CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

MEMOIR 281

STRATIGRAPHY AND PALÆONTOLOGY OF THE INTERLAKE GROUP AND STONEWALL FORMATION OF SOUTHERN MANITOBA

BY
Colin W. Stearn

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1956

One Dollar

No. 2522

CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

MEMOIR 281

STRATIGRAPHY AND PALÆONTOLOGY OF THE INTERLAKE GROUP AND STONEWALL FORMATION OF SOUTHERN MANITOBA

BY

Colin W. Stearn

MAY 15, 1956

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1956

Price, One Dollar No. 2522

3.000—1956

CONTENTS

Illustrations

PREFACE

The Williston basin straddles the International Boundary, underlying parts of Alberta, Saskatchewan and Manitoba in Canada, and North and South Dakota and Montana in the United States. Oil has been discovered in many of the strata that fill this huge basin, and thousands of wells have been drilled there, or are being drilled. As a result, information on the subsurface stratigraphy is accumulating rapidly.

This report describes the results of a detailed study of some of the beds that come to the surface in Manitoba, along the edge of the basin. These beds comprise the Interlake group of Middle Silurian age and the Stonewall formation of latest Ordovician age. The report includes descriptions and regrouping of the strata that outcrop, and descriptions of the fossils contained in them. The study of the palæontology has resulted in changes in the hitherto accepted correlation of the Interlake group and a revision of the historical geology of the region.

Oil has been found in Interlake beds in the United States and may also be present in these rocks in Canada. For intelligent exploration, a knowledge of both surface and subsurface stratigraphy is necessary, and this report is an important contribution to the former.

GEORGE HANSON,
Director, Geological Survey of Canada

OTTAWA, January 17, 1955

Stratigraphy and Palæontology of the Interlake Group and Stonewall Formation of Southern Manitoba

CHAPTER I

INTRODUCTION

The discovery of oil in the rocks of the Williston basin of Western Canada and northwestern United States has focused attention on the Palæozoic rocks that outcrop along the margins of the basin. One of the most accessible of these areas of outcrop stretches northwest of Winnipeg for 400 miles to The Pas, Manitoba. The Palæozoic rocks in this belt range from Ordovician to Devonian in age, but this report is concerned only with the Silurian and latest Ordovician rocks. No systematic work has been done on the palæontology of the northern faunas of the Silurian system since the first decade of this century and it is hoped that this report will furnish a standard section for this faunal province. The work was started in conjunction with the stratigraphic studies of A. D. Baillie in the Interlake group but during the course of the study the writer found it necessary to revise the stratigraphy considerably and these revisions are presented in this report. The Stonewall formation was included by Baillie in the Interlake group and so falls within the scope of this report although it is not now considered to belong in this group.

The topography of the area in which the Silurian rocks outcrop is very flat as the land was recently under the waters of glacial Lake Agassiz. The local relief throughout the area is rarely more than 20 feet. The surface deposits are wave-worked till and varved and unvarved lake clays (Johnston, 1934).[1] The outcrop belt of the Silurian rocks is divided into a northern and a southern area by a region of swampy unmapped country between Gypsumville and Grand Rapids. In the southern or Interlake area (*see* Map 1) the outcrops are widely scattered and rarely expose more than a few feet of strata. As a result, most of the stratigraphic information from this area has come from quarries. The exposures in the Interlake area are accessible by a network of roads leading from two highways from Winnipeg to Gypsumville and to Hodgson. An almost complete section of the Interlake group in the northern area (*see* Map 2) is exposed where the lower Saskatchewan River cuts a valley and gorge across the belt of outcrop. Most of the outcrops north of the river are lake cliffs and are accessible only by canoe or aeroplane but some along the Churchill railway and the Flin Flon highway can be visited by roads.

The first comprehensive account of the geology of the Silurian of Manitoba is that of Tyrrell (1892). In that report he summarized the history of exploration and geological investigation that had preceded his work in Manitoba during the years 1887-90. The report is concerned

[1] Names and dates in parentheses are those of References cited at the end of this chapter.

chiefly with the northern area of outcrop and contains an excellent account of the Silurian rocks along the valley of the lower Saskatchewan River and on the east shore of Lake Winnipegosis. A study of the fossils collected by Tyrrell and Whiteaves was undertaken by the latter and published in 1906. These authors both regarded the strata that are the subject of this report as of Middle Silurian (Niagaran) age.

Kindle (1914) proposed that the Silurian rocks of southern Manitoba be called the Stonewall formation and divided into three units: a lower zone of *Virgiana decussata,* a middle evaporite unit, and an upper zone of *Leperditia hisingeri.* In 1915 he described the stratigraphy of the lower Saskatchewan River and two brachiopods from these rocks. During the early 1930s S. R. Kirk constructed an outcrop map of the Interlake area that was never published but was made available to the writer, with his notes, by the Geological Survey. Goudge (1944) has given detailed accounts of the major quarries and easily accessible outcrops with reference to the economic exploitation of the dolomites. Information on the subsurface configuration of the Interlake group and Stonewall formation has been compiled by Kerr (1949).

The most comprehensive and recent account of the stratigraphy of the Silurian has been published by Baillie (1951). He proposed that the strata between the Stony Mountain and Ashern formations be called the Interlake group and he divided the group into five lithologic members designated by letters and five biostratigraphic units. The lower two faunal zones were correlated with the Lower Silurian and the upper three with the Middle Silurian. Baillie removed the gypsum-anhydrite deposits of the Gypsumville area from the Silurian because there is no evidence for their age.

The extension of the Interlake group and Stonewall formation into Saskatchewan has been described by Kupsch (1953). Because exposures are restricted, no subdivisions of the Interlake group can be recognized in Saskatchewan, but the presence of *Amplexoides severnensis* in one outcrop suggests that rocks equivalent to the Inwood formation are exposed. Stearn (1953) has shown that the Stonewall formation is Ordovician in age and should be removed from the Interlake group, because the rest of the group is Middle Silurian in age.

The field work of collecting, measuring sections, and mapping was carried on during the summers of 1950 and 1951. The writer is grateful to the officers of the Mines Branch of the Department of Mines and Natural Resources of Manitoba for co-operation throughout the study, and especially to Dr. A. D. Baillie whose suggestions on the stratigraphy were invaluable both during the field work and in subsequent discussions. The writer acknowledges the courtesy and co-operation of the quarry managers and land owners of the area.

Parts of this report were used as a thesis submitted in partial fulfilment of the requirements of the degree Doctor of Philosophy in Yale University. The writer is grateful to many members of the geological faculty and especially to Dr. C. O. Dunbar for guidance on the problems of stratigraphy and palæontology.

The writer was ably assisted in the field during the summer of 1950 by R. O. Freedman, and during the summer of 1951 by R. Daw.

REFERENCES

Baillie, A. D.
(1951): Silurian Geology of the Interlake Area; Manitoba Mines Branch, Pub. 50-1.
(1952): Ordovician Geology of Lake Winnipeg and Adjacent Areas; Manitoba Mines Branch, Pub. 51-6.

Bassler, R. S.
(1932): The Stratigraphy of the Central Basin of Tennessee; Tenn. Div. Geol., Bull. 38.
(1950): Faunal Lists and Descriptions of Paleozoic Corals; Geol. Soc. Amer., Mem. 44.

Bassler, R. S., and Kellett, B.
(1934): Bibliographic Index of Paleozoic Ostracoda; Geol. Soc. Amer., Spec. Paper 1.

Black, M.
(1933): The Algal Sediments of Andros Island, Bahamas; Roy. Soc. London Phil. Trans., ser. B, vol. 222, pp. 165-192.

Bolton, T. E.
(1953): Silurian Formations of the Niagaran Escarpment in Ontario; Geol. Surv., Canada, Paper 53-23.

Butler, A. J.
(1937): A New Species of *Omphyma* and Some Remarks on the *Pycnactis-Phaulactis* group of Silurian Corals; Ann. Mag. Nat. Hist., 10th ser., vol. 19, pp. 87-96.

Cooper, G. A.
(1944): Brachiopoda, in North American Index Fossils, by H. Shimer and R. Shrock.

Ehlers, G. M.
(1921): Niagaran Rocks of the Northern Peninsula of Michigan; Bull. Geol. Soc. Amer., vol. 32, pp. 129-130.

Flower, R. H., and Kummel, B.
(1950): A Classification of the Nautiloidea; Jour. of Pal., vol. 24, pp. 604-616.

Foerste, A. F.
(1930): Port Byron and other Silurian Cephalopods; Denison Univ. Bull., Jour. Sci. Lab., vol. 25, pp. 1-124.

Gillette, T.
(1947): The Clinton of Western and Central New York; New York State Mus. Bull. 341.

Goldfuss, G. A.
(1826): Petrafacta Germaniae, Dusseldorf, 128 pp.

Goudge, M. F.
(1944): Limestones of Canada, Part V, Western Canada; Bur. of Mines, Canada, Mines and Geology Branch, Rept. 811.

Grabau, A. W.
(1922): Paleozoic Corals of China, Part 1—Tetraseptata; Paleont. Sinica, B. II, pp. 1-76.

Grove, B. H.
(1935): Studies on Paleozoic Corals, II—A Revision of some Mississippian Zaphrentids; Amer. Midland Nat., vol. 16, pp. 337-378.

Henbest, L. G.
(1931): Use of Selective Stains in Paleontology; Jour. of Pal., vol. 5, pp. 355-364.

Hill, D.
(1940): The Silurian Rugosa of the Yass-Browning District, N.S.W.; Linnean Soc. N.S. Wales, Proc., vol. 65, pt. 3-4, pp. 388-420.

Johnston, W. A.
(1934): Surface Deposits and Ground-water Supply of Winnipeg Map-area, Manitoba; Geol. Surv., Canada, Mem. 174.

Jones, O. A.
(1936): The Controlling Effect of the Environment on the Corallum of *Favosites*; Ann. Mag. Nat. Hist., 10th ser., vol. 17, pp. 1-24.
(1937): The Australian Massive Species of the Coral Genus *Favosites*; Australian Mus. Rec., vol. 20, No. 2, pp. 79-102.

Jones, T. R.
(1891): Contributions to Canadian Micro-palæontology of the Cambro-Silurian Rocks of Canada, pt. III; Geol. Surv., Canada.

Kerr, L.
(1949): The Stratigraphy of Manitoba with Reference to Oil and Natural Gas Possibilities; Manitoba Mines Branch, Pub. 49-1.

Kindle, E. M.
(1914): The Silurian and Devonian Section of Western Manitoba; Geol. Surv., Canada, Sum. Rept. 1912, pp. 247-261.
(1915): Notes on the Geology and Palæontology of the Lower Saskatchewan River Valley; Geol. Surv., Canada, Mus. Bull. No. 21.

Kupsch, W. O.
(1953): Ordovician and Silurian Stratigraphy of East Central Saskatchewan; Saskatchewan Geol. Surv., Rept. 10.

Lambe, L. M.
(1899): A Revision of the Genera and Species of Canadian Palæozoic Corals; Contrib. Can. Pal., vol. 4, pt. 2, pp. 1-96.

Lang, W. D., Smith, S., and Thomas, H.
(1940): Index of Palæozoic Coral Genera; The British Museum, London.

Lecompte, M.
(1936): Revision des Tabules Devoniens decrits par Goldfuss; Mus. Roy. Nat. Hist., Belge, Mem. 75.
(1939): Les Tabules du Devonien moyen et superior du bord sud du bassin de Dinant; Mus. Roy. Nat. Hist., Belge, Mem. 90.

Lee, G. W.
(1912): Notes on the Arctic Paleozoic Fossils from the "Hecla" and "Fury" Collections; Edinburgh, Proc. Roy. Phys. Soc., vol. 18, pp. 255-264.

LeMaître, D.
(1931): Contribution à l'etude des polypiers Devoniens du bassin d'Ancenis; Geol. Soc. France, ser. 5, T. 1, pp. 573-580.

Lonsdale, W.
(1839): The Corals *in* Murchison, R. I., The Silurian system, pt. II, pp. 214, 582, 586, 675 *et seq.*

Milne-Edwards, H., and Haime, J.
(1851): Monographie des polypier fossiles des terraines Paleozoiques; Arch. Mus. Hist. Nat., Paris, vol. 5.

O'Connell, M.
(1913): Revision of the Genus *Zaphrentis*; Ann. New York Acad. Sci., vol. 23, pp. 177-192.

Okulitch, V. J.
(1938): Some Black River Corals; Roy. Soc., Canada, Trans., sec. IV, vol. 32, pp. 87-111.
(1943): The Stony Mountain Formation of Manitoba; Roy. Soc., Canada, Trans., sec. IV, vol. 37, pp. 59-73.

Ower, J. R.
(1953): The Subsurface Stratigraphy of Southwestern Manitoba; Can. Inst. Min., Bull., vol. 46, pp. 735-743.

Parks, W. A.
(1915): Palæozoic Fossils from a Region South-west of Hudson Bay; Roy. Can. Inst. Trans., vol. 11, pp. 3-95.

Poulsen, Ch.
(1941): The Silurian Fauna of North Greenland; Med. Grønland, vol. 72, No. 2.

Radugin, K. V.
(1936): Some Coelenterates from the Lower Silurian of Gornaya Shoria; Rec. Geol. West Siberian Region, No. 35, pp. 89-105.

Savage, T. E.
(1918): Correlation of the Early Silurian Rocks of the Hudson Bay Region; Jour. of Geol., vol. 26, pp. 334-340.

Savage, T. E., and Van Tuyl, F. M.
(1919): Geology and Stratigraphy of the Area of Paleozoic Rocks in the Vicinity of Hudson and James Bays; Bull. Geol. Soc. Amer., vol. 30, pp. 339-377.

Schindewolf, O. H.
(1931): On the Genotype and Septal Development in the Coral Genus *Petraia* Münster; Quart. Jour. Geol. Soc. London, vol. 87, pp. 630-648.
(1938): Zur Kenntnis der Gattung *Zaphrentis* (Anthoz.-Tetracoralla) und der sogenannten Zaphrentiden des Karbons; Jahrbuch Preuss. Geol. Landesanst (1937), vol. 58, pp. 439-454.

Simpson, G. B.
(1900): Preliminary Descriptions of New Genera of Paleozoic Rugose Corals; New York State Mus. Bull., vol. 8, No. 39, pp. 199-222.

Smith, S.
(1945): Upper Devonian Corals of the Mackenzie River Region, Canada; Geol. Soc. Amer., Spec. Paper 49.

Smith, S., and Gullick, B.
(1925): The Genera *Favosites* and *Emmonsia* and the Species *Emmonsia parasitica;* Ann. Mag. Nat. Hist., ser. 9, vol. 15, pp. 116-126.

Soshkina, E. D.
(1937): Corals of the Upper Silurian and Lower Devonian of the Eastern and Western Slopes of the Urals; Acad. Sci. U.S.S.R., Inst. Sci. Min. Econ. Trav. Inst., Paleo-zool., vol. 6, No. 4, pp. 1-153.

Stearn, C. W.
(1953): Ordovician-Silurian Boundary in Manitoba; Bull. Geol. Soc. Amer., vol. 64, pp. 1477-1478.

Stewart, G. A.
(1938): Middle Devonian Corals of Ohio; Geol. Soc. Amer., Spec. Paper 8.

Stumm, E. C.
(1952): Species of the Silurian Rugose Coral *Tryplasma* from North America; Jour. of Pal., vol. 36, pp. 841-843.

Teichert, C.
(1933): Der Bau der actinoceroiden Cephalopoden; Paläontographic, Bd. 78, Abt. A, Lf. 4-6, pp. 111-234.
(1937): Ordovician and Silurian Faunas from Arctic Canada; Rept. 5th Thule Expedition, 1921-24, vol. 1, No. 5, 169 pp.

Tripp, K.
(1933): Die Favositen Gothlands; Paläontographic, vol. 79, Abt. A, pp. 75-142.

Twenhofel, W. H.
(1928): Geology of Anticosti Island; Geol. Surv., Canada, Mem. 154.

Tyrrell, J. B.
(1892): Report on Northwestern Manitoba; Geol. Surv., Canada, Ann. Rept. 1890-91, pt. E, pp. 1-235.

Ulrich, E. O., and Bassler, R. S.
(1923): Silurian; Geological Survey of Maryland.

Vogdes, A. W.
(1907): The Genus *Encrinurus*: Its History, Its Species, Its Proper Division in Family of *Trilobites;* San Diego Soc. Nat. Hist. Trans., vol. 1, pp. 61-82.

Wang, H. C.
(1948): Notes on Some Rugose Corals in the Gray Collection from Girvan, Scotland; Geol. Mag., vol. 85, pp. 97-106.
(1950): A Revision of the Zoantharia Rugosa in the Light of Their Minute Skeletal Structure; Roy. Soc. London, Phil. Trans., ser. B, vol. 234, No. 611, pp. 175-246.

Whiteaves, J. F.
(1906): Fossils of the Silurian Rocks of Keewatin, Manitoba, the Northeastern Shore of Lake Winnipegosis, and the Lower Saskatchewan River; Geol. Surv., Canada, Palæozoic Fossils, vol. 3, pt. IV, pp. 243-298.

Williams, M. Y.
(1919): The Silurian Geology and Faunas of the Ontario Peninsula and Manitoulin and Adjacent Islands; Geol. Surv., Canada, Mem. 111.

CHAPTER II

GENERAL GEOLOGY

GENERAL STATEMENT

The Interlake group lies between the Stonewall formation of Upper Ordovician age and the Ashern formation of Silurian or Devonian age. It is part of a section of Palæozoic rocks that outcrop along the boundary of the Canadian Shield from Winnipeg to northern Saskatchewan. All of these beds dip at a very low angle to the southwest towards the Williston basin, which was a site of more rapid deposition during the lower Palæozoic than the surrounding shelf area. The average dip of these sediments is about 10 feet to the mile but is locally much smaller. In the East Arm of Moose Lake for instance, a determination of dip showed only about 2 feet to the mile.

Dolomite is the most common rock in the Palæozoic section of Manitoba and constitutes about 90 per cent of the Interlake group and Stonewall formation. The remaining 10 per cent is magnesian limestone, argillaceous dolomite, shale, sandstone, and conglomerate. The dolomites are commonly buff coloured or in the Munsell colour designation that is used throughout this report, a greyish yellow. The great variety in structure and texture of these dolomites allows them to be grouped into formations for detailed stratigraphic work. The rocks all show evidence of being deposited in shallow water that was withdrawn periodically leaving drying mud flats in which salt crystals could grow. The fossils are preserved almost exclusively as moulds and casts, as is usual in dolomites

The Interlake group maintains a thickness of about 350 feet with little change as it is traced down dip in wells (Kerr, 1949; Ower, 1953). Within the boundaries of the province no changes in the lithology of the Silurian rocks occur and the subsurface section is composed of compact dolomite. Farther westward, however, the Silurian dolomites appear to grade into an evaporite facies in the centre of the Williston basin. The sequence of anhydrite, gypsum, and salt, which is correlated with the Silurian, is the lower part of the Elk Point formation. The Silurian rocks on the western side of the basin are restricted in their distribution and constitute the Briscoe formation.

The Interlake group has been divided in this report into six new formations on the basis of lithologic differences. The division is shown on the accompanying table of formations. The formations are thin but have great lateral continuity and nearly all of them can be traced from the Interlake to the northern outcrop area. It appears that the formations here recognized in surface exposures cannot be separated in the subsurface from well logs. In the investigation of the palæontology many species were found to be restricted to small parts of the section and to be useful for correlation. The fossils establish that the Stonewall formation is latest Ordovician in age and that the Interlake formations range in age from lower Clinton to Lockport or Guelph.

A summary of the correlations described in detail in the text is presented as Figure 1.

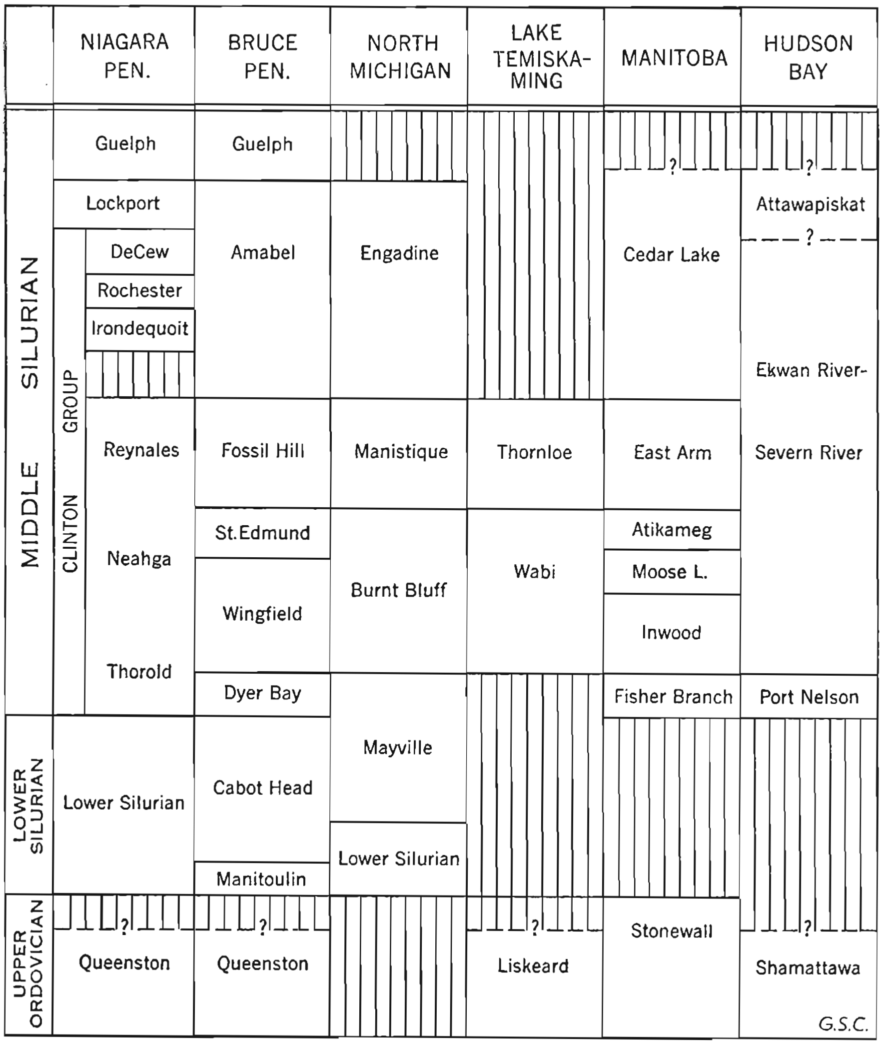


Figure 1. Correlation diagram.

