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MIDDLE ORDOVICIAN BEDS IN THE SAGUENAY VALLEY, QUEBEC

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ABSTRACT. Beds of Middle Ordovician age have long been known in the Saguenay Valley of Quebec, but their age has been debated. Re-examination, in the light of modern work on equivalent beds further south, permits identification of horizons in the Black River and Trenton groups of the Mohawkian.

INTRODUCTION

THE presence of outliers of Ordovician rocks well within the margin of the Canadian Shield near Lake St. John has been known since 1829, when Baddeley described the area (1829, p. 125 ff.). These outliers were studied by Richardson (1858), and his collections were described by Billings and by Lambe. The area adjacent to Lake St. John was studied by Dresser (1916) and a second area north of Chicoutimi, some fifty miles to the east, was the subject of a report by Denis (1933), the paleontology being done by McGerrigle. The last two reports are readily available, and it will be assumed in these notes that the reader can refer to the detailed maps contained in them.

The age of the beds comprising these outcrops has been debated. Billings referred his fossils to the Black River or Trenton. Dresser quoted Raymond's determination of his fossils as indicating a horizon "either in the Black River or at the very base of the Trenton, more probably the latter." Bassler (1915), whose influence in matters of age assignment has probably been stronger than that of other workers, cited the Lake St. John fossils in his Index as "Black River or Richmond." McGerrigle (Denis, 1933) decided his collections indicated the age as Cobourg. All these workers assumed that the limestones were all of one age.

In view of these varied age determinations, there has been a natural reluctance to accept the presence of abundant *Halysites* low in the Middle Ordovician as proven. The known occurrence of beds of Richmond age on islands in Lake St. John has caused an understandable suspicion in the minds of workers elsewhere that some error might be involved.

In 1945 I spent four weeks in the vicinity of Roberval and Chicoutimi, in the employ of the Geological Survey of Canada, engaged in reconnaissance stratigraphy and collecting. Although this work left many problems unsolved, and many gaps which an instrumental survey will fill in, it did permit determination of the succession of the Middle Ordovician rocks of the outliers, and collection of sufficient material to permit tentative correlations and to serve as a basis for critical work by others. On a later trip to Chicoutimi I had the privilege of showing Dr. R. H. Flower over the section, and had the benefit of his opinions.

I wish to express my gratitude to the Geological Survey of Canada, and to Dr. W. A. Bell, then chief of the Palaeontological Section, for the opportunity of seeing this area. I must also thank Dr. W. K. Gummer, then of the Aluminum Company of Canada at Arvida, for his kindness in showing me outcrops on the Company's property, and giving me information based on test holes drilled by them.

Although my first trip to the district was made for the Geological Survey of Canada, and the material collected forms part of their collections, this paper does not reflect any official views.

In general the determinations of fossils are to be taken as first approximations, i.e. they have the value they usually do in faunal lists. The task of critical revision of the Trenton faunas is under way, but of necessity it is a slow one. Papers revising some small genera have appeared, three of them (*Dimeropyge*, *Eobronteus* and *Glyptocystites*) involving species from this area. Dr. R. H. Flower has undertaken study of the cephalopods and has published some preliminary notes on them (1952). The nature of these lists is stressed because of my conviction that the stratigraphy of the Trenton will not make sense as long as our fossils are referred to a limited number of "standard" species. So long as the bewildering variety of calymenids are all listed as *Flexicalymene senaria*, so long the calymenids will be worthless in correlation, and the same is

true of other genera where specific names are used so conventionally that they are useless or, worse, misleading.

Although I have suggested correlation of these beds with parts of the New York and Ontario sequence, I feel that use of formational names defined in these distant areas would be misleading at this stage of our study. Accordingly, I have introduced local names to permit unambiguous reference to the beds of these outliers. If later work shows the Tremblay to be indeed the local expression of the Lowville, then the local name can be dropped. For the present its use emphasizes that more study is needed for complete understanding of the relationships. The name Simard had been used informally by Dresser and McGerrigle for the limestones as a whole in the Simard area. I here use it formally, and apply it to a part of the sequence. I consider correlation between Chichoutimi and Roberval to be sufficiently certain to permit use of the same terms in both regions, although, as I have indicated below, there are some beds which I cannot place with certainty.

