March, 1933), Professor Raymond (March, 1933), and Dr. Foerste (April, 1933). Each

② T. H. Clark, Bull. Mus. Comp. Zool., Vol. 63, 1919-20.

recognizes the presence of what are considered to be Black River as well as "Trenton" elements in the writer's faunal list of the Simard area, and the possibility of mingling of zones or inaccurate identification of species is warned against. In either event, the preponderance of the evidence, in the faunal list as a whole, definitely favours a "Trenton" age, and almost as definitely favours Cobourg. Furthermore, most of the forms considered as Black River indicators by these authorities are questioned in the writer's list, and questioned forms are not considered in the process of correlation.

No judgment is passed in any of the three communications referred to above: but Raymond recognises the Cobourg in *Playfairia* (*Rafinesquina*) *deltoidea*, *Rhynchotrema increbescens*, *Subulites*, the *Fusispiras*, and *Hormotomas*. And the following is significant: Where younger and older faunal elements are present "the youngest forms should be of the greater importance, as indicating newly opened connections and new invasions, while the older ones are usually only relics left over in more favoured basins" (Ruedemann). While Foerste now holds no brief in favour of Black River age for the Pointe Bleue rocks, he hesitates to adopt our conclusion of Cobourg age until more complete information has been obtained.

#### FAUNAL LIST FROM SHALE OF THE SIMARD AREA

##### GRAPTOLITHIDA:

- Climacograptus typicalis* Hall c.
- Glossograptus quadrimucronatus* (Hall) c.
- Glossograptus quadrimucronatus cornutus* (??) Ruedemann r.
- Leptograptus* cf. *L. annexians* (Walcott) typus Ruedemann c.
- Diplograptus* sp., genus common.

##### BRACHIOPODA:

- Leptobolus insignis* Hall c.
- Trematis* sp., r.

##### PELECYPODA:

- Pterinea* sp., cf. *P. insueta* (Emmons) r.

##### CEPHALOPODA:

- Endoceras proteiforme* Hall c.

##### TRILOBITA:

- Triarthrus glaber* Billings c.

## AGE CONSIDERATIONS

None of the forms in the above list goes against the correlation here made with the Gloucester, a correlation that is confirmed by Ruedemann (personal communication, March, 1933). But only two of the species are really significant, namely, *Glossograptus quadrimucronatus* and *Triarthrus glaber*.

*Glossograptus quadrimucronatus*, originally described from Lake St. John, occurs in the Upper Collingwood and Upper Gloucester of Ontario (Parks, 1928). It also occurs in the Atwater Creek shale, a Frankfort facies following upon the Deer River black shale. The latter formation is correlated with the Collingwood—"It is then probable that the Atwater Creek shale corresponds to the Gloucester formation of Canada" (Ruedemann, 1925). The variety *cornutus*, here doubtfully identified, occurs in earlier horizons than the typical species (Ruedemann, 1925; and personal communication, 1933).

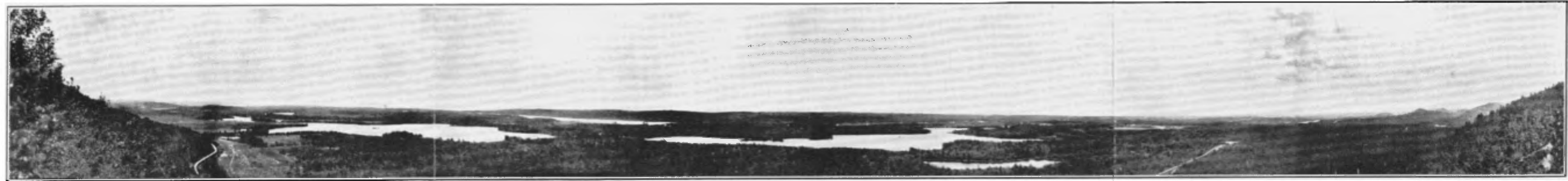
*Triarthrus glaber*, likewise, is a form apparently restricted in its vertical range, for, in Ontario, it is definitely known only from the Gloucester (Parks, 1928).

Thus, the two significant species favour Gloucester age, while the fauna as a whole is certainly Utica and (except for one doubtful form) offers nothing against a late Utica or Gloucester age. Also, these shales are to be correlated with the shales at Lake St. John, which Raymond (1916) considered as "Utica". This correlation adds another argument in favour of the correlation of the limestones of the Simard area with those of Lake St. John, and, if the writer's correlations are correct, the corollary of this is that both limestones are Cobourg.



*B. T. Denis*

Plate I



A—Panorama taken from Valin hills, across lowland, towards the Saguenay river to the south.

*B. T. Denis*



B—View towards Valin hills, which mark the northern limit of the lowland area.

*B. T. Denis*



C—Limestone on the west bank of Shipshaw river, range II, Falardeau township.  
The beds to the left are tilted at the approach to a small fault.



A—Outcrop of granite rising above level of the plain, north of Ste. Anne village, Tremblay township.

*B. T. Denis*



B—East bank of Shipshaw river, two miles below falls at Chute aux Galets. Limestone resting unconformably on anorthosite, and overlain by mantle of unconsolidated sediments.



*B. T. Denis*



Section in limestone exposed at falls on Shipshaw river, at Chute aux Galets,  
Falardeau townships.





A—Terraces in Champlain deposits on banks of Aux Vases river, Simard township.

*B. T. Denis*



B.—Stratified clays on Caribou river, Tremblay township.