TABLE OF FORMATIONS

Era	Period or epoch	Formation and thickness in feet	Lithology
Palæozoic	Silurian or Devonian	Ashern formation 0-25	Red dolomite; minor cream dolomite and breccia
		Disconformity	
	Middle Silurian	Cedar Lake formation 150	Thin bedded dolomite
		Chemahawin member	Fossiliferous reef dolomite
		Cross Lake member	Biostromal dolomite
		East Arm dolomite 40	Stromatolitic fine-grained dolomite; oolite
		Atikameg dolomite 16	Massive, porous dolomite
		Moose Lake dolomite 28	Stromatolitic and fine-grained dolomite
		Inwood formation 42	Dolomite, stromatolitic, fine-grained, fragmental, argillaceous
		Fisher Branch dolomite 16	Medium-grained, fossiliferous dolomite
		Disconformity	
	Upper Ordovician	Stonewall formation 30	Dolomite, dolomite conglomerate; minor sandy dolomite
		Stony Mountain formation	Cream dolomite, red, sandy and argillaceous dolomite and shale

DESCRIPTION OF FORMATIONS

Stonewall Formation

Many definitions of the term Stonewall formation have been proposed since Kindle named it in 1914. The confusion centres around the type section in the Stonewall quarries where there are two members of dolomite separated by a nodular bed, and an underlying sequence of red and grey, argillaceous and arenaceous dolomites (Figure 2).

Kindle proposed the term Stonewall formation to include all the rocks of the Silurian system exposed in Manitoba, and to replace the term Niagara dolomites used by Tyrrell (1892). He introduced the formation name in the belief that the best section of the Silurian beds was exposed in the quarries at the town of Stonewall, situated about 20 miles north of

Winnipeg. The type section in his report includes the 15 feet of dolomite in the main quarries and the 5 feet of porous dolomite exposed in the test pit of the northern quarry. Okulitch (1943) determined that the lower 5 feet of dolomite contained Ordovician fossils and relegated it to the Birse member of the Stony Mountain formation, thus restricting the strata called Stonewall. In seeking for a more comprehensive term to include the

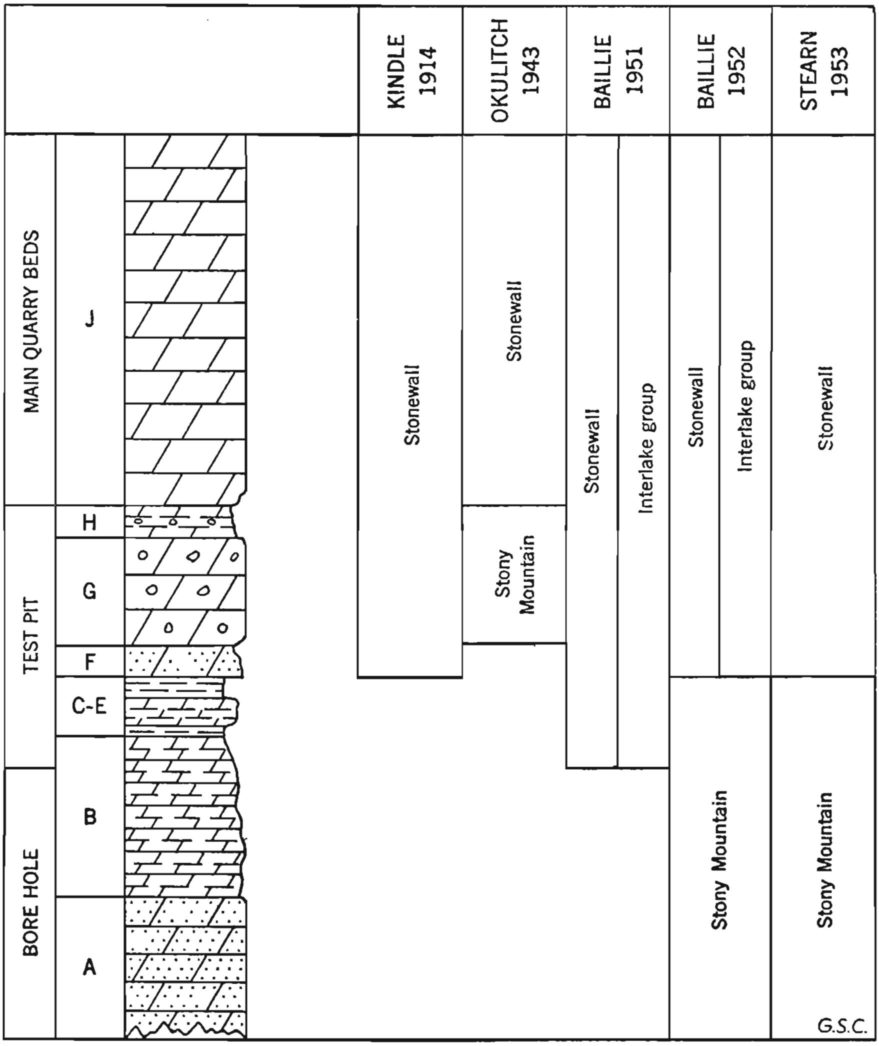


Figure 2. Correlation of interpretations at Stonewall quarry.

whole Silurian section of the province, Baillie (1951) chose the name Interlake group and redefined the Stonewall formation, the basal formation of this group, as those beds overlying the Stony Mountain formation and underlying the zone of *Virgiana decussata.* On the basis of its lithologic similarity to the overlying main quarry beds, he reinstated the lower 4 feet of dolomite and added the red argillaceous dolomite (units B-G) to the Stonewall formation. When drilling information showed that the argillaceous and arenaceous beds graded downward without a break into the Stony Mountain formation, Baillie (1952) considered that the lower boundary of the Stonewall formation should be drawn at the greatest lithologic break, that is, at the base of the lower dolomite member where Kindle originally placed it. As the argillaceous and arenaceous beds are barren of fossils and their inclusion with or exclusion from the Stonewall formation is only a question of convenience, Baillie's last definition is used in this discussion but the whole formation is regarded as of Ordovician age and removed from the Interlake group (Stearn, 1953).

Distribution. The Stonewall formation has been traced in a belt of outcrop stretching from its type locality northwest to the Saskatchewan border. It can be identified in the Atikameg and Moose Lake districts, at Fisher Branch, and at Stonewall.

A complete section of the formation is not exposed in the area so that the thickness cannot be measured directly. The best evidence on the thickness comes from the type section of the Fisher Branch formation on sec. 3, tp. 25, rge. 2, W. Prin. mer., where a well at the base of the hill reaches red arenaceous dolomite at a depth of 15 feet (Baillie, 1951). The interval between this red dolomite, which is probably correlative of unit D, of the Stonewall section and the Fisher Branch dolomite is 30 feet. The thickness of the Stonewall formation appears to be between 30 and 40 feet.

Lithology. The Stonewall formation consists in large part of dolomite and dolomite conglomerate. The basal part contains red and green argillaceous dolomite, thin shale beds, and some sandstone. These beds are the only terrigenous sediments found in the geological section for a considerable interval and form a convenient marker to the formation in well samples. The lithologic expression of the formation varies along its strike but the formation can be recognized by its stratigraphic position and largely clastic nature.

Of the several quarries at Stonewall, that west of the highway at the north end of the town has always been considered the type section because near the lime kilns, lower beds than are seen in the other quarries are exposed in a test pit. By means of digging and drilling the section in this quarry has recently been extended down to a dolomite that appears to be the Stony Mountain formation. The following is the section measured by the writer in 1950:

Stonewall formation

J. 15·0 feet—Dolomite: light yellowish grey to almost white, in places faintly mottled, fine grained, in some layers conglomeratic, evenly bedded, fossiliferous. *Beatricia regularis, Stromatoporella* sp., *Paleofavosites capax, P. prolificus, P. okulitchi, Angopora manitobensis, Tryplasma gracilis, ? Öpikina stonewallensis, Megamyonia nitens, Monomerella* cf. *laurentina, Palaeopteria parvula, Colpomya* sp., *Liospira* sp., *Trochonema* sp., *Metaspyroceras meridionale, Bickmorites insignis, Ephippiorthoceras minutum, Encrinurus* sp.

H. 1·2 feet—Dolomite: shaly, nodular, pale red, fine grained.

G. 4·5 feet—Dolomite: yellowish grey, slightly mottled, massively bedded, tough, vuggy, containing poorly preserved fossils. *Paleofavosites okulitchi, Lyellia* sp., *Ephippiorthoceras minutum, Kochoceras* cf. *productum, Antiplectoceras shamattawaense, Hormotoma* sp., *Lophospira* aff. *bicincta.*

F. 1·0 feet—Dolomite: arenaceous, yellowish grey, fine grained; in a single bed, obscurely crossbedded.

Stony Mountain formation

E. 0·5 foot—Shale: arenaceous, light olive-grey, thin bedded.

D. 1·3 feet—Dolomite: argillaceous, reddish brown, fine grained, unevenly bedded, breaking into pieces the size of a fist.

C. 0·2 foot—Shale: reddish brown, soft, fissile.

B. 1·9 feet—Dolomite: argillaceous, arenaceous, greyish red; in beds 2 inches thick.

Baillie has extended this section as follows:

B.? 4·0 feet—Dolomite: argillaceous, silty, pale yellowish brown, mottled greyish orange.

A. 6·0 feet—Dolomite: arenaceous, light yellowish grey, with about 10 per cent quartz grains, becoming less arenaceous downward.

There are several quarries in the Stony Mountain formation in the vicinity of Stonewall but no other notable outcrops of the Stonewall formation. In the Birse quarry, 5 miles northeast of Stonewall, 15 feet of thin-bedded, yellowish grey, slightly mottled dolomite is exposed. The fossils found here are scarce and very poorly preserved and the writer was able to identify only *Calapoecia canadensis* and *Paleofavosites capax* although Okulitch (1943) reported also *Beatricia* sp.

Okulitch has chosen this quarry as the type section of his Birse member of the Stony Mountain formation and correlated it with unit G of the Stonewall section. This correlation seems hardly tenable in the light of the argillaceous and sandy dolomites exposed in the test pit since Okulitch's study. Baillie (1952) does not believe that the Birse is a recognizable member and includes it with the Gunton member, implying that the strata correlative with the Birse quarry underlie unit A at Stonewall. The beds at Birse are dissimilar to both typical Gunton rocks and unit J of the Stonewall section and their meagre fauna does not indicate either alternative correlation. The writer would suggest the possibility that the Birse beds may be correlative of the main quarry beds (unit J) at Stonewall, but a thinner bedded, less fossiliferous facies.

In the Fisher Branch area the beds of the Stony Mountain formation and the Stonewall formation can be distinguished only with difficulty for the beds of the latter are red-stained and similar to the typical Gunton member of this district. The lack of outcrops showing more than a few feet of sediments makes it difficult to construct a stratigraphic section. The upper contact of the Stonewall formation is probably exposed at the type section of the Fisher Branch dolomite on the southeast corner of sec. 3, tp. 25, rge. 2, W. Prin. mer., where greyish yellow, aphanitic, thin-bedded dolomite with small white spheres is exposed at the base of the escarpment. Similar platy dolomite without the spheres is found flooring many of the tablelands to the north and east of Fisher Branch and composes the upper unit of the Stonewall formation in this area. It is practically barren of fossils except for large colonies of *Paleofavosites capax,* which cannot be found by splitting the rock but appear in relief on the under side of slabs that have been loosened from the bedrock and had their lower surfaces etched by soil acids. Although these strata can be traced throughout this area they have never been found to be more than 1 foot thick in outcrop and are probably less than 5 feet in total thickness. A small escarpment $2\frac{1}{2}$ miles east of Fisher Branch exposes 8 feet of light olive-grey, very fine-grained, irregularly fracturing dolomite in thick beds underlying the thin-bedded dolomite. This unit appears to be unfossiliferous. Both of these units are stained red and pink during weathering as is much of the section below the Fisher Branch formation. This staining is shown along the highway to Hodgson, 3·3 miles north of the turnoff to Fisher Branch, where concentrically laminated structures of probable algal origin have been red-stained in preference to the surrounding dolomites. The grey, thick-bedded dolomite grades downward into greyish pink, fine-grained dolomite that is well exposed in a small escarpment 3 feet in height between the highway and railway, 4·2 miles north of the turnoff to Fisher Branch. At this locality the beds are quite fossiliferous and contain elements of the Stonewall fauna such as *? Öpikina stonewallensis.* The same fossiliferous stratum outcrops in the middle of the north border of sec. 31, tp. 24, rge. 1, W. Prin. mer., but only *Colpomya* sp. was found. Placing a boundary between this basal unit and the Stony Mountain beds is difficult although it is to be expected that an interval of sandstone and shale should separate them. Red argillaceous and sandy dolomite is penetrated by wells about 30 feet below the Fisher Branch formation and Baillie (1952) reports a silt layer in a small escarpment on the west side of l.s. 5, sec. 7, tp. 25, rge. 1, W. Prin. mer., that he believes marks the contact. Northward from this outcrop on the highway to Hodgson, in an abandoned marble quarry, and in a prominent escarpment, fine-grained brown and red dolomites with argillaceous and nodular interbeds are exposed that are similar lithologically to the typical Gunton member of the Stony Mountain formation and contain a fauna different from that of the Stonewall formation. A zone of sand grains occurs in an outcrop in the middle of the west border of sec. 35, tp. 23, rge. 1, W. Prin. mer., but these strata are not at the base of the Stonewall formation.

The formation is much better exposed and more fossiliferous where it outcrops in the neighbourhood of The Pas. Two types of dolomite, one fine grained and commonly fossiliferous, the other conglomeratic and brecciated, are interbedded. In most outcrops the conglomeratic unit is uppermost and on the southwest corner of Seven Mile Point on Lake Atikameg may be seen directly underlying the Fisher Branch formation with conformity. At this lake cliff the Stonewall formation consists of 2·5 feet of the conglomerate with pebbles not over 1 cm. in diameter overlying 2·8 feet of yellowish grey, fine-grained, thin-bedded dolomite. Along the shore of the lake northward, sections are exposed that exhibit various interbeds of fine-grained to aphanitic dolomites with several conglomeratic layers. Fossiliferous dolomite containing many elements of the Stonewall fauna is found overlying a thin conglomerate bed at the north tip of Seven Mile Point. At the opposite side of Jackfish Bay similar dolomite carries *Tryplasma gracilis* but no conglomerate is present.

The thickest section of Stonewall strata exposed in the northern area is at Mile 26·7 of the Flin Flon highway where the road passes over a conspicuous escarpment. The uppermost unit of conglomeratic dolomite forms glaciated outcrops along the road for over a mile behind the escarpment.

Stonewall formation

G. 5·0 feet—Dolomite conglomerate: yellowish grey, matrix very fine grained, phenoclasts up to 10 cm. in diameter, containing some fine-grained interbeds and pockets of green clay. *Neozaphrentis hindi.*

F. 1·5 feet—Dolomite: greyish yellow, very fine grained to aphanitic, thin bedded.

E. 5·6 feet—Covered interval.

D. 11·0 feet—Dolomite: pale yellowish orange, fine grained, massive, porous, yellowish brown at base. *Tryplasma gracilis, Paleofavosites okulitchi, P. poulseni, Calapoecia canadensis.*

C. 1·8 feet—Dolomite: yellowish grey, very fine grained, poorly bedded, stained red at base, with scattered carbonaceous inclusions.

B. 0·5 foot—Shale: red and greyish green, soft, poorly bedded; containing fragments of the dolomite below.

A. 1·2 feet—Dolomite: pale, yellowish brown, very fine-grained to aphanitic, in medium beds, conchoidally fractured, containing a 2-inch bed of red shale in the centre.

Unit D of the above section is exposed in a cut at Mile 19 of the Flin Flon railway and there additional corals may be collected. A 14-foot section of the conglomerate was measured by the writer on the shore of MacDonald Bay in Namew Lake very near the Saskatchewan border and Kupsch (1953) reports that the unit is over 20 feet thick in some sections on this lake.

Along the south shore of the north extension of Moose Lake an olive-grey, mottled yellowish grey, fine-grained dolomite that weathers to an irregular surface is found to underlie the Fisher Branch formation. In a section exposed on the beach 3 miles southwest of the northeast narrows of the lake, a thin layer of argillaceous and arenaceous red dolomite separates the two formations. The mottled dolomite may be the same stratum that is the lowest bed exposed at Grand Rapids at water level on the north bank.

Contacts. The lower contact of the formation is marked by a change from a red argillaceous dolomite to a yellowish grey dolomite. It is exposed only at the Stonewall quarries and there appears to be a disconformity. The topmost bed of the Stony Mountain formation is bleached from a red argillaceous dolomite to an olive-grey colour, perhaps by an interval of weathering. The sandy zone at the top of Stony Mountain formation has been used in wells to mark the base of the Silurian, but the base of the Interlake group as defined in this report is about 30 feet higher stratigraphically.

The upper contact is a disconformity that represents all of Lower Silurian time. The surface shows little sign of erosion but is marked on Moose Lake by a thin bed of arenaceous dolomite. This upper contact is discussed more fully in the descriptions of the Fisher Branch dolomite.

Correlation and Age. The Stonewall formation has been generally considered to be of Silurian age, although there have been suggestions that part of it is late Ordovician. Okulitch (1943) showed that the lower dolomite at Stonewall contained cephalopods that indicated a correlation with the Shammattawa limestone of the Hudson Bay region. Some of these cephalopods he identified as *Huronia* cf. *septata* but these fossils are referred in this report to the genus Kochoceras and close to the species *K. productum* Troedsson, described from the Richmond beds at Cape Calhoun. *Kochoceras* is not recorded from the Shammattawa limestone but is a common Upper Ordovician cephalopod of the Arctic region. The presence of *Antiplectoceras shammattawaense* in these lower beds at Stonewall supports their correlation with the Shammattawa and other Richmond horizons.

The fauna of the upper dolomite at Stonewall has been considered to be of Lower Silurian age but nearly all the fossils that are not local species are indicative of a Richmond age. Among the corals, *Paleofavosites capax* and *P. okulitchi* occur also in the Stony Mountain formation and do not go higher in the section. *Tryplasma gracilis* is a characteristic fossil of the Stonewall formation and a good guide to these beds but is of little value for correlation outside Manitoba. The extension of the range of both *Tryplasma gracilis* and *Calapoecia canadensis* by Savage and Van Tuyl (1919) needs confirmation. Because *Angopora manitobensis* is a new species and the first reported of the genus on this continent, it is of little value for age determination; however, it is a good index fossil to the formation and occurs both at Stonewall and in the northern outcrops. *Beatricia,* a genus characteristic of the Richmond stage, is represented in the type section of the formation by *B. regularis* sp. nov. and in outcrops farther north by *B. undulata.* Of the two species of brachiopods found, one, *Megamyonia nitens,* is restricted to the Upper Ordovician and the other is a new species probably of *Öpikina,* a genus not known to range above this epoch. The species of cephalopods from the upper dolomite are indigenous but the genera *Ephippiorthoceras, Metaspyroceras,* and *Bickmorites* (*Tyrrelloceras*) are all suggesive of a late Ordovician age.

The fauna of the northern outcrops has the following key fossils in common with the type section: *Megamyonia nitens, Tryplasma gracilis, Angopora manitobensis,* and *Beatricia.* New elements that are not present in the south include *Palaeophyllum pasense, Calapoecia canadensis, Monomerella laurentinus, Paleofavosites poulseni,* and *Neozaphrentis hindi.* Species of *Palaeophyllum* with a halysitoid growth pattern like *P. pasense* are common in Richmond rocks in the Arctic faunal province (*P. halysitoides* Troedsson and *P. halysitoides* Radugin) and have not been reported above this stage except in the Urals (Soshkina, 1937). *P. pasense* occurs also in the Stony Mountain formation. Nelson (personal communication) has collected a very similar but not identical *Palaeophyllum* from beds on Churchill River that he believes can be correlated with the Gunton member of the Stony Mountain formation. *Calapoecia canadensis* is characteristic of rocks of Richmond and older age and is not reported from Silurian rocks. *Paleofavosites poulseni* is reported from rocks believed to be Niagaran in age in Greenland and ranges up into the Inwood formation in Manitoba. The range of this species is still inadequately known. *Neozaphrentis hindi* is a new species of coral that occurs as high in the Interlake group as the Inwood formation.

Fauna of the Stonewall Formation

—	1	2	3	4	5	6	7
Beatricia regularis	x					cf.	
B. undulata					x		
Stromatoporella sp.	x						
Paleofavosites capax	x						
P. prolificus	x						
P. poulseni			x	x			
P. okulitchi	x	x	x	x		x	
Angopora manitobensis	x			cf.		x	
Calapoecia canadensis			x				
Halysites sp.				x	x		
Lyellia sp.		x					
Palaeophyllum pasense					x		
P. pasense parvum				x			
Tryplasma gracilis	x	*	x		x		
Neozaphrentis hindi			x	x		cf.	
Streptelasma cf. *integriseptatum*				x			
Megamyonia nitens	x						
Monomerella laurentina	cf.					x	
? Öpikina stonewallensis	x						x
Edmondia (?) vetusta						x	
Palaeopteria parvula	x						
Colpomya sp.	x						x
Liospira sp.	x				x		x
Trochonema sp.	x						x
Hormotoma sp.		x			x		
Lophospira aff. *bicincta*		x					
Ephippiorthoceras minutum	x	x				x	
Bickmorites insignis	x						
Kochoceras cf. *productum*		x					
Antiplectoceras shammattawaense		x					
Metaspyroceras meridionale	x					x	
Oxygonioceras (?) cuneatum	x						
Encrinurus sp.	x						

* Reported by Baillie.

1. Stonewall quarries, upper dolomite beds (unit J).
2. Northwest Stonewall quarry, test pit, lower dolomite beds (unit G).
3. Mile 26·7, Flin Flon highway.
4. Mile 19, Flin Flon railway.
5. At Mile 24·5, ¼ mile west of Flin Flon highway.
6. North tip of Seven Mile Point, Lake Atikameg.
7. Escarpment between railway and highway, 4·2 miles north of Fisher Branch turnoff.

To summarize, of the twenty-eight fossils identified from the Stonewall formation, fourteen are species that occur also in Richmond age formations, seven are indigenous species of typically Richmond age genera, and two are indigenous species of little value for correlation. Of the remaining fossils identified specifically two are found in younger rocks. The last three fossils were identified only generically: one (*Encrinurus*) is of no significance, one (*Stromatoporella*) is normally a Silurian genus, and one (*Colpomya*) is normally an Ordovician genus.

The Stonewall fauna indicates that the formation is of latest Ordovician age but correlation with other sequences must at best be vague due to the great number of new species in the formation and the absence of many stratigraphically limited species. In the Hudson Bay area the Stonewall formation is probably correlative of the upper part of the Shammattawa limestone. On Churchill River Nelson reports (personal communication) that a few feet of unfossiliferous dolomite overlies beds correlative of the Gunton member, and these may well be Stonewall equivalents. It has been suggested that the Stonewall formation is of Ellis Bay age but similarities in fauna are not sufficient to exclude either the Ellis Bay or the Vaureal from consideration as the correlative of the Stonewall. Twenhofel (1928) has correlated all of the Vaureal except the uppermost zone with the Stony Mountain formation. It is possible that the Stonewall formation is either the time equivalent of that zone or of the Ellis Bay.

Interlake Group

Fisher Branch Dolomite

The name Fisher Branch dolomite is proposed for the medium-grained, thick-bedded dolomite that overlies the Stonewall formation and underlies the dolomitic limestones of the Inwood formation. The Fisher Branch dolomite comprises the zone of *Virgiana decussata* and these strata have formerly been referred to the *Virgiana* zone of Kindle (1914) or to unit B of the members distinguished by Baillie (1951). Because the dolomite is resistant to weathering, normally of greyish yellow colour and medium grain size in contrast with the finer texture of the enclosing formations, it may be recognized on a lithological as well as a palæontological basis.