OUTLIERS IN THE SIMARD AREA

Denis and McGerrigle have described the areal distribution of the patches of limestone and shale which are found north of Ste. Anne de Chicoutimi. They treated the limestones as one unit, and on that basis McGerrigle suggested a Cobourg age for the whole. Since their work was done new quarries have been opened, and new data on the thickness of beds have been provided by exploratory drilling by the Aluminum Company of Canada, so that a reinterpretation of the section can be attempted.

There are two groups of outcrops, one about three miles northwest of Ste. Anne, which we may call for brevity the Tremblay area, the other at Chute aux Galets on the Shipshaw river, some twelve miles further northwest. Denis and McGerrigle are probably correct in postulating a connection between the two areas, but no lucid outcrops were seen in the country between them, and they may be distinct.

Tremblay area.—Throughout the area of outcrop indicated on Denis' map, small patches of limestone are met in the bush, but seldom are more than scraps of beds seen. Solution along joints has produced a karst topography, on a very small scale. Two quarries expose partial sections, and three small strippings

along the road show a few feet of beds. These would be unintelligible were they not tied in by the knowledge that they occur 58, 70 and 100 feet above the Precambrian, as determined by drill records. From these strippings, and the exposures in the quarry of the Quebec Bureau of Roads, the following section can be restored:

7.	Thick-bedded, somewhat sugary limestone, with rather thick, shaly partings. (stripping no. 3) (Simard?)	4 ft.
	Covered	22
	Simard Beds	
6.	Thick-bedded, dense, blue-gray limestone, weathering yellowish. No chert or silicification; barite rather common. Only one specimen of *Halysites* seen (stripping no. 2)	8 ft. 6 in.
	Covered	10
5.	Thick-bedded limestone, essentially one bed with an underlying shaly seam exposed. Small (4 in.) *Halysites* and *Hesperorthis* common. (stripping no. 1)	2
	Covered	18
4.	Rather thin-bedded limestone with silicified fossils and some plates of chert. Large heads (10 in.) of *Halysites* common; many actinoceroids and other cephalopods	10
3.	Dense gray limestone, weathering bluish, in beds up to 18 in. *Halysites* present but rare, *Streptalasma* common. Some bedding planes covered with indeterminable smooth trilobites	15
	Tremblay Beds	
2.	Hard brittle gray limestone in beds up to 12 in., few fossils	7
1.	Arkose, variously red or green .....to.... Precambrian.	8

Bed 2 (Tremblay) is poorly fossiliferous, but the following forms were collected:

Streptalasma corniculum (Hall), *Tetradium cellulosum* (Hall), *Rhinidictya* sp., *Ctenodonta* cf. *C. nasuta* (Hall), *Hormotoma canadensis* Ulrich and Scofield.

This faunule affords no clear picture of the age of the beds, but on the basis of the *Tetradium* they may be referred to the

Lowville. This reference is tentative only, but loosely fasciculate *Tetradium* are not usual in the higher Black River formations in Ontario and Quebec, although they recur higher in the Trenton.

Bed 3 (lower Simard) is so massive that although fossils seem to be rather common, it is very difficult to collect identifiable forms. I am sure that prolonged intensive collecting would increase this list of the forms which I found:

Streptalasma corniculum Hall, *Calapoecia* sp., *Rhinidictya* sp., *Rafinesquina* sp., *Zygospira* sp.

Ctenodonta sp., *Lophospira milleri* (Hall), *Helicotoma* sp., *Holopea* sp., *Hormotoma canadensis* Ulrich and Scofield, *Ceraurus* sp., *Bumastus* sp., *Eobronteus oratus* Sinclair, small smooth ostracods.

In bed 4, (Simard) silicification has made collecting and identification simpler, and the following list can be given:

Camarocladia sp., *Receptaculites* sp., *Stromatocerium rugosum* Hall, *Halysites quebecensis* Lambe, *Streptalasma* cf. *S. corniculum* Hall, *Lichenaria* cf. *L. typa* Winchell and Schuchert, Bryozoa spp.

Camarella sp., *Rhynchotrema* sp., *Zygospira* sp., *Helicotoma planulata* Salter, *Hormotoma gracilis* (Hall), *H. bellicincta* (Hall), H. *canadensis* Ulrich and Scofield, *Liospira vitruvia* (Billings), *Lophospira milleri* (Hall), *Omospira* sp.

Actinoceras sp., *Michelinoceras* ? sp., *Gorbyoceras* ? sp., *Westonoceras* sp., *Oncoceras* ? spp., *Sinclairoceras haha* Flower, *Eobronteus* sp., *Bumastus* sp., *Illaenus* sp., *Isotelus* sp., *Raymondites* sp., frequent ostracods.

The aspect of these two faunas is decidedly Black River, in particular recalling that of the well-known beds at Paquette Rapids on the Ottawa River.

Bed 5 (Simard) is so poorly exposed that its fauna may well be united with that of no. 6, from which it differs only in the common occurrence of *Halysites* and *Hesperorthis:*

Receptaculites occidentalis Salter, *Stromatocerium rugosum* Hall, *Favistella halli* (Nicholson), *Halysites quebecensis* Lambe, *Streptalasma* cf. *S. robustum* Billings, *Monotrypa* sp., *Prasopora* sp., *Rhinidictya* sp.

Dinorthis pectinella (Emmons), *Hesperorthis disparilis* (Conrad), *Petrocrania* sp., *Platystrophia amoena* McEwan,

Plectorthis trentonensis Foerste, *Rafinesquina alternata* (Emmons), *Resserella rogata* (Sardeson), *Rhynchotrema increbescens* (Hall), *Sowerbyella sericea* (Sowerby), *Strophomena* sp., *Zygospira recurvirostris* (Hall).

Clionychia sp., *Ctenodonta* sp., *Cyrtodonta affinis* Ulrich, *C canadensis* Billings, *C. obesa* Ulrich, *Orthodesma subnasutum* (Meek and Worthen).

Bucania sp., *Clathrospira subconica* (Hall), *Cyclonema* sp., *Ecculiomphalus trentonensis* (Billings), *Fusispira nobilis* Ulrich and Scofield, *F. subfusiformis* (Hall), *Helictomoa planulata* Salter, *Holopea parvula* Ulrich and Scofield, *H. pyrene* Billings, *H. supraplana* Ulrich and Scofield, *Hormotoma bellicincta* (Hall), *H. gracilis* (Hall), *Hyolithes* sp., *Liospira vitruvia* (Billings), *Lophospira milleri* (Hall), *L. perangulata* (Hall), *Omospira* sp., *Pterotheca* sp., *Sinuites cancellatus* (Hall), *Tetranota bidorsata* (Hall), *Trochonema umbilicatum* (Hall), *Tropidodiscus subacutus* (Ulrich).