Distribution. The Fisher Branch dolomite has been identified from five areas that define a belt of outcrop about a mile wide. In the Interlake area most of the outcrops occur north of the town of Fisher Branch but the formation may be identified as far south as Narcisse and as far north as Lake St. Martin. In the north the belt is defined by outcrops at Grand Rapids, Moose Lake, and Lake Atikameg, but has not been found farther west even though *V. decussata* has been reported from Cumberland House, Saskatchewan.

The thickness of this formation at Grand Rapids is at least 14 feet and may be a few feet more because the base is not exposed. The thickest section in the Interlake area is 13 feet thick.

Lithology. North of Fisher Branch the rocks of this formation outcrop in several small escarpments not exceeding 10 feet in height. One of these exposures, on a hill behind a farmer's yard on the SE. corner, sec. 3, tp. 25, rge. 2, W. Prin. mer., has been chosen as the type section. A greyish yellow, fine- to medium-grained dolomite comes to the surface in a series of small step-like cliffs aggregating about 12 feet in height. Brachiopods and corals are present in abundance throughout the section and *Virgiana decussata* is especially abundant in the upper beds. At the base of the escarpment, thin-bedded, fine-grained dolomite of the Stonewall formation is exposed.

The location of other outcrops of the Fisher Branch dolomite in this area are listed below:

l.s. 1, sec. 8, tp. 25, rge. 2, W. Prin. mer.
NE. corner, sec. 27, tp. 26, rge. 3, W. Prin. mer. (8 feet exposed)
l.s. 15, sec. 8, tp. 25, rge. 2, W. Prin. mer. (almost 13 feet exposed)
Sec. 23, tp. 26, rge. 3, W. Prin. mer. (about 3 feet exposed)
l.s. 6, sec. 10, tp. 25, rge. 2, W. Prin. mer. (6½ feet exposed)
l.s. 5, sec. 3, tp. 25, rge. 2, W. Prin. mer. (5 feet exposed)

The most southerly outcrops of the formation, 4 miles south of Narcisse, are unusual both in geographic position and palæontology. Their position within the belt of outcrops of the Inwood formation suggests that lower beds are brought to the surface here by a gentle anticline. The rock is a pale yellowish orange, medium-grained dolomite in beds about 2 inches thick, which contains locally an abundance of poorly preserved *Virgiana decussata.* Although these outcrops contain such common Fisher Branch fossils as *Lyellia affinis, Clathrodictyon striatellum,* and *Paleofavosites kirki,* they also contain fossils such as *Favosites* cf. *niagarensis* and *Neozaphrentis manitobensis* that otherwise occur only higher in the Interlake group.

On the south shore of the east extension of Lake St. Martin, the Fisher Branch dolomite forms flat outcrops containing rather poorly preserved fossils.

The thickest and most fossiliferous section of the Fisher Branch dolomite is exposed on the south bank of Saskatchewan River at Grand Rapids. The following beds are exposed:

Inwood formation

D. 3·5 feet—Dolomite: almost white, slightly mottled grey, argillaceous, fine grained, fossiliferous; in beds 1 inch to 3 inches thick. *Neozaphrentis tyrrelli, Asthenophyllum occidentale, Paleofavosites transiens, Dalmanella* (?) sp., *Brachyprion* sp., *Camarotoechia* sp., *Hormotoma* sp.

Fisher Branch dolomite

C. 4·0 feet—Dolomite: greyish yellow, medium grained, thick bedded, containing salt moulds, fossiliferous.

B. 7·0 feet—Dolomite: very light grey to greyish yellow, fine grained to aphanitic, with a fossiliferous zone 2 feet from the top.

A. 3·0 feet—Dolomite: yellowish grey, fine grained, medium bedded, crystalline, unfossiliferous.

Beds B and C of this section contain an extensive fauna that is tabulated on page 20.

On the north extension of Moose Lake at longitude 101° 12′, an outcrop was discovered containing *Virgiana decussata.* Beds of similar lithology but containing a poorly preserved fauna outcrop overlying the Stonewall formation at several places along the south shore of the lake. Westward from Moose Lake the Fisher Branch dolomite can be identified along the Churchill branch of the Canadian National railway and along the shore of Seven Mile Point on Lake Atikameg. The richly fossiliferous phase is found on the southwest corner of the point, but northward up the coast only the lithology of the uppermost beds of the sections indicates that they belong in the Fisher Branch formation. These Lake Atikameg outcrops are the farthest west that the formation has been traced. Kupsch (1953) in his investigation of the Silurian geology of the Cumberland House area failed to find *Virgiana*-bearing bedrock.

Contacts. The lower contact of the Fisher Branch dolomite is generally distinct, lithologically and faunally, and is a disconformity of great time value. In several outcrops of the northern area medium-grained dolomite sharply overlies the conglomeratic Stonewall formation. At the Grand Rapids section Baillie has suggested that the lower beds, composed of 3 feet of fine-grained, yellowish grey dolomite, belong to the Stonewall formation but as these beds are not similar to the Stonewall outcrops farther north and grade up into more typical Fisher Branch rocks, they are considered here a part of the Fisher Branch dolomite. On the south shore of Moose Lake, at sec. 21, tp. 60, rge. 20, W. Prin. mer., a seam of red arenaceous shale a few inches thick marks what is believed to be the lower contact of the formation. The upper contact of the Fisher Branch dolomite is exposed only at Grand Rapids and is quite sharp, with no sign of disconformity.

Correlation and Age. The correlation of the *Virgiana*-bearing beds of North America is an interesting problem upon which some light is thrown by the present study. Tyrrell (1892) considered that all the Interlake beds and the Stonewall formation were of Niagaran age, but at that time the distinctive nature of the brachiopod *Virgiana decussata* was not known. Savage (1918) correlated the beds of the Fisher Branch dolomite with the Port Nelson formation of the Hudson Bay Lowland and considered that both were of Early Silurian age. Baillie (1951) follows the correlation of Savage and places the *Virgiana* zone (B) with the Stonewall formation in the Alexandrian series. Stearn (1953) in his discussion of the Stonewall fauna noted that there was considerable evidence for the Middle Silurian age of the *Virgiana* zone but space did not permit the inclusion of this evidence. The evidence, as enumerated below, indicates that the Fisher Branch formation is of early Clinton age.

Three species of *Virgiana* from North America have been described; *V. barrandei* (Billings), *V. mayvillensis* Savage, and *V. decussata* (Whiteaves), from the Gun River and Becsie formations of Anticosti, the Mayville limestone of Michigan, and the Fisher Branch formation of Manitoba, respectively. It is pointed out in another section of this report that there is probably not enough difference between *V. mayvillensis* and

V. decussata to justify their separation on the specific level. *V. barrandei* occurs in the Lower Silurian rocks of Anticosti but Twenhofel (1928) believes that the penetration of the genus to the interior of the continent did not begin until early Clinton time. The correlation of the formations bearing *Virgiana decussata* with each other has been documented by Savage (1918) and seems to be established; the age of these formations in relation to the standard section remains to be determined. Unfortunately, the fossil does not occur in either the type Medinan or the type Clinton. Its nearest occurrence to the New York succession is in the Dyer Bay dolomite, an eastward equivalent of the upper Mayville limestone.

Williams (1919) in his report on the geology of the Ontario peninsula follows Savage in referring the Dyer Bay dolomite to an Early Silurian age. Ehlers (1921), and Ulrich and Bassler (1923), in analysing the fauna of the dolomite come to the conclusion that it is of Clinton aspect and correlate it with an earliest Clinton age. Bolton (1953) bases his arguments on lithologic correlation but comes to the same conclusion. These opinions on the age of the Dyer Bay dolomite may also be applied to the Fisher Branch dolomite.

Although many species of the fossils from the Fisher Branch dolomite are new, those that have been described from other formations are from beds of Clinton age or younger. The following is a list of these species with the stratigraphic information they give:

Paleofavosites groenlandicus—Offley I. formation (Clinton)
Lyellia affinis—Late Ordovician to Middle Silurian
Halysites compactus—Middle Silurian of the Great Lakes
Brachyprion philomena—upper Gun River formation (Clinton)
Camarotoechia indianensis—Guelph, Lockport
Monomerella laurentina—usually Late Ordovician but has an extended range in the Interlake group
Leperditia hisingeri—Early and Middle Silurian

The fauna of the Fisher Branch dolomite is more like that of the succeeding formations of the Interlake group than that of the Stonewall formation. Only one species, *Monomerella laurentina,* is common to the Fisher Branch and Stonewall formations. This brachiopod is also found in the overlying Inwood formation and appears to have a much greater range in Manitoba than at Anticosti. The great faunal gap below the Fisher Branch dolomite would not be expected if the formation were of Early Silurian age. The Fisher Branch fauna has fifteen species in common with the succeeding Inwood formation, which contains such characteristic Clinton forms as *Hyattidina junea.* Higher formations of the Interlake group, which are also of Clinton age, share this faunal unity with the Fisher Branch dolomite.

In conclusion, the facts supporting the Clinton age of the Fisher Branch dolomite are: (1) the age of the Dyer Bay dolomite; (2) the members of the fauna recorded from other Clinton formations; (3) the faunal gap below the formation; (4) the faunal similarity to younger formations of the Interlake group also of Clinton age.

Fauna of the Fisher Branch Dolomite

——	1	2	3	4	5	6	7	8	9
Clathrodictyon cf. *striatellum*		x	x		x				
Neozaphrentis tyrrelli	x			x		x		cf.	
N. manitobensis		x			cf.				
Asthenophyllum inwoodense							x		
Favosites cf. *niagarensis*		x							
F. gothlandicus	x		x	x					
F. gothlandicus magnus				x					
Paleofavosites kirki		x				x			
P. groenlandicus	x				x				
P. poulseni				cf.		x			
P. poulseni minor					x				
P. transiens						x			
Multisolenia confluens	x		x		x	x			
Lyellia affinis		x	x	x	x				
Halysites compactus					x				
Virgiana decussata	x	x	x	x	x	x	x	x	
Brachyprion paskoiacensis	x				x	cf.			
B. paskoiacensis geniculata	x								
B. philomena					aff.				
Dalmanella (?) sp.	x			x	x				
Camarotoechia indianensis	x			cf.					
Fardenia transversalis					x			x	
Monomerella laurentina					x			x	
Hindella prinstana									x
Conchidium (?) sp.		x							
Modiolopsis sp.					x				
Nuculoidea sp.					x				
Raphistomina cf. *affinis*					x				
Leperditia hisingeria cf. *fabulina*					x				

1. NE. corner, l.s. 1, sec. 8, tp. 25, rge. 2, W. Prin. mer.
2. 4 miles south of Narcisse.
3. Lake St. Martin; SE. ¼ sec. 8, tp. 32, rge. 6, W. Prin. mer.
4. SE. corner sec. 3, tp. 25, rge. 2, W. Prin. mer.
5. S. bank Saskatchewan River, foot of Grand Rapids.
6. SW. corner, Seven Mile Point, Lake Atikameg.
7. Sec. 23, tp. 26, rge. 3, W. Prin. mer.
8. S. shore, northern Moose Lake, long. 101° 12′.
9. Southeast shore, northern Moose Lake, lat. 100° 10′ W.

Inwood Formation

The term Inwood formation is here proposed for the stromatolitic, fragmental, and argillaceous dolomites that overlie the Fisher Branch formation and underlie the aphanitic and stromatolitic Moose Lake dolomite. In the southern area of outcrops the formation consists of a fragmental dolomite member underlain by a member of stromatolitic and reefy dolomite interbedded with fine-grained dolomite. These two members are believed to be the correlatives of the argillaceous, magnesian limestone and overlying massive, fragmental dolomite that succeed the Fisher Branch dolomite at Grand Rapids. The new unit includes the lower part of Baillie's zone D and the whole of his zone C.

Baillie failed to recognize any equivalents of these Grand Rapids beds in the southern area but included the outcrops here assigned to the Inwood formation in unit D.

Distribution. The Inwood formation outcrops in a belt trending northward from the Inwood quarry to Sandridge and around the outcrops of the Fisher Branch dolomite south of Narcisse. The formation may be identified in sink-holes near Chatfield, in quarries at Poplarfield and Broad Valley, west of Fisher Branch, and at the Elk Slide. The northernmost outcrop in the Interlake area is about 1 mile inland from the south shore of the east extension of Lake St. Martin. In the north the formation has been mapped only in the neighbourhood of Grand Rapids.

At Grand Rapids the beds assigned to the Inwood formation are 42 feet thick. In the Interlake area the thickest section, of about 25 feet, is exposed in the Inwood quarry. Because this figure represents only the lower member, to it must be added nearly 10 feet for the overlying fragmental member to make a total thickness of about 35 feet. The equivalent rocks in the Interlake area may be as thick as those at Grand Rapids, for this figure is a minimum estimate only.

Lithology. The lower unit of the Inwood formation in the Interlake area consists of stromatolitic rocks and associated interformational breccias and very fine-grained interbeds. In some outcrops the organic nature of the dolomite is expressed in domes several feet across that are probably of algal origin but show no structure other than a vague lamination. Such domes are commonly flanked by fragmental, fossiliferous dolomites. Other outcrops are composed of beds of continuous laminæ bent regularly upward into domes a few inches across and interbeds of edgewise breccia. At one locality the reefy nature of the lower member is expressed in a coral bioherm that truncates the surrounding strata and has a marginal facies of fragmental dolomite. The upper member is a yellowish grey dolomite composed of bioclastic debris. Much of this is crinoid columnals, much is broken brachiopod shells and small corals such as *Asthenophyllum*, most is comminuted and unidentifiable organic material. The bedding in this dolomite is massive to thick. It is very resistant to weathering.

The Interlake Area. At the type section, the quarry of Building Products and Lime Company 1 mile north of Inwood, only the lower member of the formation is exposed. The Inwood quarry section illustrates the lateral and vertical variation in types of dolomite that can be expected in this member and its dominantly stromatolitic structure.

Inwood formation, lower member

C. up to 10 feet —Dolomite: yellowish grey, very fine grained to aphanitic; unevenly and thinly bedded, breaking up into rubble on weathering, fracturing conchoidally with a porcellanous surface, varying in thickness, and replaced laterally by bioherms of unit B. At the top a bed contains small spheres 2 mm. in diameter of coarse-grained dolomite.

B. 12 feet approx..—Dolomite: a complex of stromatolites and interbioherm deposits. The bioherm cores, believed to be algal in origin, consist of coarsely laminated grey and white, fine-grained dolomite. The strata are arched over these cores and on their flanks the dolomite is an edgewise breccia. The dolomite between the cores is very fine grained. Some of the cores are surrounded by a thin layer of maroon and green shale that contains locally an abundance of *Asthenophyllum inwoodense*. The cores contain *Fardenia ellipsoides*, *A. inwoodense* and cubic salt crystal moulds. Other fossils collected from this unit are: *Neozaphrentis* sp., *Oocerina canadensis*, *Leperditia phaseolus*, *L.* cf. *hisingeri egena*.

A. 5 feet approx. —Dolomite: fine grained, fragmental; in massive beds, containing scattered pebbles and a small indeterminate brachiopod. (The base of the quarry was full of water when visited by the writer but other authors have recorded a few feet more of rock similar to unit A)

It is difficult to assign thicknesses to the units, for the bioherms of unit B may encroach on unit C and almost displace it. The position of the lower contact of the Inwood formation cannot be far below the floor of the quarry.

The coarsely fragmental member that overlies the stromatolitic member may be seen in exposures to the east and west of the village of Sandridge where it forms surface flats. The thickest section of this member was measured at the top of a sink-hole, 1·7 miles west of the village, as follows:

Inwood formation, upper member

D. 1·6 feet—Dolomite: pale yellowish orange, fine grained, saccharoidal; in beds 2 to 3 inches thick.

C. 6·0 feet—Dolomite: pale yellowish orange, fine grained, tough; in beds up to 1 foot thick, interbedded with medium-grained fragmental dolomite. *Fardenia ellipsoides.*

B. 2·2 feet—Dolomite: very similar to above fragmental, slightly laminated, with profusion of *Fardenia ellipsoides.*

Inwood formation, lower member

A. 7·9 feet—Bioherm and flank deposits: on one side of the sink is a mass of porous, structureless, fine-grained, pale yellowish orange dolomite containing patches of clay and many corals. *Paleofavosites transiens*, *P. poulseni*, *Favosites niagarensis*, *Lyellia affinis*, *Asthenophyllum inwoodense*, *Amplexoides severnensis*. Flanking the bioherm and truncated by it are coarsely detrital, thin-bedded dolomites containing *Fardenia ellipsoides* and *Hyattidina junea.*

The stromatolitic zone outcrops in several small sink-holes to the east and south of Chatfield and is here represented by a densely stromatolitic dolomite consisting of continuous laminæ deflected into small domes. Between beds of stromatolites are beds of edgewise breccia formed by the breaking of the algal structures by the waves. Structures reminiscent of those of the Inwood quarry are exposed at an abandoned quarry at Poplarfield. The 5 feet of the Inwood formation in the quarry is composed of interbedded stromatolitic dolomite, brecciated stromatolitic layers, and oolitic dolomite. In the quarry floor a dome 15 feet across is made of laminated dolomite. The dolomites exposed in the quarry just north of Broad Valley are stromatolitic only in the upper few feet but show other similarities to the Inwood section. In a test pit on the property, dolomite with earthy spheres that are similar to the spheres in unit C at Inwood occurs in several beds. At the base of the pit a small lens of maroon shale, like that at Inwood, was found. The details of this section may be found in Baillie (1951). The overlying fragmental dolomite outcrops in a low dome on l.s. 12, sec. 27, tp. 23, rge. 2, W. Prin. mer., north-northwest of the quarry. Along the south boundary of l.s. 1 and 2, sec. 8, tp. 25, rge. 2, W. Prin. mer., a series of domes containing vague laminations come to the surface. The proximity of this outcrop to those of the Fisher Branch dolomite shows that the stromatolitic dolomite directly follows the underlying formation.

A good exposure of the fragmental member may be seen on the southeast half of sec. 18, tp. 26, rge. 3, W. Prin. mer., at a cliff locally known as the Elk Slide. The upper 8·1 feet of the dolomite is coarse grained, massively bedded, and weathers to a very porous surface. Among the fossils found in a rather comminuted condition are *Hyattidina junea, Fardenia* sp., and *Amphicyrtoceras* cf. *reedsi.* The lower 3 feet of the cliff is composed of fine-grained, moderate yellowish brown dolomite, which may be part of the lower member of the Inwood formation or only an interbed in the dominantly fragmental upper member. The fragmental member crops out overlain by the Moose Lake formation near the south shore of Lake St. Martin, on sec. 33, tp. 31, rge. 6, W. Prin. mer., and there is full of *Asthenophyllum inwoodense.* This section could be visited only briefly by the writer but is more fully described by Baillie (1951) as section 33.

Section at Grand Rapids. The only rocks north of Lake St. Martin that can be assigned to the Inwood formation are at Grand Rapids. The beds underlying the fragmental member there are argillaceous dolomites and dolomitic limestones and are not resistant to weathering. The stratigraphic section must be built up from vertically restricted exposures along the river bank, for the argillaceous beds are locally completely covered with talus. The lower unit consists of about 30 feet of calcitic dolomite of greyish yellow colour and high argillaceous content that weathers to an earthy surface soft under the hammer. This unit contains a large and well-preserved fauna. Overlying this argillaceous zone is about 12 feet of fragmental dolomite that stands out as a prominent cliff in the gorge. At l.s. 8, sec. 17, tp. 48, rge. 13, W. Prin. mer., where the section below was measured, two small dome-like bioherms are present at the contact of the two members.

Moose Lake dolomite

C. 7·7 feet—Dolomite: medium brown, aphanitic, thick bedded.

Inwood formation

B. 11·5 feet—Dolomite: greyish yellow, medium grained, granular and fragmental; in beds up to 1½ feet thick with salt crystal moulds; bluish silty layer near top of unit. At the base are two small bioherms with many fossils; *Paleofavosites kirki, Neozaphrentis* sp., *Hyattidina junea, Camarotoechia indianensis, Leiopteria* sp., *Sinutropis* sp., *Coelocaulus* sp., *Mandaloceras parvulum, Blakeoceras robustum, Phragmoceras nelsoni.*

A. 1·0 foot—Dolomite: yellowish grey, fine grained, thick bedded.

An exposure of the fossiliferous argillaceous member was found in a series of abandoned beaches west of Lake Winnipeg at Eating Point. This is the farthest north that the unit was traced.

Contacts. The lower contact of the formation is not exposed in the area where the formation is defined but can be seen at Grand Rapids. The section has been recorded in the description of the Fisher Branch dolomite. The fine-grained, almost white, argillaceous dolomite of the Inwood formation overlies the medium-grained, yellowish grey dolomite of the Fisher Branch formation with sharp contact but no sign of disconformity. The upper contact of the Inwood formation is also exposed at the Grand Rapids section but is gradational, for at the top of the formation interbeds of very fine-grained dolomite appear, replacing the fragmental dolomite of the upper member. The contact is arbitrarily drawn at the highest bed of fragmental dolomite. In the Interlake area fine-grained, stromatolitic dolomite is found overlying fragmental dolomite at two localities. At the Elk Slide section (described above) Kirk (unpublished notes) records stromatolitic dolomite overlying the coarsely fragmental dolomite but this was not seen by the writer and may have occurred some distance behind the crest of the cliff. Near the south shore of Lake St. Martin, at sec. 33, tp. 31, rge. 6, W. Prin. mer., the upper part of the fragmental zone is stromatolitic and is probably gradational into the Moose Lake dolomite.

Correlation. The Inwood formation is the only one in the Interlake group that shows considerable facies change from southern to northern outcrops. There is great similarity both in lithology and thickness between the upper members in both areas but the lower members are somewhat dissimilar. Because the lower member in the southern area shows rapid facies changes from breccias, to reefs, to stromatolites, it is not surprising that it appears in a different facies 100 miles to the north.

The correlation of the formation in these two areas is based on lithologic and palæontologic evidence, which may be summarized as follows:

(1) The fragmental dolomite members are similar in lithology and thickness.
(2) The formation in both areas is underlain by the Fisher Branch dolomite and overlain by stromatolitic and fine-grained dolomites of the Moose Lake dolomite.
(3) *Hyattidina junea* occurs only in this stratigraphic zone in both southern and northern outcrops.
(4) *Amplexoides severnensis* makes its first appearance in both areas at this zone.
(5) *Asthenophyllum inwoodense,* although found at one locality in the Fisher Branch dolomite, reaches abundance in the Inwood beds of both areas.
(6) Cephalopods make their first appearance in the Interlake group in both north and south areas in these beds.

The striking differences between the faunas of the two areas may be summarized as follows:

(1) *Fardenia ellipsoides,* although abundant in the Inwood formation of the Interlake region, is not present in the Grand Rapids section in rocks older than the Atikameg dolomite.
(2) Such species as *Paleofavosites kirki, Fardenia transversalis, Brachyprion paskoiacensis,* and *Pterinea occidentalis* are not found in the Interlake area although they are common at Grand Rapids.