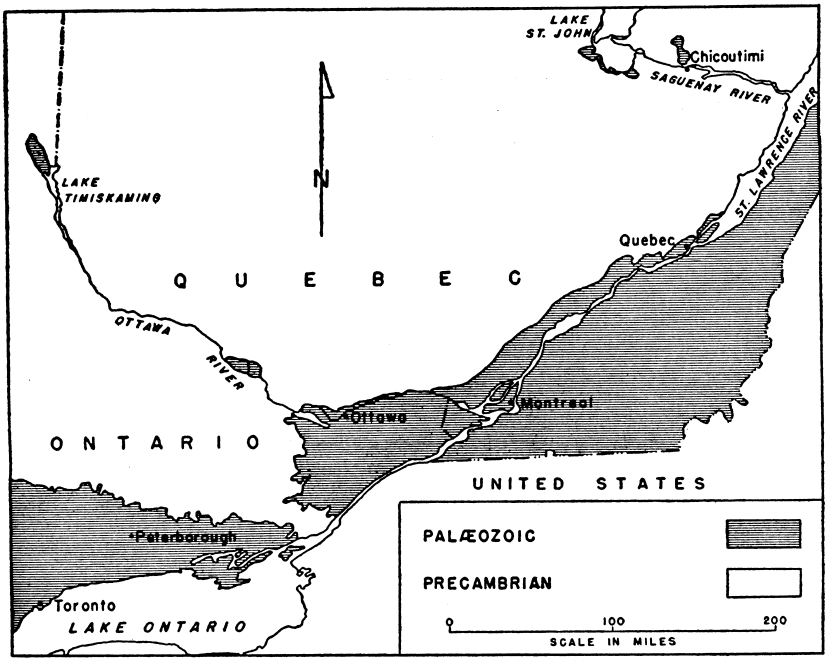

Fig. 1. Areas of outcrop of Paleozoic rocks in eastern Ontario and Quebec.

Bumastus sp., *Calliops* sp., *Flexicalymene senaria* (Conrad), *Illaenus americanus* Billings, *Isotelus* spp., *Proetus* s. l., spp., *Raymondites* cf. *R. spiniger* (Hall), *Leperditia* sp., *Technophorus* sp., *Lichenocrinus* sp.

If the beds below are doubtful in position these are not, for here we have the Paquette Rapid fauna well developed. There are some discrepancies, the presence of *Halysites*, the presence of *Fusispira* rather than *Subulites*, but these are minor, and there can be no doubt that this series of beds is at least approximately equivalent to the Ottawa Valley beds.

From the stripping, bed 7, were collected: *Streptalasma corniculum* Hall, *Prasopora* sp., *Rhinidictya* sp., *Dinorthis* sp., *Hebertella frankfortensis* Foerste, *Lingula* sp., *Öpikina* sp., *Platystrophia felis* Sinclair, *Rafinesquina alternata* (Emmons), *Resserella rogata* (Sardeson), *Rhynchotrema increbescens* (Hall), *Strophomena billingsi* Winchell and Schuchert, *S. thalia* Billings, *Zygospira recurvirostris* (Hall).

Cyrtodonta obesa Ulrich, *Bucania* sp., *Helicotoma planulata* Salter, *Holopea appressa* Ulrich and Scofield, *Hormotoma canadensis* Ulrich and Scofield, *H. gracilis* (Hall), *Liospira americana* (Billings), *Lophospira milleri* (Hall), *L. perangulata* (Hall), *Tetranota bidorsata* (Hall), *Trochonema umbilicatum* (Hall), *Flexicalyene senaria* (Conrad), *Lichenocrinus* sp.

This fauna is entirely noncommittal. The aspect is as much Trenton as Black River, but it does not recall any particular part of the Trenton. The fossils one would expect in the Rockland or Hull are missing. The exposure is too small to justify any definite assignment.

Chute aux Galets.—The beds exposed along the Shipshaw River show the following continuous section:

3.	Black shale, resting on a somewhat roughened surface (Gloucester shale)	25 ft.
2.	Rather thick-bedded limestones, weathering rubbly (Galet beds)	15
1.	Thin-bedded dense limestones with thick (up to 3 in.) soft shaly partings (Shipshaw beds)	60

The black shales were not examined in detail, except near their contact with the limestones. Their thickness is taken from McGerrigle's estimate. Besides the fossils which he lists from these beds, my small collection includes *Triarthrus spinosus*

and *Schizocrania filosa*, species which make a Gloucester correlation of the beds quite certain. Indeed the lithology and fauna are such that specimens from Chute aux Galets and Ottawa cannot be distinguished.

The upper 15 feet of the limestone is separable from the underlying beds, although no sharp line can be drawn between them. There is a gradual diminution in the amount of shale as the section is ascended, and the limestone, which below is platy, becomes dirtier and rubbly. More important, there is a faunal difference. The upper beds are not abundantly fossiliferous, but they include common *Cyclospira* (of which only one specimen was found in the lower beds), and *Illaenus americanus* as a common fossil. The fauna of these Galet beds is:

Streptalasma corniculum Hall, *Conularia trentonensis* Hall, *Prasopora* sp., *Rhinidictya* sp., *Cyclospira bisulcata* (Emmons), *Platystrophia amoena* McEwan, *Rafinesquina deltoidea* (Conrad), *Resserella rogata* (Sardeson), *Sowerbyella sericea* (Sowerby), *Strophomena* sp.

Bucania sp., *Hormotoma trentonensis* Ulrich and Scofield, *Liospira americana* (Billings), *Flexicalymene senaria* (Conrad), *Illaenus americanus* Billings, *Isotelus* sp.

The lower shaly Shipshaw beds (1) are abundantly fossiliferous, and yielded:

Ischadites iowensis (Owen), *Pasceolus globosus* Billings, *Receptaculites occidentalis* Salter, *Diplograptus* sp., *Streptalasma corniculum* Hall, *Conularia trentonensis* Hall, *Cornulites flexuosus* (Hall), *Serpulites* sp., *Prasopora* sp., *Rhinidictya* sp., *Subretepora* sp.

Craniops trentonensis (Hall), *Cyclospira bisulcata* (Emmons), *Dinorthis pectinella* (Emmons), *Hesperorthis tricenaria* (Conrad), *Öpikina* sp., *Parastrophina hemiplicata* (Hall), *Plaesiomys subquadrata* (Hall), *Platystrophia amoena* McEwan, *Plectorthis trentonensis* Foerste, *Pseudolingula major* Ruedemann, *Rafinesquina alternata* (Emmons), *R. camerata* (Conrad), *R. deltoidea* (Conrad), *R. praecursor* Raymond, *Resserella rogata* (Sardeson), *Rhynchotrema increbescens* (Hall), *Sowerbyella sericea* (Sowerby), *Strophomena billingsi* Winchell and Schuchert, *S. thalia* Billings, *S. trilobita* Owen, *Vellamo trentonensis* (Raymond).

Ctenodonta alta (Hall), *Endodesma gesneri* (Billings), *Whitella* sp., *Bucania* sp., *Clathrospira subconica* (Hall),

Fusispira nobilis Ulrich and Scofield, *F. subfusiformis* (Hall), *Holopea symmetrica* Hall, *Hormotoma salteri* Ulrich and Scofield, *H. trentonensis* Ulrich and Scofield, *Liospira americana* (Billings), *Lophospira oweni* Ulrich and Scofield, *Omospira* sp., *Phragmolithes compressus* Conrad, *Sinuites cancellatus* (Hall), *Subulites subelongatus* d'Orbigny, *Tetranota bidorsata* (Hall), *Trochonema umbilicatum* (Hall).

Bumastus sp., *Ceraurinus* cf. *C. confluens* Barton, *Ceraurus dentatus* Raymond and Barton, *C.* sp., *Dimeropyge lucifer* Sinclair, *Encrinurus* sp., *Flexicalymene* sp., *Hemiarges* sp., *Illaenus americanus* Billings, *Isotelus* sp., *Proetus* s.l., sp., *Leperditia* sp., *Cheirocrinus* sp., *Glyptocystites batheri* Sinclair, *G. regnelli* Sinclair, *Hudsonaster* sp., *Lichenocrinus* sp.

The fauna of these beds is of strikingly Sherman Fall aspect, although such elements as the *Fusispira* and *Rafinesquina camerata* would be surprising in these beds in Ontario (but not in Quebec, where the Rosemount member of the Montreal formation bears many *Fusispira*). I consider the Shipshaw as of late Sherman Fall age, being succeeded above by definitely Cobourg (Galet) beds. It may be that the whole thickness is Cobourg, but I do not think so. Until the fauna can be studied critically there is no point in pretending to greater precision.

It will be noted that I find no beds at Chute aux Galets which overlap the section at Tremblay. Rather, there seems to be a long gap in the record, with beds of Hull and lower Sherman Fall age unrepresented. There is room for them in the covered area between Tremblay and Chute aux Galets, but also a possibility that they were not deposited in this area at all.