If emphasis is placed on the first appearance of new species rather than the persistence of old forms, the correlation proposed in this report is supported, for all the species mentioned under "2" above, except *Pterinea* *occidentalis*, occur also in the Fisher Branch dolomite. *Fardenia transversalis* and *Brachyprion paskoiacensis* are species that become extinct in this formation and their extinction may have been hastened in the Interlake area. *Paleofavosites kirki* and *Pterinea occidentalis* might be classified as long ranging species.

Why *Fardenia ellipsoides* did not penetrate the northern area until so much later is a mystery perhaps to be accounted for by an unfavourable facies in that direction. That the Atikameg dolomite is not to be correlated with the fragmental zone of the Interlake area is proved by the absence in this area of *Homeospira lowi*, a universal index to the Atikameg.

The Inwood fauna, as a whole, is similar to that of the underlying Fisher Branch dolomite but contains some new brachiopods. Perhaps the most distinctive of these is *Hyattidina junea*, which occurs in great abundance within this formation but in no other formation of the group. It is most characteristic of the upper fragmental member. *H. junea* is found in the lower and middle Clinton beds of Anticosti and its close relative, *H. congesta*, is found in the lower Clinton of New York state. *Brachyprion philomena* is of little stratigraphic use other than to confirm that the beds are of Clinton or younger age. *Amplexoides severnensis* makes its first appearance in the Interlake group in the Inwood formation. In the Hudson Bay lowland, this species appears to be restricted to the Ekwan River limestone but probably has an extended range in southern Manitoba, for the rest of the Inwood fauna does not indicate a horizon as high as the Ekwan River limestone. *Pterinea occidentalis* is a pelecypod of wide geographic range in the Middle Silurian of Canada but unfortunately its stratigraphic range is great also, for it is found in rocks as young as the Guelph dolomite. The presence of *Pycnactis*, a genus found also in the Wenlock limestone, suggests that a migration route from Britain was open at this time and along it came such corals as well as the northern European ostracods. *Leperditia hisingeri* and its varieties has a wide geographic range in northern Europe and America. In Europe the species is found in Lower Silurian rocks but in America it is associated with Middle Silurian species. In the Hudson Bay lowland it occurs in formations as young as the Attawapiskat, and, in southern Manitoba, as young as the Cedar Lake. It is known also from the Fiborn dolomite of Michigan and the upper Wabi formation of Lake Timiskaming, but neither of these occurrences seems to throw much light on the correlation of the Interlake group as the species is too long lived.

The above data do not establish an exact age for the Inwood formation but suggest that it is best considered of early Clinton age.

Moose Lake Dolomite

The term Moose Lake dolomite is here proposed for the very fine-grained and dominantly stromatolitic beds that overlie the fragmental dolomite of the Inwood formation and underlie the massively bedded porous rocks of the Atikameg dolomite. These dolomites form a unit that can easily be recognized in the northern area from Grand Rapids to

Fauna of the Inwood Formation

—	1	2	3	4	5	6	7	8	9	10	11	12	13
Clathrodictyon drummondense	x	x											
C. cf. *striatellum*								x					
Paleofavosites transiens	x	x	x									x	
P. cf. *prolificus*					x								
P. poulseni												x	
P. kirki		x		x			x						
Favosites cf. *niagarensis*												x	
Halysites catenularia								x					
Neozaphrentis tyrrelli	x		x	x									
N. hindi		x		cf.	x								
Asthenophyllum inwoodense		x						x				x	x
A. occidentale			x										
Amplexoides severnensis	x											x	
Pycnactis canadensis		x											
Fardenia ellipsoides								x				x	x
F. transversalis	x						x						
F. cf. *elegans*										x			
Brachyprion paskoiacensis		cf.				x							
B. philomena				x		cf.							
B. cf. *inflata*	x												
Camarotoechia indianensis				x			x				x		
Hyattidina junea		cf.					x		x			x	
(?) *Dalmanella* sp.			x										
Monomerella laurentina				x									
Trimerellid							x						
Pterinea occidentalis		x				x							
Coelocaulus sp.		x					x						
Sinutropis sp.							x		x				
Holopea sp.	x												
Blakeoceras robustum							x						
Phragmoceras nelsoni							x						
Mandaloceras parvulum	x	x		x		x	x						
Lowoceras imbricatum	x												
Oocerina canadense													x
Amphicyrtoceras cf. *reedsi*									x				
(?) *Encrinurus tuberculifrons*											x		
Leperditia hisingeri fabulina	x					x							
L. hisingeri egena		x											cf.
L. caeca							x						
L. phaseola													x

1. North bank, Grand Rapids, l.s. 10, sec. 16, tp. 48, rge 13, W. Prin. mer.
2. North bank, Grand Rapids, ½ mile east of Old Portage.
3. South bank, Grand Rapids, foot of rapids, just above Fisher Branch dolomite.
4. South bank, Grand Rapids, centre sec. 16, tp. 48, rge. 13, W. Prin. mer.
5. North bank, Grand Rapids, l.s. 9, sec. 16, tp. 48, rge. 13, W. Prin. mer.
6. South bank, Grand Rapids, l.s. 5, sec. 16, tp. 48, rge. 13, W. Prin. mer.
7. South bank, Grand Rapids, l.s. 8, sec. 17, tp. 48, rge. 13, W. Prin. mer.
8. North of Broad Valley, l.s. 9, sec. 28, tp. 23, rge. 2, W. Prin. mer.
9. Elk Slide, SE. ¼, sec. 18, tp. 26, rge. 3, W. Prin. mer.
10. 5 miles west of Fisher Branch.
11. Quarry 1 mile north of Broad Valley.
12. Sink-hole, 1·7 miles west of Sandridge.
13. Quarry 1 mile north of Inwood.

Lake Atikameg and probably are present in the northern part of the Interlake area. The Moose Lake dolomite is a non-resistant formation and is found in lake cliffs only where protected by the Atikameg dolomite.

Distribution. The Moose Lake formation occupies a belt of outcrop that is defined by exposures in the main gorge of Grand Rapids, along the east and northwest shores of the East Arm of Moose Lake, in the vicinity of the Northern Narrows of Moose Lake, on the Churchill branch of the Canadian National railway, and on the south shore of Lake Atikameg. It characteristically forms the lowlands near the lake and is exposed only in the base of cliffs. In the Interlake area beds assigned to this formation outcrop west of Fisher Branch and near the south shore of Lake St. Martin.

Only in the northern area can the thickness of the formation, about 28 feet, be measured. Where two members can be distinguished the lower is about 15 feet thick and the upper about 13 feet.

Lithology. The type section is a cliff ½ mile west of the marshy shore of Moose Lake at latitude 54° 3′.

Section at Moose Lake

Atikameg dolomite

C. 2.0 feet—Dolomite: greyish yellow, weathering pale yellowish orange, fine grained, porous, soft on weathered surface.

Moose Lake dolomite, upper member

B. 13.0 feet—Dolomite: yellowish orange to pale brown, very fine grained to aphanitic, medium bedded, stromatolitic, bedding planes rising into small domes, beds of dolomite breccia of thin slabs common throughout, upper foot almost completely brecciated.

Moose Lake dolomite, lower member

A. 7.0 feet—Dolomite: greyish yellow, very fine grained to aphanitic, thin bedded; 3 feet from the base a bed is crowded with *Fardenia elegans* and *Leperditia* cf. *hisingeri*, 4 feet from the base a coarse-grained bed contains *Asthenophyllum inwoodense, Paleofavosites transiens, Brachyprion* cf. *paskoiacensis, Pterinea occidentalis, Sinutropis* sp., *Hormotoma* sp., and *Leperditia* cf. *hisingeri.*

The lithology illustrated by this section is typical of the formation. The most striking feature is the stromatolitic texture of the upper beds, which suggests that they were deposited by sediment-trapping algae such as Black (1933) has described from Andros Island. The type of bedding common in the Moose Lake dolomite corresponds to Black's type C; laminæ are continuous from one dome to the next. Deposition of such algal sediments takes place today in very shallow water agitated by storms. The result of such agitation in Silurian time was to break up the delicate laminæ and form beds of intraformational breccia. Throughout the northern area, as at the type section, two members can be distinguished in this formation; an upper, largely stromatolitic dolomite, and a lower, thin-bedded, aphanitic dolomite showing only rare evidence of an algal origin.

Sections similar to the type, capped by the Atikameg dolomite, are exposed on Moose Lake in many cliffs on the East Arm and at the Northern Narrows. A tabular summary of the thickness of the formation at these cliffs is given on page 30.

The upper contact of the formation is exposed in a quarry at Mile 18.6 of the Churchill branch of the Canadian National railway. The base of the quarry and the lower 2.6 feet of the wall are composed of stromatolitic Moose Lake dolomite, which projects in several domes about 2 feet across, a few inches upward into the porous rock of the overlying Atikameg dolomite. At Mile 19.5 cliffs of the Moose Lake dolomite extend for some distance north of the track and exhibit some of the finest stromatolitic bedding seen by the writer.

Saskatchewan River cuts a complete section through the Moose Lake dolomite, which forms the walls of the main gorge at Grand Rapids. In many places the section cannot be studied because the cliffs extend into the swiftly flowing river, but a few yards west of the old portage 23 feet of beds were measured. The stromatolitic nature of the beds is most evident in the upper few feet of the section and in the surface outcrops above the cliffs. A series of thin beds containing *Fardenia elegans* and other fossils occur between 5 and 10 feet from the top. The very fine-grained to aphanitic beds become thicker at the base of the formation and give way to fragmental beds of the Inwood formation in exposures a few hundred feet east of the old portage. A horizon 6 feet above the base of the Moose Lake dolomite carries hopper-shaped salt pseudomorphs 2 to 3 inches square.

Both outcrops of the Moose Lake dolomite in the Interlake area have already been mentioned. At the top of the Elk Slide are stromatolitic beds and such rock underlies the rock flats in this region. Its stratigraphic position would indicate that it belongs in this formation. At the section 1 mile south of the east extension of Lake St. Martin the upper foot of the cliff may be referred to the Moose Lake dolomite.

Contacts. At the lower contact the Moose Lake dolomite appears to be gradational into the Inwood formation both where the lower beds are stromatolitic and where they are fine grained. In the northern area this contact is exposed only at Grand Rapids where aphanitic interbeds in the top of the coarse-grained Inwood formation mark the change in sedimentation. At the exposure near the south shore of Lake St. Martin (*see* page 23) the fragmental dolomite of the Inwood formation grades upward into laminated dolomite in the upper foot of the cliff. The contact of the Moose Lake dolomite with the Atikameg dolomite may be gradational or sharp and evidence is presented under the description of the latter formation to show that it is locally an unconformity.

Correlation. The fauna of the Moose Lake dolomite is a meagre one because animals could not live under conditions requisite for good stromatolite building. Only when the waters deepened and became less clouded with sediment could even an impoverished fauna exist. Nearly every fossil is a holdover from the preceding fauna and only *Fardenia elegans* is confined to the formation. This small brachiopod was found in considerable abundance in two localities. The species was originally described from the Rochester formation of Maryland but has been recorded (Gillette, 1947) from as low as the base of the Upper Clinton in New York. Although there is little palæontological evidence for the age of the Moose Lake formation, its stratigraphic position indicates that it is Lower Clinton in age.

Fauna of the Moose Lake Dolomite

—	1	2	3	4
Paleofavosites transiens	x			
P. kirki			x	
Asthenophyllum inwoodense	x			
Pycnactis canadensis			x	
Fardenia elegans	x	x		
Brachyprion cf. *paskoiacensis*	x			
Camarotoechia indianensis		x		
Meristina sp.		x		
Pterinea occidentalis	x	x		
Sinutropis sp.	x			
Hormatoma sp.	x			x
Leperditia hisingeri	cf.		x	
L. hisingeri fabulina				x

1. West shore of Moose Lake at lat. 54° 3'.
2. North bank, Grand Rapids, a few yards west of the Old Portage.
3. Just north of the Narrows, East Arm, Moose Lake.
4. 1¼ miles south of the Narrows, East Arm, Moose Lake.

Atikameg Dolomite

The name Atikameg dolomite is here proposed for the massively bedded, porous strata that lie between the stromatolitic rocks of the Moose Lake and East Arm dolomite. The unit is included by Baillie within his unit D and was placed by Kindle in the *Leperditia hisingeri* zone.

Distribution. The northern belt of outcrop of the formation begins at Grand Rapids, continues through the upper part of Cross Lake, through the East Arm and northern part of Moose Lake, crosses the Churchill branch of the Canadian National railway between Miles 13 and 19, to the type section on the south shore of Lake Atikameg. In the Interlake area the Atikameg dolomite can be identified only at Dunsekikan Island and its locus of outcrop probably underlies the drift-covered strip in the centre of the area.

The greatest thickness of the Atikameg dolomite measured is 16.5 feet and this is believed to be approximately the true thickness. At the type section the upper contact is covered but even if all this covered interval is assigned to the lower formation a maximum of only 19 feet is obtained for the thickness of the Atikameg dolomite.

Lithology. The lithology characteristic of this formation is illustrated by the type section given below.

Section on the south shore of Lake Atikameg, ½ mile west of Clearwater Bay

East Arm dolomite

E. 6.6 feet—Dolomite: light grey to light brownish grey, very fine grained, thick bedded, stromatolitic; locally porous.

D. 6.0 feet—Covered interval.

Atikameg dolomite

C. 13.0 feet—Dolomite: very pale orange to dark yellowish orange, fine grained, massively bedded, porous, weathers to a soft surface, especially near the top where small caves are present. Some beds are very fine grained, compact, and yellowish grey. *Homeospira lowi.*

Moose Lake dolomite

B. 12.0 feet—Dolomite: yellowish grey, very fine grained, stromatolitic, thick bedded, locally ripple-marked.

A. 9.3 feet—Dolomite: yellowish grey, aphanitic, conchoidally fractured; in beds 2 to 3 inches thick, locally laminated but largely free of algal structures; scattered sand grains at the base.

The porosity and massive structure of the Atikameg dolomite suggest that it is formed by reef building organisms but in many other features the dolomite is not typically biohermal. It is a biostrom rather than a bioherm for it maintains an almost constant thickness throughout its outcrops. It is not associated with off-reef detrital beds, although locally the upper layers may be a coquina. Although fossils are scarce, those that are found most abundantly are brachiopods. Reef builders such as corals and stromatoporoids are rare. However, at Mile 18 of the Churchill branch of the Canadian National railway several small dome-like reefs about 10 feet across are exposed in a 3-foot railway cut. The cores are pale yellowish orange, porous dolomite, which locally contain an abundance of *Cyrtorizoceras* sp. and cf. *Elrodoceras exile.* Fragmental dolomite lies around and arches over the cores. The origin of the porosity in the Atikameg dolomite is problematical but it is possible that it is due to framebuilding and that the structure of the framebuilders has been destroyed by dolomitization.

The occurrence of the Atikameg dolomite in cliffs capping the Moose Lake dolomite on the shores of Moose Lake can best be summarized in a table; the exposures are very similar and do not require description.

Tabular Summary of Sections of Atikameg Dolomite on Moose Lake

(Thickness in feet)

Locality	Atikameg	Moose Lake
West shore, latitude 54° 3′	2	20
West shore, latitude 53° 59′	11	10·5
2 miles WNW. of Northern Narrows	16·5	....
½-mile SW. of Northern Narrows	6	9
¼-mile NE. of East Arm Narrows	8	8
7·7 miles NE. of East Arm Narrows	12	9·4
NE. point of Trout I., East Arm	13·5	2·8

The most fossiliferous rocks of this formation are found at Grand Rapids and on the north shore of the peninsula that divides the north part of Cross Lake. At the latter outcrop the fauna is composed of corals, brachiopods, and ostracods. By far the most conspicuous fossil found throughout this formation is the small, coarsely ribbed brachiopod, *Homeospira lowi.*

Fardenia ellipsoides is associated with it in most outcrops. In the northern area both of these brachiopods are confined to the Atikameg formation, but in the south *F. ellipsoides* is found also in the Inwood formation.

The northern outcrop belt can be traced no farther south than Saskatchewan River where the formation outcrops at the head of Grand Rapids on the southwest bank. The 12 feet of greyish yellow dolomite seen there is cavernous and contains many salt crystal moulds. The cliff is capped by a foot of compact, fine-grained, greyish orange pink dolomite. Although a considerable number of fossils are present, all but the characteristic brachiopods can be identified only generically.

The Atikameg dolomite is identifiable lithologically and faunally at a single locality in the southern area. On Dunsekikan Island in Lake St. Martin up to 9 feet of soft, porous, very pale orange dolomite is found in cliffs on the north and west sides of the island. These beds contain both *Homeospira lowi* and *Fardenia ellipsoides* and are overlain by stromatolitic dolomite that may be assignable to the East Arm formation.

Contacts. The contrast between the massive, porous Atikameg dolomite and the surrounding compact formations makes its contacts conspicuous and easy to locate. The lower contact was studied in numerous cliffs on the East Arm and north part of Moose Lake and is found to vary in its nature. In places the Moose Lake dolomite grades into the Atikameg dolomite through a compact, greyish yellow bed about a foot thick. At other places the contact is sharp but conformable, and in still others it is obviously a surface of erosion. At the type section the porous Atikameg dolomite fills depressions a few inches deep in the underlying formation. At the quarry at Mile 19 of the Churchill branch of the Canadian National railway a stromatolitic dome of the Moose Lake formation projects a few inches into the Atikameg dolomite. Either the irregular surface of deposition was preserved in the rapid change of conditions or the resistant dome was preserved when the surrounding bed was eroded. It is unlikely that the erosion that took place was subaerial and more likely that it was caused by a local increase in current strength accompanying the change in conditions in dolomite deposition. The upper contact is also locally a disconformity and at the north end of Cross Lake (longitude 99° 29′) is marked by 4 inches of shale resting on an erosion surface of the Atikameg dolomite. In most outcrops the upper contact is covered because the lower part of the East Arm dolomite does not resist weathering.

Correlation. The fauna of the Atikameg dolomite differs from that of the preceding formations only in the appearance of *Homeospira lowi* and *Asthenophyllum occidentale.* The latter is of little use for correlation as it was described from this formation and has not been identified elsewhere. The former is of widespread occurrence in the northern Silurian rocks, although in not such a restricted zone as in the Interlake group. *H. lowi* is recorded from both the Severn River and Ekwan River limestones of the Hudson Bay Lowland, and the upper part of the Wabi formation of Lake Timiskaming where it is associated with *Camarotoechia winiskensis*. It is also found in the St. Edmund formation of Manitoulin Island and the Hendricks dolomite of northern Michigan. On this evidence the Atikameg dolomite may be correlated with the St. Edmund and Wabi formations of Lower Clinton age.

Fauna of the Atikameg Dolomite

—	1	2	3	4	5	6	7
Clathrodictyon cf. *drummondense*					x		
Paleofavosites cf. *transiens*	x						
Halysites catenularia			x				
Neozaphrentis cf. *symmetricus*	x						
Neozaphrentis sp	x	x	x	x			
Amplexoides sp			x	x			
Asthenophyllum occidentale		x		x			
A. inwoodense					x		
Asthenophyllum sp	x						
Fardenia ellipsoides	x	cf.	cf.	x	x	x	x
Homeospira lowi	x	x	x	x	x	x	
Modiolopsis sp							x
Coelocaulus sp							x
Hormotoma sp		x				x	
Sinutropis sp						x	
Cyrtorizoceras sp						x	
Amphicyrtoceras cf. *reedsi*		x					
cf. *Elrodoceras exile*						x	
Leperditia hisingeri	cf.						x
L. hisingeri fabulina						x	
L. phaseola			x				

1. 2 miles east of Narrows, Cross Lake.
2. Cliff ¼-mile southwest of Northern Narrows, Moose Lake.
3. Narrows, Cross Lake, east shore.
4. Head of Grand Rapids, south shore.
5. Dunsekikan Island, Lake St. Martin.
6. Mile 18, Churchill branch, Canadian National railway.
7. South shore, Saskatchewan River, opposite head of tramway.

East Arm Dolomite

The strata that lie above the Atikameg dolomite and below the biostromal Cross Lake member of the Cedar Lake formation are here named the East Arm dolomite. The formation is characterized by the abundance of algal structures different from those of the Moose Lake dolomite and also contains a varied sequence of beds, including brecciated, arenaceous, oolitic, and fossiliferous dolomites.

Distribution. The East Arm dolomite occupies a belt of outcrop stretching from Saskatchewan River to the east shore of Reader Lake. It crops out along the Churchill branch of the Canadian National railway in several cuts between Miles 4.8 and 13. In the vicinity of Moose Lake it forms the lower beds at Crossing Bay and the Settlement, and makes lake cliffs on the east part of Big Island and on small islands to the northeast. It forms several cliffs on the west shore of the north part of Cross Lake and outcrops along Saskatchewan River between Redrock Rapids and the head of the tramway. The stromatolitic dolomite exposed in the vicinity of Dunsekikan Island on Lake St. Martin may belong to the East Arm dolomite.

The greatest thickness of the East Arm dolomite measured in one place is at the type section where 42.5 feet are present. From a consideration of the dip of the beds and the extent of outcrops along Saskatchewan River, a total thickness of about 50 feet is estimated for the East Arm dolomite. This indicates that the type section shows practically the whole of the formation.

Lithology. In the Moose Lake dolomite isolated algal masses are uncommon and the loci of most rapid upward growth are so closely packed that the laminæ continue from one to the other. Although algal structures of continuous laminæ are found in the East Arm dolomite, individual bun-shaped "heads" that correspond to Black's (1933) type B are typical. As in the older algal dolomites, a breccia of thin laminæ is commonly interbedded with the stromatolites. The East Arm dolomite is far from being a completely algal formation but includes a variety of dolomite types not found in the Moose Lake formation.

The type section is on the north side of a point in the East Arm of Moose Lake, 6.8 miles south of the Narrows (latitude 53° 48′).

Section on East Arm

East Arm dolomite

C. 37.5 feet—Dolomite: light olive-grey, very fine grained, thick to medium bedded; locally showing concentric banding caused by sediment-trapping algae; salt crystal moulds, fossiliferous at the top. *Asthenophyllum inwoodense, Paleofavosites* cf. *transiens, Corrugopora praecursor, Brachyprion* sp., *Clintonella bailliei, Modiolopsis* sp., *Hormotoma* sp., *Coelocaulus* sp., *Leperditia* sp.

B. 3.0 feet—Dolomite: oolitic, light brown, thin bedded.

A. 2.0 feet—Dolomite: yellowish grey to light olive-grey, very fine grained, stromatolitic; brecciated at top.

Although much of this section cannot be reached in the main part of the sheer cliff, it is accessible in ledges in the bush to the west of the cliff. Oolitic dolomite is not an uncommon rock in the East Arm dolomite but does not appear to be confined to the base of the formation as at the type section for it is also found in two outcrops on a point projecting from the southeast corner of Reader Lake. These outcrops consist of pale yellowish orange to pale yellowish brown, fine-grained dolomite in cliffs 8.4 feet high whose base is formed by a foot of oolite. The presence of *Meristospira dunbari* in these outcrops places them near the top of the East Arm formation. Much more common than oolite are beds of dolomite containing many isolated sand grains, and these appear to be concentrated near the base of the formation. The sand horizon at Trout Island is described in the paragraphs on the contacts of the formation. Other localities where it may be seen are on the south bank of Saskatchewan River 1 mile above the head of the tramway and on the east side of a small island in Moose Lake 6 miles southeast of the East Arm Narrows. The grains are rarely abundant enough to constitute a sandstone and are mostly scattered irregularly along a zone a few inches thick. It is possible that the grains were brought in by a local increase in currents or that they were blown in during a violent storm from some neighbouring land. Only on Trout Island can the stratigraphic position of this sand be determined but it appears probable that the other two outcrops represent the same horizon, about 5 feet above the base of the formation.