OUTLIERS AT LAKE ST. JOHN

The distribution of the Ordovician beds along the south side of Lake St. John has been described by Dresser. I was not able to establish a continuous section in this area, mainly because the level of the lake had been raised some 30 feet by power developments, and the old shore sections drowned. It is regrettable that Dresser gave no section, since apparently when he studied the district the shore could be traversed. I was able to see at various places small exposures showing (1) the contact of the limestones with the underlying Precambrian, (2) the contact with the overlying black shales, and (3) a number of

small quarries in beds of middle Trenton aspect. My notes, therefore, form three disconnected parts.

Precambrian contact.—Small exposures along the railroad north of Roberval were described and illustrated by Dresser (1916, pl. 4B). The basal sediments are rather thin-bedded limestones, with no residual weathered material between them and the irregular Precambrian surface. Hollows in the surface were filled rather rapidly, and at a height of a foot or so above the contact the bedding of the limestones is essentially level. Fossils are few, but collecting conditions are not good, and this poverty may be illusory. Some beds have poorly silicified brachiopods. I did not see here any beds which could have yielded the slabs with finely silicified mollusks which were collected by Richardson and by Dresser and are preserved in the Geological Survey collections in Ottawa. Presumably they came from a shore exposure which is not now accessible. At the railroad cut I found in the 7 feet of beds exposed there:

Receptaculites occidentalis Salter, *Streptalasma corniculum* Hall, *Rhinidictya* sp., *Dinorthis* cf. *D. alternata* Wilson, *D.* sp., *Rafinesquina* sp. aff. *R. deltoidea* (Conrad), *Rhynchotrema* sp.,

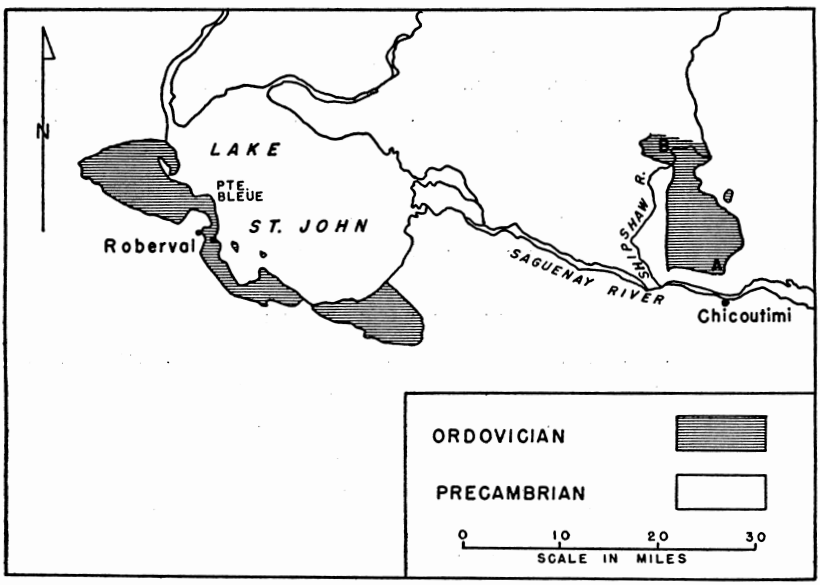

Fig. 2. Lake St. John, Quebec, and vicinity, showing the distribution of the outcrops discussed in the paper. North of Chicoutimi the Tremblay quarry area is marked A, Chute aux Galets is marked B.

Zygospira recurvirostris (Hall), *Bucania* sp., *Trochonema canadensis* Ulrich and Scofield.

No *Halysites* was seen. This small faunule does not permit a definite assignment, but I feel that it belongs above the *Halysites* beds at Tremblay.

Middle Trenton.—A series of small quarries about two miles north of Roberval (lots 3-5 of range A) expose about 47 feet of beds which seem to be Middle Trenton. The same beds are repeated several times by small faults, but I did not see them in contact with other beds at any place. The lithology is a rather argillaceous limestone but with the clayey material so disseminated that on fresh surfaces the appearance is of a very thick-bedded limestone, in beds up to 5 feet thick. Only on very long weathering do these beds break down to a softer rubbly mass. The fauna of the three quarries studied is essentially the same, and is combined here:

Hindia parva Ulrich, *Ischadites iowensis* (Owen), *Pasceolus globosus* Billings, *Receptaculites occidentalis* Salter, *Climacograptus* sp., *Diplograptus* sp., *Aulopora trentonensis* Winchell and Schuchert, *Protaraea vetusta* (Hall), *Streptalasma corniculum* Hall.

Conularia trentonensis Hall, *Cornulites flexuosus* (Hall), *Metaconularia* sp., *Corynotrypa* sp., *Helopora* sp., *Monotrypa* sp., *Prasopora* sp., *Rhinidictya* sp., *Subretepora* sp.

Craniops trentonensis (Hall), *Cyclospira bisulcata* (Emmons), *Glyptorthis* sp., *Hesperorthis disparilis* (Conrad), *H. tricenaria* (Conrad), *Öpikina* sp., *Parastrophina hemiplicata* (Hall), *Petrocrania* sp., *Plaesiomys meedsi* (Winchell and Schuchert), *P. ulrichi* (Foerste), *Platystrophia amoena* McEwan, *Pseudolingula major* Ruedemann, *Rafinesquina alternata* (Emmons), *R. camerata* (Conrad), *R. deltoidea* (Conrad), *R. normalis* Wilson, *R. praecursor* Raymond, *R. robusta* Wilson, *R. salmoni* Wilson, *Resserella rogata* (Sardeson), *Rhynchotrema increbescens* (Hall), *R. intermedia* Wilson, *Sowerbyella sericea* (Sowerby), *Strophomena filitexta* Hall, *S. scofieldi* Winchell and Schuchert, *Trematis ottawaensis* Billings, *Vellamo trentonensis* (Raymond), *Zygospira recurvirostris* (Hall).

Ctenodonta intermedia (Ulrich), *Cyrtodonta obesa* Ulrich, *Orthodesma gesneri* (Billings), *Whitella* sp., *Archinacella trentonensis* Billings, *Bellerophon clausus* Ulrich, *Bucania* sp., *Clathrospira subconica* (Hall), *Cyclonema* sp., *Ecculiomphalus tren-*

tonensis (Billings), *Fusispira angusta* Ulrich and Scofield, *F. nobilis* Ulrich and Scofield, *Gyronema liratum* Ulrich and Scofield, *Hormotoma bellicincta* (Hall), *H. gracilis* (Hall), *H. trentonensis* Ulrich and Scofield, *Liospira americana* (Billings), *L. angustata* Ulrich and Scofield, *L. micula* (Hall), *Lophospira milleri* (Hall), *L. perangulata* (Hall), *Phragmolithes compressus* Conrad, *Proplina unguiformis* Ulrich and Scofield, *Sinuites cancellatus* (Hall), *Subulites nanus* Ulrich and Scofield, *S. subelongatus* d'Orbigny, *Trochonema umbilicatum* (Hall).

Achatella sp., *Acrolichas* aff. *A. trentonensis* (Conrad), *Bumastus* sp., *Calliops* sp., *Calyptaulax* sp., *Ceraurinus* cf. *C. confluens* Barton, *Ceraurus dentatus* Raymond and Barton, *C. matranseris* Sinclair, *Dimeropyge lucifer* Sinclair, *Encrinurus* spp., *Eomonorachos* sp., *Flexicalymene senaria* (Conrad), *Hemiarges* sp., *Homotelus* sp., *Illaenus americanus* Billings, *Isotelus* sp., *Otarion* sp., *Proetus* s. l., spp., *Remopleurides* aff. *R. striatulus* Walcott, *R.* aff. *R. linguatus* Ruedemann, *Sphaerocoryphe* sp.

Leperditia sp., *Eurychilina* sp., *Primitia* sp., *Tetradella* sp., *Glyptocrinus* sp., *Glyptocystites* sp., *Hudsonaster narrawayi* (Hudson), *Lepidocoleus* sp., *Lichenocrinus* sp., *Promopalaeaster* sp., *Pleurocystites* sp.