Within the belt of outcrop of the East Arm dolomite a unique breccia is found at Shoulderblade Island in Moose Lake. On the north shore, where a 22-foot section was measured, the fragments in the breccia range from 6 feet to $\frac{1}{4}$ inch in diameter and are set in a fine-grained, yellowish grey matrix. Many of the smaller fragments have been derived from stromatolites and some are sandstone. The larger blocks are of thin-bedded dolomite that could not have moved far without being disrupted, yet are truncated against the breccia mass. Baillie suggests that the brecciation is due to collapse into solution cavities and regards the larger blocks as having settled down with little change in attitude. It does not seem probable that collapse would cause such a thorough brecciation of the small phenoclasts and the writer suggests that the breccia is due to wave erosion on a reef mass and slump of sediments from its sides. The hypothetical reef may have occupied the centre of the island because the breccia outcrops on all sides of it, but this area is now covered by a small lake. Further research should solve the problem of the origin of the brecciation.

The top of the formation contains a zone to which *Meristospira dunbari* is confined and in which it is abundant. The outcrop of this zone at Reader Lake has already been mentioned and it may be identified at l.s. 6, sec. 4, tp. 57, rge. 20, W. Prin. mer., and just above Redrock Rapids on Saskatchewan River. A section through this zone is exposed on the west shore of Moose Lake on the southeast corner of sec. 4, tp. 57, rge. 20, W. Prin. mer.

Section on western Moose Lake

Cross Lake member, Cedar Lake formation

B. 8.0 feet—Dolomite: greyish yellow, fine to medium grained, massively bedded, porous, crinoidal, containing articulated columnals; *Amplexoides severnensis*.

East Arm dolomite

A. 16.0 feet—Dolomite: alternation of two phases: (i) yellowish grey, fine to very fine grained, containing algal "heads" up to 2 feet in diameter, which strew the beach; (ii) yellowish grey, fine to medium grained, locally crinoidal. *Clathrodictyon fastigiatum*, *Cystiphyllum* sp., *Paleofavosites* cf. *transiens*, *P. prolificus*, *Favosites* cf. *gothlandicus*, *Halysites catenularia*, *Striatopora robusta*, *Clintonella bailliei*, *Sinutropis* sp., *Coelocaulus* sp.

Although *Meristospira dunbari* was not collected from this outcrop it is found in abundance in beds of the same stratigraphic interval less than a mile to the northwest. *Clintonella bailliei* is another new species of brachiopod that makes its appearance in the East Arm dolomite and becomes so abundant as to be present in nearly every outcrop of the formation. This brachiopod reaches its acme of abundance and preservation at a railway cut at Mile 5.5 of the Churchill branch of the Canadian National railway where it occurs in the lower 3 feet of beds in coquina-like proportions. The upper 3 feet of the cut is made of dominantly stromatolitic dolomite.

Contacts. That the lower contact is locally a disconformity as at the north end of Cross Lake has been explained in a previous section. At other localities, as on the south shore of Trout Island in the East Arm $\frac{1}{2}$ mile from its southern point, there is no sign of erosion along the contact. Some sand grains occur in the lower part of the East Arm dolomite but these are not found at the base of the formation and in the Trout Island exposure lie 5.3 feet above the base. The upper contact is exposed on the southeast corner of sec. 4, tp. 57, rge. 20, W. Prin. mer., and just above Redrock Rapids on Saskatchewan River, and in both outcrops the contact between the stromatolitic and crinoidal dolomites is apparently conformable.

Correlation. The fauna of the East Arm dolomite is varied, abundant, and interesting. It contains several newcomers to the Interlake group and several fossils that make its correlation with other beds possible. Stromatoporoids first become abundant in these beds and the distinctive species *Clathrodictyon fastigiatum* and *Actinodictyon keelei* are common in some outcrops. Both of these fossils are found in beds of Niagaran age in the Arctic regions. The new genus *Corrugopora* makes its appearance in the East Arm dolomite with its two species but is not very common. The most valuable coral for correlation is *Multisolenia tortuosa,* which is present in this formation at one locality but only reaches abundance in the Cross Lake member of the Cedar Lake dolomite. It is known not only from the Thornloe limestone of the Lake Timiskaming area but also from the Silurian of Mongolia and Novaya Zemlya. The appearance of the brachiopod genus *Clintonella* in a new species would tend to substantiate the correlation of these beds with the Clinton group, for this genus, although collected from the drift in New York, is believed to have come from a Clinton horizon. *Camarotoechia winiskensis* is a brachiopod that becomes more abundant in the Cross Lake dolomite but appears in the East Arm formation. In the Hudson Bay region it is found in the Severn River formation and in the Lake Timiskaming area in the Wabi formation. Both of these occurrences seem, on the basis of other evidence, to be at a lower horizon than the Manitoba ones. The presence of *Megadiscosorus remotus* and a *Stokesoceras* similar to *S. romingeri* indicate correlation with the Manistique and Burnt Bluff formations of Michigan respectively. The ostracod *Dihogmochilina latimarginata* first appears in the East Arm dolomite and is present in some abundance. It has been described from the Silurian of Southampton Island and the Severn River limestone.

The evidence points to a lower Clinton age for the East Arm dolomite and correlation of it with the Manistique and Thornloe limestones.

Fauna of the East Arm Dolomite

—	1	2	3	4	5	6	7	8	9	10	11	12	13
Clathrodictyon cystosum			cf.	x						x			
C. fastigiatum				x				x		x			
Actinodictyon keelei						cf.	x						
Actinostroma sp.				x	x								
Favosites gothlandicus			cf.				x	cf.					
F. cf. *favosus*						x							
Paleofavosites transiens	cf.		x					cf.		x			
P. prolificus								x					
Multisolenia tortuosa									x				
Corrugopora praecursor	x				x								
C. rhabdota							x						x
Striatopora robusta								x					
Alveolites cf. *labechei*									x				
Halysites catenularia			x		x	x		x		x			
Lyellia affinis				x									
Neozaphrentis symmetricus							x						
Asthenophyllum occidentale									x				
A. inwoodense	x		x			x			x				
Cystiphyllum sp.								x					
Dolerorthis redrockensis												x	
Brachyprion cf. *robustus*						x							
Camarotoechia winiskensis			x										
Clintonella bailliei	x	x	x			x	x	x	x	x			
Meristospira dunbari				x	x							x	
Modiolopsis sp.	x												
Coelocaulus sp.	x	x				x		x					
Hormotoma sp.	x												
Sinutropis sp.		x						x					
Elrodoceras exile											x		
Sactoceras marginale		cf.	x										
Stokesoceras cf. *romingeri*										x			
Megadiscosorus remotus							x						
Leperditia phaseola		x		cf.	cf.	x			cf.				
Dihogmochilina latimarginata					x	x	x					x	

1. 5·1 miles southeast of Narrows, west shore, East Arm, Moose Lake.
2. Redrock Rapids, lower Saskatchewan River, south shore.
3. Northeast Bay of Big Island, Moose Lake.
4. l.s. 6, sec. 4, tp. 57, rge. 20, W. Prin. mer., Moose Lake.
5. North side of point from southeast corner of Reader Lake.
6. East end of Big Island, Moose Lake.
7. Mile 5·5, Churchill branch, Canadian National railway.
8. Southeast corner sec. 4, tp. 57, rge. 20, W. Prin. mer.
9. Centre sec. 33, tp. 5, tp. 56, rge. 20, W. Prin. mer., Moose Lake.
10. Middle Bay, northwest side of Big Island, Moose Lake.
11. Centre sec. 9, tp. 57, rge. 20, W. Prin. mer., Moose Lake.
12. Redrock Rapids, lower Saskatchewan River, north shore.
13. $2\frac{3}{4}$ miles upstream from head of tramway, Saskatchewan River, south shore.

Cedar Lake Dolomite

At the top of the Interlake group are a series of fine-grained, thin-bedded, greyish yellow dolomites that are here named the Cedar Lake dolomite. The new formation includes a variety of dolomites; some stromatolitic, some biohermal, and some biostromal. In recognition of this variety it is convenient to divide the formation into members, each representing a local development of a particular type of dolomite within the Cedar Lake formation. In the basal part of the formation, a biostromal dolomite with a coral and stromatoporoid fauna is designated the Cross Lake member because it is best exposed near the outlet of Cross Lake. At the top of the formation scattered areas of reef rock are found and these are separated as the Chemahawin member. The new formation includes the upper part of unit D and the whole of unit E of the Interlake group. Between the two members, replacing them laterally, and to a certain extent interbedded with them, is the middle part of the Cedar Lake dolomite.

Distribution. All outcrops visited by the writer on the shores and islands of Cedar Lake are composed of the Cedar Lake dolomite. It is prominent in lake cliffs on the islands in the centre of the lake, on the large irregular island known locally as Crossing Island, and at the outlet of the lake into the lower Saskatchewan River. The Chemahawin reef member has its type locality near the entry of Saskatchewan River to the lake on the southwest corner. On Moose Lake, outcrops of the Cedar Lake formation are confined to the Cross Lake member, which occurs at the Settlement, on sec. 4, tp. 57, rge. 20, W. Prin. mer., and at the west end of Big Island. The best vertical sections of the middle part of the Cedar Lake dolomite are found in cliffs between the Narrows and Demicharge Rapids on Saskatchewan River. The shores of the southern part of Cross Lake and Saskatchewan River between Demicharge and Redrock Rapids are underlain by the Cross Lake member. The Cedar Lake dolomite underlies the east shore of Lake Winnipegosis from Ami Island to Pickerel Creek but outcrops are poor in this area.

In the Interlake area only the upper part of the formation is exposed and the Cross Lake member cannot be identified. The outcrops define an irregular belt from Davis Point to Lundar bordered on the west by the Ashern formation and on the east by the drift-covered region at the axis of the Interlake area. The Chemahawin member occurs in four groups of outcrops each of which probably represents a reef set in the upper Cedar Lake dolomite, but lack of outcrops makes it difficult to eliminate the possibility that some or all of the reefs are connected. One such group of outcrops runs south from Davis Point to the crest of Jackpine Ridge (6 miles southwest of Gypsumville). This reef may be continuous with another found southwest of the town of Fairford, or even with a disconnected outcrop of reefy dolomite that occurs on the west shore of Lake St. Martin on sec. 29, tp. 29, rge. 8, W. Prin. mer. The most southerly reef discovered is in a quarry 1 mile east of Lundar. An interesting boulder in the drift at Embury, Manitoba (sec. 31, tp. 17, rge. 9, W. Prin. mer.), described in Kirk's unpublished notes, is evidently of the Chemahawin member.

The thickness of the Cedar Lake formation is imposible to deduce from surface data. If the known thickness of the lower formations of the Interlake group be subtracted from the 350 feet of the Interlake group penetrated in drill-holes, the residue of about 150 feet may be assigned to the Cedar Lake formation. The dominantly organic members at the base and top of the formation are probably each not over 40 feet thick.

Lithology. As no single exposure shows a representative part of the Cedar Lake formation, no type section has been selected but the whole of the Cedar Lake region may be considered the type area. Representative outcrops can be studied on two unnamed islands in the lake at sec. 5, tp. 52, rge. 18, W. Prin. mer., and sec. 1, tp. 52, rge. 19, W. Prin. mer., and along the north shore of a large irregular island at the mouth of Summerberry River. The section exposed on the south side of the second mentioned of these islands will illustrate the lithology typical of most of this formation.

Section on island in centre of Cedar Lake

Cedar Lake dolomite

F. 2.5 feet—Dolomite: yellowish grey, very fine grained, porous, with vugs stained a deeper yellow and formed largely by ostracods.

E. 1.8 feet—Dolomite: yellowish grey, fine grained, thick bedded, minutely porous, each cavity filled with yellow clay. *Brachyprion acanthopterus,* gastropods.

D. 0.6 foot—Dolomite: similar to unit F, with pores of obscurely organic origin.

C. 7.6 feet—Dolomite: light olive-grey, very fine grained, thin bedded, compact; weathering to a rough surface. *Brachyprion acanthopterus, Leperditia* sp., *Encrinurus hypoleprus.*

B. 1.1 feet—Dolomite: pale yellowish orange, fine grained, porous; in a single bed, containing vugs stained pale red. *Brachyprion acanthopterus, Leperditia* sp.

A. 0.6 foot—Dolomite: light olive-grey, very fine grained, evenly fracturing.

The section illustrates the varied types of dolomites that are repeated in most exposures of the formation. Many of these dolomites are very fine grained, a few are aphanitic. Fragmental dolomites and intraformational conglomerates are found more rarely, and neither of these rocks is as common in the Cedar Lake dolomite as in the East Arm dolomite. The formation carries a fauna composed of about 80 per cent brachiopods and ostracods. The pygidia of *Encrinurus hypoleprus* occur in abundance at such localities as the north shore of Crossing Island and the east shore of Lake Winnipegosis. In general the dolomite is compact but where porosity is found it is mostly organic in origin.

Of the sections exposed at the outlet to Cedar Lake, that at Anchor Point on Saskatchewan River is thickest and most representative.

Section at Anchor Point

Cedar Lake dolomite

C. 9.0 feet—Dolomite: pale yellowish brown to greyish yellow, very fine grained; in massive beds some of which are stromatolitic.

B. 5.9 feet—Dolomite: pale yellowish orange, composed of a fine grained, soft, porous phase interfingering with a very fine grained, compact phase. Fossiliferous near top. *Neozaphrentis* sp. A, *Cystiphyllum* sp., *Brachyprion acanthopterus, Camarotoechia indianensis, Leperditia* cf. *hisingeri,* salt crystal and orthorhombic moulds in the habit of barite.

A. 8.0 feet—Dolomite: light brown to light grey, aphanitic, massively bedded, brittle.

Stromatolites are rare in the Cedar Lake dolomite and are known only from the immediate neighbourhood of Anchor Point. This distribution suggests that they are confined to this stratigraphic interval. Beds lithologically similar to those of unit B occur in several lake cliffs around the Narrows, and the thin *Brachyprion*-bed near the top of the unit can be identified in several outcrops. At the Narrows this horizon contains chert nodules some of which are banded and contain beautifully replaced ostracods. This layer also contains peculiar orthorhombic crystal moulds up to half an inch in length of a tabular, pseudohexagonal shape. This crystal form suggests that the mineral that filled these cavities was barite. The sharpness of the angles indicates that the crystal grew in place like the salt crystals whose moulds are also present. The only other locality at which such crystals were found, outside of the Saskatchewan River area, is at the east shore of Lake Winnipegosis, due east of the tip of Denbeigh Point, where a boulder full of them was collected. The beds of dolomite contain much chert along this shore and are probably at the same horizon as those at the Narrows.

Although the Cedar Lake dolomite comes to the surface in many outcrops along the east shore of Lake Winnipegosis, most of the outcrops are similar and may be described together. The rock is exposed in a series of very low domes a few feet across, which cannot be definitely related to organic structures but may be caused by draping of sediment over small reefs. Two types of dolomite are interbedded in these exposures and perhaps displace each other laterally. One type is aphanitic to very fine grained and so in places breaks with a conchoidal fracture like porcelain. The other is a very finely porous dolomite in which the pores are less than 1 mm. in diameter and arranged parallel with the bedding. Fossils are common in this dolomite and many bedding planes are covered with *Brachyprion acanthopterus.* The strange pin-point porosity precludes good preservation of these fossils. In many outcrops, especially those on Ami Island, nodules of chert several inches in length occur that contain silicified ostracods and brachiopods. At the mouth of Pickerel Creek, Tyrrell reported oolitic dolomite but the rock collected by the writer at this locality was not definitely oolitic but consisted of a thin-bedded, fine-grained dolomite full of minute earthy spheres that showed no structure. These spheres were also found in a 3.3-foot bed at the base of the section at the Narrows on Saskatchewan River and at other localities downstream. The origin of these spheres is entirely problematical but they are doubtless the result of conditions similar to those that produced the spheres in the Inwood formation at its type locality and Broad Valley.

In the Interlake area it is difficult to distinguish between the beds of the Cedar Lake dolomite below the reefs of the Chemahawin member and those between the reefs. Outcrop is so restricted that the reefs cannot be traced laterally into bioclastic deposits with any certainty. One of the thickest sections of the Cedar Lake formation is at Jackpine Ridge on the highway 6 miles southwest of Gypsumville. Yellowish grey and yellowish orange, thick-bedded, largely unfossiliferous dolomites outcrop in the gutters and test pits through a vertical distance of 26 feet. At the top of the section a bed contains a rich fauna, including such characteristic Cedar Lake species as *Brachyprion acanthopterus, Leperditia whiteavesii,* and (fide Kindle, 1914) *Leptaena parvula.* The thin-bedded, greyish yellow, fine-grained dolomite underlies much of the grassland northeast of Fairford beneath a thin soil cover. Ten feet of it may be measured in a sink-hole 2.5 miles east-northeast of the village. Many flat outcrops of this formation east and north of Hilbre do not expose more than a few feet of beds. The dolomite is more orange coloured than is usual in the rest of the formation and contains earthy orange material lining cavities and along bedding planes. The fauna has been characterized by Baillie as the "*Amplexus severnensis*" zone but the only fossil that seemed foreign to the usual fauna, collected from these outcrops by the writer, was *Brachyprion robustus.*

In the neighbourhood of Grahamdale, Moosehorn, and Ashern, interbioherm dolomite of another type outcrops. In this dolomite are lenses a few feet thick and several feet wide that show a porous structure of coarse laminæ about 1 inch apart separated by irregular vertical pillars. Such a structure is similar to that built by certain lime-secreting algae and is almost identical with that of some fresh-water limestones in the Triassic rocks of Connecticut. These are best exposed in an abandoned quarry 2 miles west of Spearhill where the lens forms part of the uppermost beds of the Interlake group and is overlain by the Ashern formation. The algal lens is flanked and covered with fragmental dolomite containing much green clay. Outcrops that show similar algal dolomite are found 4.1 miles south of Moosehorn on the highway and 1 mile east of Grahamdale (l.s. 6, sec. 13, tp. 28, rge. 8, W. Prin. mer.). The dolomite lying between these lenses is similar to that on Cedar Lake and contains only poorly preserved ostracods.

Cross Lake Member. In recognition of the dominantly biostromal character of the base of the Cedar Lake formation, these lower beds are designated as a new member. As the bioclastic dolomite grades laterally into typical Cedar Lake dolomite so that in a restricted outcrop, assignment to the Cedar Lake or Cross Lake dolomites might be in doubt, the unit is not given formational status. The typical dolomite of this member is pale yellowish orange, medium to coarse grained, and medium bedded. The dolomite might be classed as a crinoidal calcarenite but unlike most such rocks it is porous, soft, and contains much pale orange earthy matter. The crinoidal dolomite is too coarse to preserve the moulds of brachiopods and molluscs in any detail. The best preserved fossils are corals and stromatoporoids, which occur in great abundance in thin beds of soft, nodular dolomite. Wave action during most of the time of deposition of the member reduced any accumulating organic matter to sand size, and only when this action stopped did whole fossils collect on the sea floor. The orange, porous, biostromal dolomite weathers to a highly irregular pitted surface. It shows a coarse, horizontal lamination, caused by more compact dolomite interbedded between the porous dolomite at intervals of about 1 inch. The compact beds are resistant to weathering and stand out on the pitted surface.

A typical section of these beds is exposed in a cliff at the base of the north channel of Cross Lake Rapids. At the west end of the cliff the following section was measured:

Section at Cross Lake Rapids

Cross Lake member, Cedar Lake formation

C. 6.0 feet—Dolomite: medium yellowish orange, fine to medium grained, massive, soft; weathers to an irregular surface; consists of a compact, fine-grained phase and a porous earthy phase intermixed. Fossiliferous 1 foot from the base; *Clathrodictyon* sp., *Halysites catenularia, Favosites gothlandicus, Lyellia affinis, Amplexoides* sp., *Neozaphrentis* sp., *Asthenophyllum inwoodense, Clintonella* sp, *Brachyprion inflatus, Camarotoechia winiskensis.*

B. 4.0 feet—Dolomite: greyish orange, very fine grained to aphanitic, thick and thin bedded, brittle; some intercalated medium-grained beds.

A. 1.0 feet—Dolomite: dark yellowish orange, aphanitic, brittle, cavernous.

At the east end of the outcrop the fine-grained, more compact beds have replaced the basal part of the biostromal dolomite and the lower 9.3 feet of the cliff is composed of this denser rock. Five feet from the base of this section a chert-bearing lens was found but this is the only occurrence of chert at this horizon. Such rapid facies changes cause difficulties in correlating the measured sections of this member even over short distances. On a point on the south shore of Portage Bay of Cross Lake, anticlinal warping of the porous dolomite suggests that it may be covering a reef structure that cannot be detected.

Near the top of the member at Demicharge Rapids the soft, medium-grained, pale yellowish orange dolomite persists, but there are no coral beds and the fauna is largely of poorly preserved gastropods.

At Moose Lake Settlement the Cross Lake member overlies grey aphanitic dolomites of the East Arm dolomite. In the rock flats on which the village is built the Cross Lake dolomite rises into domes about a foot across. The laminæ are formed by the alinement of small vugs and not by the superimposed layers of dense dolomite that characterize the lower formations. Near the base of the member there, a bed of cavernous dolomite contains a very large coral fauna. The outcrop of the member farthest north is on sec. 4, tp. 57, rge. 20, W. Prin. mer., and is recorded in the account of the East Arm dolomite.

In summary, the characteristic features of the Cross Lake member are:

(1) Coarse- to medium-grained bioclastic texture, in many samples a crinoidal calcarenite.

(2) Porosity in zones along the bedding, locally irregularly cavernous.

(3) Intercalated nodular beds of corals and stromatoporoids.

(4) Rapid facies changes from medium-grained to aphanitic dolomites.

(5) Pale yellowish orange colour, associated with orange earthy matter.

Chemahawin Member. The dolomite of reef origin that occurs near the top of the Interlake group is here separated as a member of the Cedar Lake formation and called the Chemahawin dolomite. The rocks are equivalent to Baillie's unit E. Because this organic dolomite grades laterally into dolomites of the Cedar Lake facies and is to some extent interbedded with them, it is not desirable to distinguish it as a separate formation.

The Chemahawin dolomite is typically composed of the skeletons of stromatoporoids and corals in position of growth. It is yellowish grey, has the porous nature of reef rocks, and has little or no bedding. The principal rock builder was the stromatoporoid *Clathrodictyon*, which locally fills in the entire space between coral colonies. *C. cystosum* is the most abundant species but *C. fastigiatum* and *C. osteolatum* occur in some reefs. The tabulate corals are only slightly less important contributors to the dolomite and many species and subspecies of *Favosites* may be collected. Colonial and single tetracorals make up less of the fauna than their tabulate cousins but are still abundant and represented by *Pycnostylus*, *Dinophyllum*, and *Synamplexoides*. Some of the beds in the reefs are of a fragmental nature and contain bioclastic debris that cannot be identified. Other interbeds are fine grained to aphanitic.