Taken as a whole, this is a typical later Sherman Fall fauna, but the details are puzzling. In spite of the abundant representation of the trilobites, the harpeids and the leonaspids are completely missing, and those groups which have been studied in detail seem to differ specifically from the Trenton forms of New York and adjacent areas. Again, some elements point to Cobourg affinities. Until more critical determinations can be made, nothing more definite can be said than that the fauna seems to be "Middle" Trenton. Certainly, it is the same as the fauna of the Shipshaw beds at Chute aux Galets.

Black shale contact.—Several small exposures along the lake shore exhibit the contact of the black shales on the limestones. The best section seen was:

3. Black shale with *Triarthrus glaber, T. spinosus.* Very typical Gloucester shale.
2. Thick-bedded limestone, with few fossils other than large straight cephalopods. The upper surface, at the contact with the shale, strikingly uneven ..... 15 ft.

1. Somewhat thinner-bedded limestone, with rubbly or thin shaly interbeds 18

Although well exposed, the beds seemed sparingly fossiliferous, only the following species being found in bed 1:

Ischadites cf. *I. iowensis* (Owen), *Streptalasma corniculum* Hall, *Climacograptus* sp., *Dinorthis* cf. *D. subquadratus* (Hall), *Glyptorthis* sp., *Rafinesquina* cf. *R. camerata* (Conrad), *Strophomena* sp., *Sowerbyella* cf. *S. semiovalis* Wilson, *Parastrophina* sp., *Hormotoma trentonensis* Ulrich and Scofield, *Isotelus* cf. *I. gigas* DeKay.

This is a Cobourg type of assemblage, so far as it goes, and taken in conjunction with its position, I think we may look on these beds as Cobourg, and equivalent to the Galet beds at Chute aux Galets.

In summary, we have at Lake St. John beds which are apparently equivalent to the Shipshaw and the Galet, but no certain representation of the lower beds seen at Tremblay. It must be remembered that *Halysites quebecensis* was originally described from Lake St. John, and so (unless its range be greater than suspected) beds equivalent to the Simard must occur somewhere along the lake, although I did not see them.

REGIONAL IMPLICATIONS

Having established a tentative section for the Saguenay outliers, with representation of beds from Lowville to Gloucester age, some implications must be mentioned although they cannot be developed here.

(1) The succession described here is on the whole that found at Ottawa and in central Ontario near Peterborough. Although details differ, the resemblance of the Galet to the Cobourg, of the Shipshaw to the beds in Ontario identified as Sherman Fall, is striking. Now, this Sherman Fall-Cobourg sequence is not found at Montreal, nor in the St. Lawrence Valley below Montreal. Although the Montreal Tetrauville formation can be correlated with the Cobourg with some assurance, still it differs lithologically and faunally from the Ontario beds and the resemblances are very general ones. The succeeding Terrebonne is unknown in Ontario, unless indeed it be equivalent to the Collingwood, which it does not resemble except in position. As one moves northeast in the St. Lawrence both these thick limestone formations are replaced by shales, just as they are

replaced by shales as one moves south into the Champlain-Hudson valley. If the late Trenton beds at Peterborough, Ottawa and Lake St. John are similar lithologically and faunally, as they are, where was the connection? Not to the south, for we know the Trenton there, and it is different. I think we must imagine a continuous belt of carbonate facies running roughly parallel to the St. Lawrence, but 100 miles or so to the northwest of it. Judging by the distribution of clastics, this was an offshore belt, with the source of detrital materials south and east of the St. Lawrence. Obviously, adjustments are needed in our thinking about Laurentia in Trenton time. I understand that a number of other areas of Trenton limestones are known still further within the Shield, although their descriptions have not been published. I do not think we are nearly ready to make maps of the Ordovician seas in this part of the continent.

(2) It will be noted that at both Lake St. John and Chute aux Galets the contact of the Gloucester on beds of Cobourg age is seen, and there is no trace of the Collingwood. The whole question of the distribution and relationships of the Collingwood is a large one, and cannot be considered here. The present study only eliminates one possible direction of encroachment of the Collingwood fauna.

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