Outcrops are not extensive enough to allow a study of the relation between the reef and off-reef deposits but in the neighbourhood of Chemahawin an interfingering of bioclastic dolomite containing reef fossils with an aphanitic, inter-reef facies can be seen. At Chemahawin itself a cliff 13 feet high on Saskatchewan River shows aphanitic and medium-grained dolomites at the base overlain by reefy, stromatoporoidal, and coralline dolomite. Aphanitic inter-reef dolomite at Fort Island is interbedded with lenses of porous, medium-grained dolomite containing a coral and brachiopod fauna. In some outcrops these non-persistent beds are crinoidal and at all outcrops probably represent debris swept from now unexposed reefs.

The four areas in which the Chemahawin facies is exposed east of Lake Manitoba have been described above. The shoreline beds at Davis Point have been described by Tyrrell (1891) but he does not mention that behind the shoreline an aphanitic dolomite of inter-reef origin is draped in low domes over the reef below. Near Fairford two outcrops of the Chemahawin member were found but their relationship to each other is obscure. A tenth of a mile along the road leading westward from the highway to Fairford, a porous, medium-grained dolomite full of corals and stromatoporoids forms a low outcrop in the gutter. A half mile southwest of Fairford a similar organic dolomite is overlain by thin-bedded, fine-grained dolomite that dips south at a low angle. The Chemahawin facies overlies aphanitic, thin-bedded dolomite east of Hilbre on NW. $\frac{1}{4}$ sec. 29, tp. 29, rge. 8, W. Prin. mer., but this outcrop does not appear to be related to those at Fairford and is removed from them several miles. The most accessible exposure of the reef facies is in a quarry 1 mile east of Lundar. The quarry is 5 to 7 feet deep but is usually filled with water to within a few feet of the top. The dolomite is composed for the most part of *Clathrodictyon cystosum* but tetracorals and *Favosites* colonies occur in abundance. Pockets of red clay are present in many places and a red argillaceous lens is reported by Baillie in the north wall.

Contacts. The Cedar Lake dolomite rests on the East Arm dolomite with a contact that is locally difficult to draw. The point of transition is marked by a change from a yellowish grey, very fine-grained, locally stromatolitic dolomite to a coarser grained, pale yellowish orange, massively bedded dolomite containing layers rich in corals and stromatoporoids. The lower contact is arbitrarily placed at the first bed of this pale yellowish orange dolomite. It is exposed in small cliffs just above Redrock Rapids on Saskatchewan River, and at the most westerly outcrop on the north side of Big Island, Moose Lake. At sec. 4, tp. 57, rge. 20, W. Prin. mer., the contact is more abrupt and the overlying Cross Lake member is coarse grained and crinoidal (*see* section on page 34).

The upper contact is the top of the Interlake group and the overlying beds are the red dolomite of the Ashern formation. The surface between these two units is a disconformity marked by erosion of the Cedar Lake formation and a basal breccia in the Ashern formation. The disconformity may be examined in an abandoned quarry 2 miles northwest of Spearhill where a surface with a few inches of relief has been formed at the top of the Cedar Lake formation. Elsewhere Baillie states that there is an apparent gradation downward from the red Ashern dolomite to the buff Interlake dolomite.

Two to three feet of thick-bedded, porous, greyish orange dolomite is exposed at the base of the quarry in the Elm Point limestone (Devonian) at Spearhill. The brown dolomite rises into domes 6 feet high in the quarry floor and overlies the mottled, partly dolomitized limestone of the Elm Point formation in tongues. *Atrypa arctica,* a Devonian brachiopod with delicate growth laminæ, is found in this dolomite a foot below the contact. Baillie (1951) has interpreted the dolomite as the uppermost beds of the Interlake group underlying the Devonian unconformably. Close examination of the contact convinced the writer that it is gradational and represents a front of dolomitization. The dolomitization process has affected the lower porous beds and those beds in the updomed areas of the quarry floor, but has been only partially successful in converting the rest of the Elm Point formation. The presence of *Atrypa arctica* in the dolomite was explained as due to the reworking of the upper part of these beds during the Devonian transgression but it seems unlikely that any reworking would result in a delicate brachiopod being preserved at such a depth below the contact. Dolomite is found in similar stratigraphic position to that at Spearhill on the southeast corner of sec. 5 tp. 23, rge. 6. W. Prin. mer.

Correlation. Although the Cedar Lake formation as a whole has considerable faunal unity, each of the members is characterized by a particular fauna. The Cross Lake fauna might be described as the zone of *Brachyprion inflatus,* the fauna of the middle part of the Cedar Lake as the zone of *Brachyprion acanthopterus,* and the Chemahawin fauna as the zone of *Pycnostylus guelphensis.*

The coelenterate element of the Cross Lake member is the most striking feature of the fauna. Great numbers of colonies of *Clathrodictyon drummondense, C. striatellum,* and *Paleofavosites transiens* may be collected from the coral bands in the biostromal dolomite. This is the highest zone in which *Paleofavosites* occurs in any abundance in Manitoba. The best specimens of the peculiar coral *Multisolenia tortuosa* come from these beds but they are not very common. Tetracorals flourished but are very poorly preserved (most commonly as calicular moulds), and it is only with difficulty that two species of *Neozaphrentis* and the ubiquitous *Asthenophyllum inwoodense* can be identified. *Brachyprion inflatus* is confined to the member but is not abundant enough to form a good index fossil. *Camarotoechia winiskensis* is last seen in the Cross Lake dolomite. It appears from the evidence of *C. winiskensis* and *Multisolenia tortuosa* that the Cross Lake member is correlative with the Thornloe and Manistique dolomites.

The undivided beds of the Cedar Lake dolomite present a brachiopod-ostracod facies. The most abundant fossil throughout these beds is *Brachyprion acanthopterus*. This brachiopod cannot be said to be confined to the inter-reef facies of the Cedar Lake dolomite because specimens that the writer has referred to this species are found also in the Chemahawin member but are a variety that may be distinguished statistically. The ostracods *Leperditia hisingeri, L. whiteavesii,* and *Dihogmochilina latimarginata* are associated with this brachiopod in many outcrops. Three other brachiopods, *B. robustus, Leptaena parvula,* and *Meristina manitobensis,* are found in this unit but are not all confined to it. The first is found at Anticosti from Becsie to Jupiter horizons and so is not very useful as a stratigraphic marker. Of the other two, which are Manitoban species, *L. parvula* is a distinctive marker of a horizon near the top of the Cedar Lake dolomite throughout its range.

At the top of the Cedar Lake dolomite, although there is no change in lithology, there is an introduction of a new fauna. This is signalled by the appearance of the corals *Favosites niagarensis* and *F. hisingeri,* the brachiopods *Hesperorthis davidsoni* and *Howellella* cf. *crispa,* and several gastropods of Guelph affinities. The beds carrying this fauna are probably an inter-reef facies of the Chemahawin member because several of the fossils are encountered elsewhere only in the Chemahawin reefs.

The fauna of the Chemahawin member is characterized by familiar corals and stromatoporoids. Many of these are similar to those of the Manistique and Fossil Hill formations that Bolton (1953) correlates with a Lower Clinton age but others suggest a later age. The reefs occupy the same stratigraphic interval and contain the same fossils as the Attawapiskat reefs of Hudson Bay, which are also included in the Lower Clinton by Bolton. However, both the Chemahawin and the Attawapiskat rocks contain *Pycnostylus guelphensis,* a coral characteristic of the Guelph dolomite and unknown below a Gasport horizon. The only other Guelph fossil in the Interlake group, *Euomphalopterus valeria,* is found in the Cedar Lake inter-reef beds. These two fossils suggest to the writer that the upper part of the Cedar Lake formation is of Lockport-Engadine age and possibly of Guelph age.

Fauna of the Cedar Lake Dolomite, Cross Lake Member

——	1	2	3	4	5	6	7	8	9
Clathrodictyon drummondense			x						
C. striatellum							x		
Clathrodictyon sp.			x			x			
Favosites gothlandicus		x	x		x		x		
Paleofavosites transiens	x	x	x			x	x		cf.
Multisolenia tortuosa			x						
Halysites catenularia			x		x	x	x		
Lyellia affinis					x				
Neozaphrentis symmetricus			cf.			x	x		
N. manitobensis			x				cf.		
Asthenophyllum inwoodense		x	x		x	x	x	x	
Amplexoides severnensis							x		
Amplexoides sp.					x				
Trimerella cf. *acuminata*	x								
Platystrophia sp.				x		x			
Brachyprion inflatus			x		x				
B. aff. *acanthopterus*	x								
B. cf. *philomena*								x	
Camarotoechia winiskensis			x	x	x				x
Clintonella bailliei	x	cf.	x						
Meristina cf. *manitobensis*			x						
Hormotoma sp.		x	x	x					x
Eunema sp.		x				x			
Eotomaria sp.				x					
Elrodoceras exile		x							
Phragmoceras cf. *parvum*				x					
Encrinurus hypoleprus					x				
Leperditia hisingeri				x					
L. phaseola									x
Dihogmochilina latimarginata			x			x			

1. South shore, Saskatchewan River, opposite Cross Lake Rapids.
2. Point on south shore, Portage Bay, Cross Lake.
3. Small island, southeast corner, Cross Lake.
4. Foot of south channel, Demicharge Rapids, Saskatchewan River.
5. At discharge of main channel, Cross Lake Rapids, Saskatchewan River.
6. South bank of Saskatchewan River, N. 40° W. of main channel of Cross Lake Rapids.
7. Moose Lake Settlement.
8. Middle of north channel, Cross Lake Rapids.
9. Cranberry Bay, Cross Lake.

Fauna of the Cedar Lake Dolomite, Undifferentiated Beds

——	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Clathrodictyon cf. *striatellum*...				x											
Favosites hisingeri............					cf.										
F. niagarensis...............											x				
Paleofavosites transiens........				x											
Halysites catenularia..........					x					x			x		
Dinophyllum cf. *lundarense*....													x		
Neozaphrentis sp. A...........					x			x	x						
Asthenophyllum sp. A.........		x		x											
Cystiphyllum sp..............					x			x							
Hesperorthis davidsoni........										x					
Brachyprion acanthopterus.....		x		x	x	x	x	x	x	x	x		x		x
B. robustus..................							x				x				
Leptaena parvula.............			x		x										
Camarotoechia indianensis.....		x		x	x			x						cf.	
Meristina manitobensis........	x		x	x	x										
Howellella cf. *crispa*..........						x							x		
Plectatrypa sp...............		x		x											
Pentamerus sp...............															x
Ctenodonta cf. *ovata*..........		x													
Iliona (?) parvula............		x													x
Leiopteria cf. *subplana*........												x			
Mytilarca sp................												x			
Hormotoma sp...............		x									x	x			
Eotomaria cf. *galtensis*........												x			
Raphistomina affinis..........		x													
Eunema sp..................		x													
Euomphalopterus valeria......										x					
Gyronema pauper............												x			
Elrodoceras exile............			x												
Phragmoceras parvum.........														x	
Kionoceras sp...............		x													
Encrinurus hypoleprus........				x	x				x						
E. cf. *tuberculifrons*..........					x										
Arctinurus sp...............	x			x											
*Acidaspis perarmata**.........															
Leperditia whiteavesii.........	cf.	x								x	x				x
L. hisingeri.................								cf.	x						
L. caeca...................				x											
Dihogmochilina latimarginata..						x									

1. Sec. 36, tp. 29, rge. 9, W. Prin. mer.
2. Top bed in gutter, Jackpine Ridge, southwest of Gypsumville.
3. East shore, Lake Winnipegosis, east of tip of Denbeigh Point.
4. West shore, Cross Lake, 3½ miles northeast of Demicharge Rapids.
5. l.s. 2, sec. 7, tp. 51, rge. 19, W. Prin. mer., Cedar Lake.
6. l.s. 8, sec. 21, tp. 29, rge. 8, W. Prin. mer.
7. Ami Island, Lake Winnipegosis.
8. Anchor Point, Saskatchewan River.
9. Sec. 5, tp. 52, rge. 18, W. Prin. mer., small island in Cedar Lake.
10. Fort Island, Cedar Lake.
11. First road intersection north of Hilbre.
12. 1·2 miles west of highway 6 on road between sec. 15-11, tp. 23, rge. 6, W. Prin. mer.
13. Centre sec. 32, tp. 50, rge. 20, W. Prin. mer., Cedar Lake.
14. 2·3 miles west of highway 6 on road of locality 12.
15. 2 miles northeast of Fairford.

* Recorded by Whiteaves from east shore of Lake Winnipegosis.

Fauna of the Cedar Lake Dolomite, Chemahawin Member

—	1	2	3	4	5	6	7
Clathrodictyon cystosum	x	cf.	cf.	x	x		
C. osteolatum					x		
C. fastigiatum	x						
C. cf. *regulare*			x	x			
C. cf. *striatellum*						x	
Stromatopora cf. *constellata*				x			
Labechia cf. *conferta*					x		
Favosites niagarensis lundarensis	x	x					
F. niagarensis inaequalis	x	x			x		
F. hisingeri		x	x	cf.	x	x	
F. gothlandicus		x			x	x	
F. cf. *favosus*			x			x	
Corrugopora rhabdota				x			
Halysites catenularia	x	x				x	x
Lyellia affinis					x		
Amplexoides sp. A		x				x	
Asthenophyllum sp. A							x
Dinophyllum lundarense		x					
Synamplexoides varioseptatus		x	x				
Pycnostylus guelphensis	x	x	x	x	x	x	x
Cystiphyllum cf. *niagarense*		x					
Cyathophyllum sp.					x	x	
Hesperorthis davidsoni							x
Brachyprion acanthopterus	x						x
Leptaena parvula	x						
Camarotoechia indianensis							x
Meristina sp.			x				
Eunema sp.			x				

1. Chemahawin, Saskatchewan River.
2. Quarry 1 mile east of Lundar.
3. NE. ¼ sec. 29, tp. 29, rge. 8, W. Prin. mer., E. of Hilbre.
4. ½ mile west of highway 6 between sec. 12-13, tp. 31, rge. 10, W. Prin. mer.
5. Davis Point, Lake Manitoba.
6. 0·1 mile east along road from highway 6 to Fairford.
7. Northwest corner of Fort Island, Cedar Lake.

CHAPTER III

SYSTEMATIC PALÆONTOLOGY

INTRODUCTION

The fauna of the Interlake group as a whole shows considerable similarity to that of the Middle Silurian of Europe and Asia. It belongs to a northern faunal realm and differs in many respects from the southern Silurian faunas. Several of the New York and Ontario species occur in Manitoba and the northern fauna may be traced southward through Lake Timiskaming and northern Michigan, but, in general, the Manitoban species are much different from those of eastern North America. In its affinities to Europe, the Interlake fauna resembles that of Anticosti and close correlation can be drawn between the two areas. When more is known about the Silurian faunas of the Arctic Islands and Hudson Bay, their similarity to the Manitoba fauna may be more obvious.

The fossils of the Interlake group and Stonewall formation are poorly preserved, generally as moulds and casts. The group most satisfactorily preserved is the corals. Many of the favositids are in a better state of preservation for study than had they been entombed in limestone. The state of preservation of certain parts of the fauna such as the pelecypods and the gastropods is very poor. These groups have been identified in most part only to genus as their specific identification depends on the preservation in detail of surface ornament and hinge lines. In a few specimens where preservation is better or shape distinctive, the fossils have been identified specifically. Neither pelecypods nor gastropods are described in the systematic palæontology section. Bryozoa are almost entirely absent from the Stonewall formation and Interlake group. The few specimens of cryptostomes that were collected are not well enough preserved to warrant description. All of the stromatoporoids, corals, brachiopods, cephalopods, trilobites, and ostracods that were collected by the writer are described below. The descriptions are grouped according to the most recent classification available. The tetracorals have been classified according to Wang (1950) and the cephalopods according to Flower and Kummel (1950). As the classification of brachiopods is now under revision, no detailed subdivision of this phylum is attempted.

DESCRIPTION OF SPECIES

COELENTERATA

Class, STROMATOPOROIDEA

Genus, *Actinostroma* Nicholson

Actinostroma sp.

Plate I, figure 2

Coenosteum composed of cylinders about ½ mm. in diameter, connected with each other along their length in two places, forming chains like the corallites of *Halysites,* in some specimens growing singly; laminæ concentric around axes of cylinders, continuous, plane with little undulation, spaced about 15 in 5 mm.; pillars of same thickness as laminæ, disposed radially from the axis of cylinders, passing through several laminæ, spaced at about the same interval as laminæ, appearing in tangential section as small dots with few 'connecting arms'; astrorhizae apparently absent.

The specimens from which the above description was framed were found at two localities in the East Arm dolomite. This halysitoid manner of growth is not common in species of *Actinostroma* but the internal skeleton is obviously organized on the *Actinostroma* plan. A more complete series of specimens should be collected before this form is described as a new species.

Hypotype, G.S.C. No. 11029.

Genus, *Clathrodictyon* Nicholson and Murie

Clathrodictyon cystosum Parks

Plate II, figure 1

Clathrodictyon cystosum Rominger, Parks, 1908, Univ. Toronto Stud. Geol. Ser. No. 5, p. 21, Pl. 1, figs. 2, 3, 4, Pl. 8, figs. 6, 7.

Coenosteum hemispherical, laminar, or encrusting; surface undulatory but not rising into prominences; laminæ bent upward at irregular intervals to form pillars, otherwise relatively plane and continuous, spaced 3 to 4 in 1 mm.; pillars in many places not extended to next laminæ, enclosing cystose interspaces, forming with the laminæ an irregular network, appearing in tangential section as vermiculate lines; astrorhizae apparently lacking.

The distinguishing features of this species are its coarse texture and cystose structure. Two specimens from the East Arm dolomite associated with *C. fastigiatum* show the more regular structure and lack of chevron-folding of *C. cystosum.* In the reefy Chemahawin dolomite at Lundar and on NE. ¼ sec. 29, tp. 29, rge. 8, W. Prin. mer., poorly preserved stromatoporoids are associated with *Synamplexoides varioseptatus.* Although recrystallization has destroyed the fine details of the structure of these stromatoporoids, they are probably referable to *C. cystosum* for they have irregularly inflected laminæ spaced about 3 in 1 mm. In addition to the coral mentioned above, fine tabulated tubes that are of the same type as have been described as *"Caunopora"*, invade these coenostea. Astrorhizae are developed on all well-preserved surfaces. Better preserved specimens, which can definitely be assigned to this species, are found in other outcrops of the Chemahawin member.

Hypotype, G.S.C. No. 11057.

Clathrodictyon fastigiatum Nicholson

Plate II, figure 5

Clathrodictyon fastigiatum Nicholson, 1886-92, Mon. Brit. Stromatoporoids, p. 43, fig. 3, p. 152, Pl. 19, figs. 1-5. Parks, 1907, Univ. Toronto Stud. Geol. Ser. No. 4, p. 18, Pl. 1, fig. 6.

Coenosteum laminar to cake-like, up to several centimetres in diameter; surface regular, not well preserved in Manitoban specimens; laminæ thin, bent into many irregular chevron-folds, also minutely crumpled; pillars arising from inflections of laminæ, appearing in tangential sections as small dots between vermiculate cut edges of upturned laminæ; astrorhizae inconspicuous.

This species is easily recognized by the irregularity of its structure and the chevron-like folding of its laminæ. The structure as Parks points out, is transitional into the more regular network of *C. cystosum*. This species was collected from the top of the East Arm dolomite and the Chemahawin member of the Cedar Lake formation.

Hypotype, G.S.C. No. 11030.

Clathrodictyon drummondense Parks

Plate II, figure 4

Clathrodictyon drummondense Parks, 1908, Univ. Toronto Stud. Geol. Ser. No. 5, p. 26, Pl. 7, fig. 5, Pl. 8, figs. 3, 7.

This species is distinguished from others of the genus by the minute crumpling of the laminæ, the form of the pillars that arise from both the top and bottom of the laminæ enclosing polygonal interspaces, and the tendency for a slight irregularity in the structure. The laminæ of the specimens at hand are commonly spaced so that 6 occur in 1 mm. but variations in this spacing are found within a single section.

Specimens of this species were collected from the Cross Lake and Inwood formations.

Hypotype, G.S.C. No. 11028.

Clathrodictyon striatellum (D'Orbigny)

Plate II, figure 3

Stromatopora concentrica Lonsdale, 1839, Silurian System, p. 680, Pl. 15, fig. 31.
Stromatopora striatellum D'Orbigny, 1850, Prodrome de Paleontologie, t. 1, p. 51.
Clathrodictyon striatellum (D'Orbigny). Nicholson, 1888, Mon. Brit. Stromatoporoids, p. 156, Pl. 1, fig. 1, Pl. 5, fig. 3, Pl. 19, figs. 6-12.

Coenosteum hemispherical, laminar, or encrusting; surface undulatory but without prominences; laminæ relatively plane and continuous, spaced regularly about 5 or 6 in 1 mm., regularly bent down into radial pillars; pillars commonly double at top, commonly not reaching the lamina below but projecting into interlaminar space, appearing in tangential section as small dots connected by a few lines; astrorhizae absent.

This species is characterized by the regularity of its internal structure, the close spacing of its laminæ, and the double form of its pillars. It has only been identified definitely from the Cross Lake member of the Cedar Lake formation but several other poorly preserved specimens in the collection are comparable with it. These have been collected from the Fisher Branch, Inwood, and Cedar Lake formations.

Hypotype, G.S.C. No. 11027.

Clathrodictyon osteolatum Nicholson

Plate I, figure 1

Clathrodictyon osteolatum Nicholson, 1873, Ann. Mag. Natr. Hist. ser. 4, vol. 12, p. 90, Pl. 5, fig. 1a. Whiteaves, 1906, Palæozoic Foss., vol. 3, pt. 4, pp. 284-285.

A single specimen collected by Tyrrell from Davis Point from the Chemahawin member may be referred to this species. It has a regular internal structure and the laminæ are spaced so that 5 occur in 1 mm. These laminæ are sharply inflected into a series of domes that appear on the surface as nipple-like prominences. No canals piercing the prominences were observed but otherwise the specimen has the features of *C. osteolatum.* The species has been identified by Nicholson from Davis Point but, as Whiteeaves points out, no reference to this locality occurs in his later descriptions of the species.

Hypotype, G.S.C. No. 10466.

Clathrodictyon cf. *regulare* Rosen

Plate II, figure 2

Several specimens from the top of the Cedar Lake formation resemble Rosen's species in many respects. The network of the pillars and laminæ is very fine (7 or 8 laminæ in 1 mm.) and regular. The interspaces are almost square but slightly rounded at the top by the thickening of the pillars. The specimens differ from the type in the slightly closer spacing of the pillars and laminæ.

Hypotype, G.S.C. No. 11056.

Genus, *Actinodictyon* Parks

Actinodictyon keelei Parks

Plate I, figure 5

Actinodictyon keelei Parks, 1909, Univ. Toronto Stud. Geol. Ser. No. 6, p. 35, Pl. 19, figs. 5, 6.

Coenosteum hemispherical, laminar, or cylindrical; surface without marked prominences; laminæ minutely and irregularly folded, giving rise to pillars on flexures as in *Clathrodictyon,* irregularly spaced, 3 to 4 in 1 mm.; pillars extending from one lamina to next, more rarely passing through several laminæ, about same thickness as laminæ, appearing in tangential section as dots, commonly joined by vermiculate lines representing upturned laminæ; interspaces very irregular in size and shape; astrorhizae lacking in specimens from Interlake group but present in types.

The specimens from southern Manitoba were collected from an outcrop of the East Arm dolomite at Mile 5.5 of the Churchill branch of the Canadian National railway. Although the internal structure of these specimens is that described by Parks, they differ in having a hemispherical or laminar growth form and in lacking astrorhizae.

Hypotype, G.S.C. No. 11025.

Genus, *Stromatopora* Goldfuss

Stromatopora cf. *constellata* Hall

Plate I, figure 3

A few specimens collected from the Chemahawin member of the Cedar Lake formation between sections 12 and 13, tp. 31, rge. 10, W. Prin. mer., may be compared with Hall's species. Weathering has removed the coenosteum between the astrorhizal mammelons leaving them standing as columns. Each mammelon is pierced axially by an open tube at the centre of the astrorhiza. The mammelons are irregularly distributed in the coenosteum but the distance between them is commonly about 1 cm. Internally the pillars are better developed than the thin laminæ and are spaced about 13 in 5 mm.

The structure of these specimens is coarser than that of typical *S. constellata* and in this characteristic approaches that of *S. hudsonica* (Dawson). Dawson's species is commonly regarded as the same as, or a variety of, *S. constellata.*

Hypotype, G.S.C. No. 11026.

Genus, *Stromatoporella* Nicholson

Stromatoporella sp.

Plate I, figure 4

Coenosteum irregular, known only from a few fragments; surface without prominences, laminæ gently undulatory, each composed of 2 sheets separated by a thin interspace, spaced about 5 in 1 mm., deflected regularly into pillars; pillars thick, never connecting more than two laminæ, spaced widely and irregularly, appearing in tangential section as hollow lenticular bodies irregularly joined into chains; interspaces long, lenticular; coenosteum traversed by untabulate, vermicular tubes, $\frac{1}{2}$ mm. in diameter.

In the specimens from the Stonewall formation at the type locality, dolomitization has obliterated the finely porous structure of the laminæ that is an indication of *Stromatoporella.* During dolomitization the canal through the centre of each lamina appears to have been enlarged so that each lamina now appears to be double (*see* Nicholson, 1886, Pl. 1, fig. 5). The circular or lenticular section of the pillars is characteristic of the genus. The tubes that run through the coenosteum have a wall of their own and may not be a part of the stromatoporoid. Until more and better preserved material is available, a specific determination of this form cannot be made.

Hypotype, G.S.C. No. 11021.

Genus, *Labechia* Milne-Edwards and Haime

Labechia cf. *conferta* Nicholson

Coenosteum hemispherical, about 7 cm. in diameter; surface undulatory but not rising into prominences; laminæ replaced by cystose tissue, no continuous laminæ traceable, cysts convex upwards, spaced so that about 3 occur in 1 mm., highly variable in spacing even within a single section; pillars irregular in distribution, straight, proceding through several millimetres of coenosteum, appearing in tangential section as masses of dolomite joined by the cut edges of the cysts. Smaller radial pillars may pass from cyst to cyst but these obscured by dolomitization.

A single specimen collected by Tyrrell from Davis Point in the Chemahawin reef is in the collection of the Geological Survey. Its state of preservation is not good enough to allow definite identification.

Hypotype, G.S.C. No. 11061.

Genus, *Beatricia* Billings

Beatricia regularis sp. nov.

Plate IX, figure 14

Coenosteum cylindrical, consisting of an axial tube of large cysts, enclosed by finely cystose tissue, at least 10 cm. in length; central tube relatively large, about 8 mm. in diameter, having straight sides indented slightly at the contact between cysts; axial cysts large, hemispherical, in a single series except in a few places where 1 cyst replaced by 2, spaced so that $2\frac{1}{2}$ cysts occupy 1 cm.; zone of finely cystose tissue 2 cm. or less in outside diameter, composed of vertically elongate cysts of irregular shape, very poorly preserved in most specimens, represented in some specimens by a zone of concentrically laminated dolomite; radial pillars not observed; surface apparently irregularly covered with small sharp nodes less than 1 mm. across.

Most of the specimens consist of the camerate axial tubes of the organism but some show adhering fragments of the outer vesicular zone. All the specimens come from the upper dolomite bed of the Stonewall formation at the Stonewall quarry. *B. regularis* differs from the common Richmond species *B. undulata* Billings and *B. nodulosa* Billings in the smallness of its coenosteum and the relatively greater diameter of its central camerate tube. In dimensions it resembles, to some extent, *B. gracilis* Foerste but lacks the spirally arranged nodes of that species. True *Beatricias* (or *Aulaceras*) are reported only from the upper and middle Ordovician rocks. Those collected from the Silurian and Carboniferous rocks can be referred to this genus only with considerable doubt.

Holotype, G.S.C. No. 10467; paratypes, G.S.C. Nos. 11002 and 11003.

Beatricia undulata Billings

Beatricia undulata Billings, 1857, Geol.. Surv., Canada, Rept. of Prog. 1853-56, p. 344.

A single poorly preserved specimen of this species was collected from the Stonewall formation on a side road a quarter mile west of the Flin Flon highway at Mile 25. Although the fine structure of the specimen is obscure, the large size, deeply ridged surface, and central tube are unmistakable features of this species.

Class, ANTHOZOA

Subclass, **Tabulata**

Family, FAVOSITIDAE

Genus, *Favosites* Lamarck

Favosites Lamarck, 1816, Hist. An. sans Vert., vol. 2, p. 204.
Calamopora Goldfuss, 1826, Petrafacta Germaniae, vol. 1, p. 77.
Astrocerium Hall, 1851, Pal. New York, vol. 2, p. 120.

Corallum of variable shape, cerioid; composed of prismatic, polygonal corallites, which are placed in communication with each other by circular mural pores that pierce the wall not the corners of the corallites; walls thin, with spiniform septa or with no septa at all; tabulæ numerous, complete; basal attachment small; lower surface covered with an epitheca.

Favosites gothlandicus Lamarck

Plate IV, figure 7

Favosites gothlandicus Lamarck, 1816, Hist. An. sans Vert., vol. 2, p. 206. Hall and Clarke, 1903, N.Y. State Mus. Mem. 5, p. 30.
Favosites gothlandicus Lamarck (partim.). Nicholson, 1879, Pal. Tabulate Corals, pp. 46-56. Tripp, 1933, Paleontographica, vol. 79a, p. 101.
(non) *Favosites gothlandicus* Lamarck, Lambe, 1899, Contrib. Canadian Pal., vol. 4, p. 3. Whiteaves, 1906, Palæozoic Fossils, vol. 3, pt. 4, p. 244. Billings, 1859, Can. Jour., vol. 4, pp. 95-105.
Favosites gothlandicus forma *gothlandica* Jones, 1936, Ann. Mag. Natr. Hist., 10th ser., vol. 17, p. 8.
(?) *Favosites maximus* Quenstedt, 1852, Petrefactenkunde, p. 642.

Corallum hemispherical to spherical; corallites polygonal, commonly hexagonal, uniform in size within a corrallum; diameter of adult corallites about 4 mm.; walls thin, straight; mural pores in walls only, large, generally in two rows, alternating or paired, commonly surrounded by a raised rim; septa rudimentary, appearing as scattered short spines or small granules, rarely forming obscure low ridges by their fusion, commonly absent; tabulæ plane, sinuous, or convex, marginally deflected into 12 funnel-shaped pits; spaced at variable distances, commonly remote.

The above synonymy is not intended to be comprehensive and only covers a few of the many references to this species. The species has been so broadly and differently defined by authors that it has become necessary to redefine it before use. The synonymy indicates that the writer wishes to restrict the species to those forms in which the septal spines are absent or in a rudimentary condition.

This species has long been defined on the absolute and relative sizes of its corallites. It is commonly stated that the corallites must be over 3 mm. in diameter and that they must show great uniformity of size within the corallum. Such characteristics were contrasted with those of *F. forbesi*, which, in the words of the original description (Milne-Edwards and Haime, 1851, p. 239), has corallites, "...extrêmement inégaux, les plus grands sont ordinairement espacés au milieu des plus petits et souvent presque arrondis ...". There has been much discussion regarding the degree of dependency between the relative size of the corallites, the environment of growth, and the shape of the corallum (Lecompte, 1936, 1939; Jones, 1936, 1937; Tripp, 1933). It is the opinion of Lecompte and Jones that the inequality of corallites is caused solely by rapid budding at times of rapid upbuilding of the corallum and is to be correlated with a columnar growth habit.

An investigation of rate of budding and growth of corallites in serial sections of typical *F. gothlandicus* and *F. forbesi*, and a vain attempt to correlate growth form with the size distribution of the corallites, has convinced the writer that the pattern of corallites is controlled by the length of the immature stage of the corallites and by no outside influence nor rate of budding. If the corallites are immature (i.e., they are continually expanding and pyramidal) for a considerable time, then many small ones will be present in any given section, a condition characteristic of *F. forbesi*. If they reach maturity (i.e., a prismatic stage) after a short time of growth, there will be few small corallites in a section, as in *F. gothlandicus*. The "*forbesi*" condition is not a product of environment but neither is it characteristic of any one species. Specimens that show distinguishable features may both have great inequality of corallites but should not be assigned to a single species on this criterion alone. The same is true for coralla that show great equality of corallite sizes. In the above definition of *F. gothlandicus* it is not the relative size of the corallites alone that is important but a combination of characters that includes suppression of septa, absolute size of the corallites, and pores in one or two rows in the walls.

The North American species of *Favosites* with large equal corallites have been identified as *F. favosus* Goldfuss. This species was described as having vertical striations on the wall into which the pits of the tabulæ are deflected. The specimens in the Manitoban Silurian that have this character have been assigned to *F. favosus* but those with plane walls are retained in *F. gothlandicus*.

The mean of the adult corallite diameter of Manitoban *Favosites gothlandicus* is 4.03 mm. (s=0.42 mm., N=35)[1]. Several variants of this species may be distinguished on the basis of their tabulæ. In a suite of specimens from the Cross Lake member the tabulæ are crowded, uniformly convex, and many of them are dimpled in the centre by an oval depression and show vague radiating lines on their surface. The tabulæ in this variant are similar to those of *F. gothlandicus incerta* Tchernychev, but in the Russian subspecies the tabulæ are not convex. Another variant is found in the Fisher Branch dolomite and may be described as a *F. gothlandicus* with highly convex tabulæ but without a central depression in them.

In Manitoba the species ranges throughout the Interlake group but is least prominent in the middle formations. It is one of the most commonly found corals in the Chemahawin reefs.

Hypotype, G.S.C. No. 10499.

Favosites gothlandicus magnus subsp. nov.

Plate VI figures 2, 4.

Corallum hemispherical, probably over 5 cm. in diameter, imperfectly known only from fragments; corallites very large, with an adult diameter of 5.76 mm. (s=0.56 mm. N=16); walls relatively thin (0.2 mm.) pores relatively small, surrounded by raised rims, abundant in two series on the walls, rare and inconspicuous in the corners; septa absent or represented by granules; tabulæ plane, slightly deflected into pits at the margins.

The large diameter of the corallites, which rarely attain 7 mm., distinguishes this species from other favositids in the Interlake group. This character places the subspecies close to *F. maximus* Quenstedt but its corallites are not as large as those of this European species. *F. gothlandicus magnus* is confined to the Fisher Branch dolomite and has been found at only two localities. The type locality is near Fisher Branch on l.s. 6, sec. 10, tp. 25, rge. 2, W. Prin. mer., and the other is on the SE. corner sec. 3, tp. 25, rge. 2, W. Prin. mer.

Holotype, G.S.C. No. 10472; paratype, G.S.C. No. 10474.

Favosites niagarensis Hall

Favosites niagarensis Hall, 1852, Pal. New York, vol. 2, p. 125. Lambe, 1899, contrib. Canadian Paleon., vol. 4, p. 7. Shimer, 1905, N.Y. State Mus. Bull. 80, p. 236.
(non) *Favosites niagarensis* Rominger, 1876, Geol. Surv., Mich. Foss. Corals, p. 22, Pl. V, fig. 1.

Corallum cylindrical, hemispherical, branching, or irregular, usually small, corallites polygonal in section, 1.5 to 2.0 mm. in diameter, uniform in size or showing many immature corallites; walls thin, straight; mural

[1]In this and following places where the mean of measurements is given s is the standard deviation and N the number of measurements made.

pores in the walls only, in two rows, usually paired, rarely alternating, round, small, commonly surrounded by a raised rim; septa represented by granules on the wall, the result of recrystallization around spines, in 12 longitudinal series; tabulæ plane, commonly deflected marginally into 12 pits, spaced about 20 in 1 cm.

The more typical members of this species occur in the upper part of the Interlake group and are discussed under two subspecies below. In the Fisher Branch and Inwood formations two variants were found that are provisionally assigned to this species with the reservation that further collecting may justify the erection of new subspecies for their reception. One suite of specimens comes from the Fisher Branch dolomite 4 miles south of Narcisse and has all the features mentioned in the above description but differs in that the diameter of the corallites (2.13 mm. s=0.34, N=12) is greater than that of the later members of this species. These corals have a cylindrical growth form. Another variant, from the Inwood formation at Sandridge, has slightly larger corallites and a hemispherical growth form.

F. niagarensis may be distinguished from other favositids in the Interlake group by the straightness of the wall, the size of the corallites, and the poor development of the septa.

Favosites niagarensis lundarensis subsp. nov.

Plate III, figures 3, 5; Plate X, figure 14

Corallum cylindrical, branching, or irregular; rarely over 4 cm, in length and 2 cm. in diameter, composed of corallites that grow vertically up the axis for a short distance, then bend gradually outwards to open at the surface; corallites unequal in size, with an adult diameter of 1.6 mm. (s= 0.24 mm., N=23), normally six-sided, commonly eight- or four-sided; wall thin (0.1 to 0.2 mm.), straight; mural pores small (0.15 mm.), spaced about 8 in 5 mm., in two rows, alternating or paired; tabulæ crowded at the periphery, spaced 20 to 1 cm. in the centre.

This subspecies is common in the rocks of the Chemahawin member at the type locality, an abandoned quarry 1 mile east of Lundar. It is also found on Jackpine Ridge south of Gypsumville in the same formation. Specimens that are very similar to the Lundar forms have been collected from the north shore of Crossing Island in Cedar Lake from the Cedar Lake dolomite. The specimens from Chemahawin are characterized by the smallness of their cylindrical coralla.

Holotype, G.S.C. No. 10475; paratypes, G.S.C. Nos. 10476 and 11034.

Favosites niagarensis inaequalis subsp. nov.

Plate III, figures 1, 2

Corallum hemispherical, at least 6 cm. in diameter, represented in the collections by fragments only; corallites unequal, many immature corallites found in a section; mature corallites many-sided, subrounded, as in *F.*

forbesi, with an adult diameter of 1·91 mm. (s=0·45 mm., N=15); walls thin (0·15 mm.), straight; pores generally obscured by recrystallization, small, in 2 rows or a single row; tabulæ crowded or spaced about 20 in 1 cm.

This subspecies can be distinguished from *F. niagarensis lundarensis* by the hemispherical shape of its corallum and the greater inequality of its corallites. The difference in the diameters of the mature corallites was found to be not statistically significant. The subspecies *inaequalis* occurs in the Chemahawin reefs and to a lesser extent in the inter-reef beds of the Cedar Lake dolomite. The type locality is the quarry 1 mile east of Lundar.

Holotype, G.S.C. No. 10471; paratypes, G.S.C. Nos. 10477 and 11052.

Favosites hisingeri Milne-Edwards and Haime

Plate III, figure 7

Favosites hisingeri Milne-Edwards and Haime, 1851, Polyp. Foss. des Terr. Palaeoz., p. 240, Pl. 17, figs. 2, 2a, 2b, 1855, Brit. Foss. Corals, p. 256, Pl. 61, figs. 1, 1a, 1b. Lambe, 1899, Contrib. Can. Pal., vol. 4, p. 6.
Favosites venustus Rominger, 1876, Geol. Surv., Mich., Fossil Corals, p. 22, Pl. 5, fig. 3.
Favosites hispida Rominger, 1876, Geol. Surv., Mich., Fossil Corals, p. 22, Pl. 5, fig. 4.

Corallum hemispherical, 10 cm. in diameter in the largest specimen seen, commonly about 6 cm. in diameter; corallites polygonal, irregular in shape, uniform in size, 1·39 mm. (s=0·23 mm., N=40) in adult diameter; walls thick (0·2 mm.), straight; mural pores obscure, as seen in thin section rather remote, small, round, in 1 or 2 rows in the walls; septal spines well developed, abundant, extended about half the distance to the centre of the corallite, curved upward slightly at their ends, in 12 longitudinal series; tabulæ plane or irregular, spaced about 20 in 1 cm.

This species is the only true *Favosites* in the Silurian of southern Manitoba that has well-developed spines. Preservation of nearly all specimens of this species is poor, probably because of extensive recrystallization around the spines. It is possible that this species is a descendant of the long-spined *Paleofavosites* of the Fisher Branch dolomite, but as no intermediate forms occur in the intervening formations this relationship is merely hypothetical. *Favosites hisingeri* is confined to the Cedar Lake formation and is especially abundant in the Chemahawin reefs.

Hypotype, G.S.C. No. 10470.

Favosites cf. *favosus* Goldfuss

A series of specimens from the Cedar Lake and East Arm dolomites are doubtfully referred to this species on the evidence of the folding of the walls of their corallites. The coralla from the Chemahawin member of the Cedar Lake dolomite have an irregularly branching growth habit but the single specimen from the East Arm dolomite appears to have been broken from a hemispherical colony. The corallites differ greatly in size within a corallum and many immature ones appear to be present. The walls of each corallite are striated by about 12 infolds and show only rudimentary septal spines. Mural pores are numerous in the broad areas between striations. Tabulæ are sinuous, remote, and deflected at the margin into the striations on the walls. The corallites are 3 to 3·5 mm. in diameter.

The Cedar Lake specimens differ from typical *F. favosus* in having smaller corallites, greater inequality among corallites, and a branching growth form. From the meagre evidence at hand, it would appear that these specimens belong to a new species, but until more and better specimens are collected it seems advisable to identify them provisionally. The specimen from the East Arm dolomite resembles *F. favosus* to a greater degree but is too fragmentary for positive identification.

Genus, *Paleofavosites* Twenhofel

Paleofavosites Twenhofel, 1914, Nat. Mus., Canada, Bull. 3, p. 24, 1928, Geol. Surv., Canada, Mem. 154, p. 125.

Amended Description. Tabulate corals with all the characters of the genus *Favosites* except that most or all of the mural pores occur in the corners of the corallites.

The genus *Paleofavosites* was established to contain two species that showed mural pores in the corners of the corallites. The first species was to include *Favosites aspera, F. alveolaris, F. prolificus,* and *F. capax* and the second was to be described but was never established. The designated genotype is *F. aspera* despite Twenhofel's later (1928) efforts to change it to *P. prolificus.* Because in Twenhofel's descriptions there is no discussion of specimens containing pores in both the walls and the corners, presumably such do not occur at Anticosti.

The genus *Paleofavosites* has not been generally accepted outside North America. Lang, Smith, and Thomas (1940) do not regard the characters of *F. aspera* as being generically separable from *Favosites* s.s. Jones (1936) rejects the genus as the genotype shows pores both in the walls and the corners of the corallites and is, therefore, not fully distinct from *Favosites.* That many *Paleofavosites* contain pores both in the walls and corners has been recognized by many authors. As early as 1839, Lonsdale wrote that in *F. alveolaris* (=*aspera*) some of the pores may be found in the walls as well as in the corners. Poulsen (1941) has described as *P. groenlandicus* specimens that have some pores in the walls but most in the corners.

In the Stonewall formation and Interlake group the favositids show an almost complete transition from *Paleofavosites* to *Favosites.* In the Stonewall formation there are species with pores only in the corners (*P. capax, P. prolificus*) and also those with pores distributed equally in both loci (*P. okulitchi*). In the lower formations of the Interlake group, those favositids with pores only in the corners decrease in abundance, those with pores in both loci are dominant (*P. transiens*), and those with pores only in the walls appear (*F. gothlandicus*). By the end of Interlake time the transition is complete and only those with pores in the walls remain. There is no gradual shift in pores from one locus to the other; the change appears to be a single mutational character. In each of the lineages proposed for the favositids in this study, there is a shift in importance of the pore locus.

In order to draw a boundary between *Favosites* and *Paleofavosites* in this gradational series, *Paleofavosites* must be redefined. The amended description is a reinterpretation of the genus in terms of the genotype, which has some pores in the walls. If there are more pores in the walls, the species is considered to belong to the genus *Favosites.* This brings *Paleofavosites* into the same relationship to *Favosites* as that of *Emmonsia* (Smith and Gullick, 1925). *Paleofavosites* like many tabulate genera is merely a stage of evolution or a genomorph. This, however, is no reason for discarding the genus, which remains a convenient grouping of species even if it is not, like the ideal genus, monophyletic.

Paleofavosites prolificus (Billings)

Plate IV, figure 1; Plate X, figure 13

Favosites prolificus Billings, 1865, Canadian Nat. Geol., n.s., vol. 2, p. 429. 1866, Cat. Sil. Foss. Anticosti, p. 6. Whiteaves, 1895, Palæozoic Foss., vol. 3, pt. 2, p. 113.

Favosites aspera D'Orbigny (partim.). Lambe, 1899, Contr. Canadian Pal., vol. 4, p. 4, Pl. 1, fig. 2.

Paleofavosites prolificus (Billings). Twenhofel, 1914, Nat. Mus., Canada, Bull. 3, p. 24.

Some confusion exists as to the size of the corallites in this species and its relationship to *P. aspera* and *P. capax.* The descriptions of Billings and Whiteaves place the diameter at 2 mm. Twenhofel includes under this species only specimens with corallite diameters of 1 to 1·5 mm. and assigns those with diameters of 2 to 3 mm. to *P. capax.* Billings' original description of *P. capax* states that the corallite diameter is 4 mm. The relationship of all these species to *P. aspera* is also a problem, for the corallite diameter of this species is quoted as anywhere from 1 to 4 mm. In the Stonewall formation there are two species of *Paleofavosites* with poorly developed septa; one with large and the other with small corallites. It is convenient to designate these as *P. capax* and *P. prolificus* respectively.

Corallum discoidal to hemispherical, reaching 5 mm. in diameter; corallites fairly uniform in size, 2·34 mm. ($s=0 \cdot 22$ mm., $N=10$) in adult diameter, thin walled; pores abundant in the corners, in prominent poral processes[1] that make the wall appear transversely folded at the corners, rare in the walls; septal spines short, rudimentary, in some specimens represented by granules; tabulæ plane, spaced 20 in 1 cm., commonly deflected at the margin.

Transitionary forms between *P. prolificus* and *P. transiens* show an increase in the number of pores in the walls of the corallite. This species is not common in the Interlake group or the Stonewall formation but is abundant in the underlying Stony Mountain formation. In the Interlake group specimens have been identified from the Inwood formation and the East Arm dolomite.

Hypotypes, G.S.C. Nos. 10410 and 11009.

[1]Poral processes are indentations of the wall at the corners of the corallite in which the pores are set. If they are well developed, the wall is corrugated transversely at its edge.

Paleofavosites capax (Billings)

Plate X, figure 12

Favosites capax Billings, 1866, Cat. Sil. Foss. Anticosti, p. 6.
Favosites aspera D'Orbigny (partim.). Lambe, 1899, Contr. Canadian Pal., vol. 4, p. 4,
Paleofavosites capax (Billings). Twenhofel, 1914, Nat. Mus., Canada, Bull. 3, p. 24. 1928, Geol. Surv., Canada, Mem. 154, p. 126.

Corallum discoidal to hemispherical, attaining a diameter of 8 cm. in the specimens in the collections; corallites approximately equal in size, 3.79 mm. (s=0.69 mm., N=37) in adult diameter, commonly six-sided; walls very thin, less than 0.1 mm.; pores in the corners of the corallites only, about 0.1 mm. in diameter, abundant; septa usually absent, rarely developed as short, scattered spines; tabulæ plane.

This species does not penetrate into the Interlake group but is common in the Stonewall formation and the upper members of the Stony Mountain formation. In Anticosti the coral ranges only as high as the Ellis Bay formation. In the Fisher Branch region *P. capax* is commonly found in a light brown, aphanitic dolomite that underlies the Fisher Branch dolomite. In these beds the walls of the corallites have been bent and fractured minutely during preservation.

Hypotype, G.S.C. No. 10493.

Paleofavosites okulitchi nom. nov.

Plate III, figures 4, 6; Plate VIII, figure 3

Favosites intermedius Okulitch, 1943, Trans. Roy. Soc., Canada, sec. IV, p. 70, Pl. I, fig. 16.
(non) *F. intermedius* Stewart, 1938, Geol. Soc. Amer. Spec. Pap. 8, p. 62, Pl. 13, figs. 4, 5.

Corallum hemispherical, as large as 5 cm. in diameter; corallites unequal in size, with many immature ones in any section like *Favosites forbesi;* larger corallites subrounded, 3·73 mm. (s=0·80 mm., N=29) in mean diameter, surrounded by immature corallites, varying in size between coralla as indicated by the large standard deviation; walls thin (0.2 to 0.3 mm.), straight; pores without rims, about 0.2 mm. in diameter, abundant in both walls and corners, more densely spaced (14 in 1 cm.) in the corners, in 2 rows on the walls; septa rudimentary to absent; tabulæ plane, usually marginally deflected, crowded.

The description of the specimens from the Stonewall formation (above) differs from that of the Gunton specimens in two minor details. Most of the younger specimens show 2 rows of pores in the walls yet Okulitch mentions only one row and the holotype (from the Gunton member of the Stony Mountain formation) shows that a single row is the most common condition. The occurrence of 2 rows of pores in one of the corallites of the holotype justifies the inclusion of the Stonewall specimens in this species. The difference between Stonewall and Stony Mountain specimens illustrates the general trend towards more pores in the walls in younger species. The size of the corallites of the Stonewall specimens seems to be slightly larger than those from the Stony Mountain formation but this character shows so much variation in the specimens on hand that the change is probably not significant.

The change in the generic name of this species results from the redefinition of *Paleofavosites* and the change in the specific name from the homonymy of *F. intermedius* Okulitch with *F. intermedius* Stewart.

The species is confined to the Stonewall and Stony Mountain formations.

Hypotypes, G.S.C. Nos. 10404 and 12865.

Paleofavosites transiens sp. nov.

Plate IV, figures 2, 3; Plate VII, figure 9; Plate X, figure 15

Corallum hemispherical, attaining a diameter of 3 cm., or cylindrical, attaining a length of 7 cm.; corallites not very uniform in size; most large corallites six-sided, 1.96 mm. (s=0.24 mm., N=131) in adult diameter; walls straight, thin (0.2 mm.); mural pores abundant both in the walls and corners of the corallites, small, without rims; pores on the wall spaced 8 to 10 in 1 cm. in a single row or irregularly scattered; pores in the corners on small poral processes, spaced about 14 in 1 cm.; septal spines short, commonly inconspicuous, in many series on the wall; tabulæ plane, spaced normally.

This species is distinguished from *P. okulitchi* principally on the size of the corallites. From other described species of *Paleofavosites* and *Favosites*, *P. transiens* differs in having the pores almost equally distributed on the walls and in the corners of the corallites. A frequency plot of 131 measured corallite diameters showed a bimodality that suggested that two variations of the species are present. An attempt was made to divide the specimens so as to produce two unimodal distributions but the division made did not eliminate the bimodality of one of the samples.

Paleofavosites transiens is the most abundant coral in the middle formations of the Interlake group. It ranges from the Fisher Branch dolomite to the Cedar Lake dolomite and reaches its acme in the Cross Lake member of the latter formation. It does not appear in the Chemahawin reefs. There is some evidence that in Manitoba *Paleofavosites transiens* was an outgrowth of the *P. prolificus* stock and gave rise to *F. niagarensis*.

Holotype, G.S.C. No. 10490; paratypes, G.S.C. Nos. 10405 and 10487.

Paleofavosites poulseni Teichert

Plate IV, figures 6, 11; Plate X, figure 16

Paleofavosites poulseni Teichert, 1937, Rept. 5th Thule Exped. 1921-24, vol. 1, No. 5, p. 130, Pl. 6, fig. 1.

Corallum hemispherical, in some specimens depressed, rather large, in fragments on hand commonly 8 cm. in diameter; corallites uniform in size, 1.66 mm. (s=0.22 mm., N=31) in adult diameter, commonly hexagonal in cross section; wall variable in thickness from 0.1 mm. to 0.2 mm. in different specimens; pores abundant in the corners, rare in the walls, 0.1 mm. in diameter, without rims, 8 to 10 occurring in 5 mm. in poorly developed poral processes; septal spines well developed, reaching in well-preserved specimens 0.5 mm. towards the centre, in 12 or 18 rows, slightly inclined upward; tabulæ rather densely spaced up to 45 in 1 cm., usually 30 in 1 cm., commonly sinuous, more rarely inosculating and incomplete.

This species differs from *P. aspera* in the regular development of the septa in series, the slightly larger corallites, and the regularity of the corallites. From *P. prolificus* it differs in the better development of the septal spines. The Manitoba specimens differ from Teichert's description only in the spacing of the tabulæ. In Manitoba, this species is characteristic of the Stonewall and Fisher Branch formations but ranges up to the Inwood formation in the sink at Sandridge. It is very abundant in the porous dolomites exposed at Mile 26.9 of the Flin Flon highway and at Mile 19 of the Flin Flon railway.

It appears that *P. poulseni* has descended from *Angopora manitobensis* in Stonewall time as transitional forms are found when both occur at the same locality. By the breaking up of the septal laminæ into spines and the spreading of the spines along the length of the corallite, *Angopora* is transformed into *Paleofavosites.*

Hypotypes, G.S.C. Nos. 10483, 10500, and 11023.

Paleofavosites poulseni minor subsp. nov.

Plate IV, figures 9, 10

Corallum irregular to discoidal, known only from a few fragments; corallites uniform in size, in adult diameter 0.89 mm. (s=0.17 mm., N=12); walls thin, straight; pores generally in the corners, rarely in the walls, in poorly developed poral processes; septal spines numerous, in about 12 rows; tabulæ sinuous, about 30 occurring in 1 cm.

This subspecies differs from *P. poulseni* only in having a smaller corallite diameter and a different growth habit. *P. poulseni minor* is a geographical subspecies for it has been found only in the Fisher Branch dolomite at Grand Rapids. It differs from *P. arcticus* Poulsen in its poorer development of poral processes and its abundance of spine septa. From *P. nina* Tchernychev it may be distinguished by the uniformity of the corallites and the lack of well-defined poral processes.

Holotype, G.S.C. No. 10492; paratype, G.S.C. No. 11008.

Paleofavosites kirki sp. nov.

Plate VII, figures 1, 3, 10, 11

Corallum discoidal, usually somewhat irregular, up to 8 cm. in diameter, 1 to 2 cm. thick; corallites of nearly uniform size, 1.81 mm. (s=0.26 mm., N=46) in adult diameter; walls relatively thick (0.1 mm.), locally thickened probably owing to recrystallization around the base of septal spines, locally corrugated longitudinally, straight in parts of the corallum; pores in both walls and corners of the corallites, more abundant in the latter locus but not uncommon in the former, small, 0.1 mm. in diameter, round; poral processes poorly developed; septal spines well developed, projecting about half the way to the axis of the corallite, in about 12 rows, slightly inclined upward; tabulæ irregular, may be convex or sinuous, spaced about 20 to 30 in 1 cm.

Only one other described species of *Paleofavosites* is known to the writer that shows a longitudinally corrugated wall. *P. kirki* differs from this species (*Favosites marginatus* Hill) in the smaller size of its corrallites, its larger septa, and the presence of pores in some of the walls.

P. kirki is common in the Fisher Branch dolomite in many localities along the outcrop belt from south of Narcisse to Mile 24 on the Churchill branch of the Canadian National railway. It is also found in the Inwood formation and the type locality is in this formation on the south shore of Grand Rapids at the base of the upper member. In the Moose Lake dolomite a coral has been found that is assigned to this species but is transitional to *Corrugopora praecursor*. This specimen is characterized by a highly folded wall, well-developed spines, and pores in the walls of the corallites.

P. kirki is named in honour of S. R. Kirk whose early work in the Palæozoic rocks of Manitoba has shown the way for later studies.

Holotype, G.S.C. No. 11005; paratypes, G.S.C. Nos. 11044 and 11045.

Paleofavosites groenlandicus Poulsen

Plate VII, figure 8

Paleofavosites groenlandicus Poulsen, 1941, Medd. Grønland, vol. 72, No. 2, pp. 21-22, Pl. 3, fig. 12, Pl. 4, figs. 1-3.

Corallum hemispherical, 3 to 4 cm. in diameter; corallites unequal in size, not so much so that the larger corallites are subrounded, 1.98 mm. ($s=0.30$ mm., $N=18$) in adult diameter; walls thin, straight; pores not abundant, commonly rimmed, both in the corners and walls, more common in the corners; septal spines well developed, short, closely set, arranged in many rows in some corallites, in others without arrangement, extending 0.6 mm. towards the axis of the corallite, generally shorter; tabulæ plane or concave, rather remote.

This species is distinguished by its densely set, short septa and its pores. The Manitoban forms differ from Poulsen's only in their less prominent poral processes. *P. groenlandicus* occurs only in the Fisher Branch formation at Grand Rapids and 8 miles northwest of Fisher Branch. This species was originally described from the Offley Island formation of North Greenland.

Hypotype, G.S.C. No. 11022.

Genus, *Alveolites* Lamarck

Alveolites cf. *labechei* Milne-Edwards and Haime

A single specimen from the East Arm dolomite is doubtfully referred to this species because its preservation is such that neither pores, tabulæ, nor septa can be satisfactorily determined. The corallum is about 20 mm. in diameter, 0.5 mm. thick, and consists of a single layer of corallites inclined to the base. The apertures of the corallites are lunate and have a long diameter of about 0.5 mm.

Genus, *Multisolenia* Fritz

The writer has collected several specimens of this interesting genus from the Cross Lake, East Arm, and Fisher Branch dolomites. The specimens from the Cross Lake beds are well preserved and the matrix filling the corallites has been removed so that the structure may be examined in three dimensions. This material has led the writer to a different interpretation of the structure of the genus than Fritz's, which was based on a thin section study.

Amended Generic Analysis. Favositidae similar in structure to *Paleofavosites* or *Favosites* but in which the diameter of the mural pores is nearly that of the corallites and in which the pores are situated on large poral processes. The corallites appear in transverse section to inosculate.

In transverse section the corallites are irregular and of meandering pattern because they appear to be confluent where the section passes through a large pore. Several corallites may appear to be joined together in this manner. There is no evidence in the sections examined by the writer that the septa play any part in the increase.

Longitudinal sections show the walls of the corallites to be fairly straight, if the plane of section passes between poral processes. If the section passes close to a line of pores, the wall zigzags conspicuously and, if it passes through the pores, the locus of the wall is represented by a series of circles that are the poral processes. These processes, which appear to connect the corallites as tubes but actually only interpenetrate from one corallite to another, were called "solenia" by Fritz. The structure is that of the Favositidae as was recognized by Tchernychev but is so different from the normal structure of *Favosites* and *Paleofavosites* that species showing it are best removed to the new genus *Multisolenia*.

In the genus as redefined, two species may be placed definitely and a third tentatively. The first is the genotype, *M. tortuosa* Fritz. The second is a new species to be described from the Fisher Branch dolomite, *M. confluens* Stearn. The third is *Favosites inosculans* Nicholson from the Devonian of France (LeMaître, 1931). The genus shows some similarity to *Sapporipora* Ozaki but does not have the pores in the walls of the corallites nor the method of gemmation of this coral.

Multisolenia tortuosa Fritz

Plate V, figures 1-4

Multisolenia tortuosa Fritz, 1937, Jour. Paleontology, vol. 11, p. 233, Pl. 1, figs. 1-4, 1939, Jour. Paleontology, vol. 13, pp. 512-13, Pl. 59, figs. 3-4.

Paleofavosites mirabilis Tchernychev, 1937, Silurian and Devonian Tabulates of Mongolia and Tannu Tuva, p. 13, Pl. 2, figs. 1a-1e, 1937, Trans. Arctic Inst. Leningrad, vol. 91, pp. 86, 117, Pl. 7, figs. 4a-4c.

Corallum hemispherical to plate-like, several centimetres in diameter, massive, consisting of corallites in contact along their whole length; corallites of irregular shape, roughly polygonal, about 0.5 mm. in diameter; walls curved to straight; pores very large, nearly three-quarters diameter of corallites, situated on exaggerated poral processes that interlock along the corners of the corallites, round, densely set, 5 in 4 mm.; septa sparsely scattered as stout spines reaching 0.1 mm. into the corallites; tabulæ complete or abutting against each other, convex upward.

The appearance of this coral in section is described fully under the generic analysis.

There is some confusion as to the priority of name for this species for the exact time when the Russian report was published is not known. Until further evidence of priority is uncovered, Fritz's specific name is adopted with the generic name. *M. tortuosa* may be distinguished from *M. confluens* Stearn by the smaller size of its corallites and by its septa. It differs from *M.* (?) *inosculans* (Nicholson) in its complete tabulæ and septal spines. In the Interlake group *M. tortuosa* is found in the East Arm dolomite and the Cross Lake member of the Cedar Lake formation. The species is apparently widespread in the boreal Silurian for it is now known from Novaya Zemlya, Mongolia, Lake Timiskaming, and Manitoba. In Canada the species appears to be confined to the Clinton series.

Hypotypes, G.S.C. Nos. 10485, 10486, and 11046.

Multisolenia confluens sp. nov.

Plate V, figures 6-8

Corallum flattened, discoidal, known only from fragments the largest of which is 4 cm. in longer dimension; corallites uniform in size, small, 1.07 mm. (s=0.16 mm., N=15) in adult diameter, in cross section rarely polygonal, commonly oval, more commonly between two extremes; walls gently curved, thin; pores large, attaining a diameter of 0.5 mm., situated at the corners of corallites in deep poral processes that cause the wall at the corners to be folded transversely, in transverse section appearing to make corallites inosculate where the plane of section passes through, spaced 16 in 1 cm.; septa not observed, probably absent; tabulæ complete, flat, horizontal, remote, spaced 15 in 1 cm.

The confluent nature of the corallites in this species is very striking and some corallites may be traced into 5 others in a transverse section. The size of the corallites and absence of septa separate this species from *M. tortuosa.* It differs from *M.* (?) *inosculans* (Nicholson) in the larger size of its corallites and their rounded cross section.

This coral is found in the Fisher Branch dolomite at a few localities. The type locality is the NE. corner, l.s. 1, sec. 8, tp. 25, rge. 2, W. Prin. mer.

Holotype, G.S.C. No. 10412; paratypes, G.S.C. Nos. 10419, 10495, and 10496.

Genus, *Angopora* Jones

Laminopora Jones (preoccupied), 1930, Abs. Dissertations Cambridge U. 1928-29, p. 35.

Angopora Jones, 1936, Ann. Mag. Natr. Hist., 10th ser., vol. 17, p. 20, Pl. 2, figs. 4-7, Pl. 3, figs. 1-2

"Tabulate coral resembling *Favosites* but with discontinuous lamellar septa which break up into spines along their axial edges" (Jones). The genotype is *A. hisingeri* Jones, which Lang, Smith and Thomas (1940) state is the same as *Agaricia swinderniana* Goldfuss (1826), the genotype of *Thecia* Milne-Edwards and Haime. This is puzzling for the original generic analysis of *Thecia* is much different from that of *Angopora* and includes lateral union of the septa by calcareous deposits.

Angopora manitobensis sp. nov.

Plate IV, figures 4, 5, 8; Plate V, figure 5

Corallum hemispherical, up to 4 cm. in diameter, known only from fragments; corallites uniform in size, 1.89 mm. (s=0.23 mm., N=17) in adult diameter, polygonal; walls straight, variable in thickness within coralla, about 0.1 mm. thick in corallites with septa, thinner in corallites without septa; pores abundant in the corners of corallites, rare in walls, approximately 0.1 mm. in diameter; septa locally well developed, locally completely absent, typically coherent laminæ projecting about 0.2 mm. into the corallites; not spinose on their inner margins, passing longitudinally into rows of spines; tabulæ plane, spaced 20 to 30 in 1 cm.

The greater size of the corallites and the shortness of the septa of *A. manitobensis* distinguish it from *A. hisingeri* Jones. The corallites are larger and the pores smaller than those of *A. jonesi* Regnell. *A. manitobensis* is confined to the Stonewall formation but is areally widespread in Manitoba. The type locality is the upper dolomite beds at the Stonewall quarries.

Holotype, G.S.C. No. 11048; paratypes, G.S.C. Nos. 10407, 11007, and 11041.

Genus, *Corrugopora* gen. nov.

Corallum ceriod; corallites prismatic, slightly rounded in cross section; wall folded longitudinally producing 12 indentations into each mature corallite; septa narrow lamellæ on the crest of each fold, discontinuous in some species; mural pores in the walls, small, round; tabulæ plane, complete.

Although several favositids have been described as having lamellar septa, *Corrugopora* differs from all these genera in the corrugation of the wall and the relation of the septa to these folds. The original description of *Nyctopora* Nicholson is very similar to that of *Corrugopora* but the two cannot be considered synonymous in the light of the many revisions of the genus, all of which refute the presence of mural pores (Lambe 1899; Bassler, 1932, 1950). The new genus may be distinguished from *Angopora* Jones by the lack of spines along the septa as well as by the folding of the wall. Indeed, the septa do not seem to have had their origin in the coalescence of the base of the spines but appear to have been the result of the infolding of the wall. The initial condition is shown by *C. praecursor* in which the lamellar septa appear only in places. Infolding of the polyp wall in these places has reached such a stage that the layers of ectoderm, instead of secreting a wall, secrete a plate. There are scattered septal spines in this species but they appear to bear no relation to the septal lamellæ as do those of *Angopora. Boreaster* Lambe has 12 lamellar septa but they are in 2 cycles and the secondary 6 are poorly developed. Another tabulate in this group is *Laceropora* Eichwald, which has a highly porous wall, a ramose corallum and septa that have no spines. The genotype is *Corrugopora rhabdota.*

Corrugopora rhabdota sp. nov.

Plate VI, figures 5-7, 9

Corallum hemispherical, 3.5 cm. by 6.5 cm. in the largest specimen; corallites unequal in size; mature corallites surrounded by immature corallites, subrounded in cross section, 2.45 mm. (s=0.24 mm., N=22) in diameter; walls thin (0.1 mm.), intensely longitudinally corrugated; pores in longitudinal rows between the septa, small, numerous, commonly in 2 rows to each wall, only seen satisfactorily in section; septa continuous lamellæ following the crest of each infold, projecting 0.2 to 0.3 mm. into the corallites, marked by an axial lamella that is joined to that of the wall; septal spines scattered over walls and lamellæ alike, rarely forming along the inner margin of the lamellar septa; tabulæ plane or slightly curved, strongly deflected at the margins in crossing the septa so that the funnel-shaped depressions may invaginate with the ones below; tabulæ spaced 20 to 30 in 1 cm.

The continuity of the septa serves to distinguish this species from *C. praecursor* but gradational forms may be hard to place. *C. rhabdota* makes its appearance in the East Arm dolomite and recurs in the Chemahawin member of the Cedar Lake formation. The type locality is Mile 5.5 on the Churchill branch of the Canadian National railway.

The trivial name refers to the fluted appearance of the interior of the corallites.

Holotype, G.S.C. No. 10406; paratypes, G.S.C. Nos. 10401 and 10481.

Corrugopora praecursor sp. nov.

Plate VII, figures 2, 4, 7

Corallum hemispherical, about 4 cm. in diameter; corallites unequal in size; mature corallites surrounded by immature corallites, subrounded, 2.56 mm. (s=0.21 mm., N=12) in diameter; walls weakly corrugated longitudinally; pores in the walls, rimless, round, commonly in 2 rows, spaced 15 in 1 cm.; septa discontinuous ridges on the crests of infolds on the wall, rarely projecting over 0.1 mm. from the wall, locally completely absent; septal spines rudimentary, small, scattered in no arrangement on the wall, not crowded on the infolds; tabulæ plane, slightly marginally deflected, spaced 20 in 1 cm.

This species may represent the link of *Corrugopora* with *Paleofavosites*. The stratigraphic relations and the morphology suggest that it is related to *P. kirki* and may be an outgrowth of that species. *C. praecursor* occurs in the same formation as *C. rhabdota* but not at the same locality and appears to have given rise to the species. *C. praecursor* is confined to the East Arm dolomite and occurs at Reader Lake and on the East Arm of Moose Lake. The small point on the southeast shore of Reader Lake is the type locality.

Holotype, G.S.C. No. 10402; paratypes, G.S.C. Nos. 11010 and 11060.

Genus, *Striatopora* Hall

Striatopora robusta sp. nov.

Plate VIII, figures 1, 2, 5

Corallum cylindrical, dichotomously branching, composed of stems laterally compressed in the plane of branching and about 9 mm. in long diameter; corallites arising in the axis of the stems and bending out abruptly to meet the surface at right angles, polygonal, approximately uniform in size, 1.56 mm. ($s=0.56$ mm., $N=10$) in diameter; walls thin in the interior, thickening as the corallites bend outward, restricting apertures at the surface to half corallite diameter; calyx funnel-shaped, striated by 12 grooves that leave between them depressed septa; pores rather large, in one row in each wall, with slightly raised rims; tabulæ thin, horizontal, plane, in the central part spaced 20 in 1 cm., much crowded at the periphery so as to produce with the stereoplasmic thickening of the walls, a rind of dense material equal in thickness to one-half to one-third of the radius of the stem; septal spines absent in the interior or represented by scattered granules.

In general, members of this genus from America have thin coralla and corallites opening obliquely at the surface, but Russian and northern European species have thicker stems and corallites opening at right angles to the surface. *Striatopora robusta* belongs to the latter group. *S. robusta* differs from *S. mutabilis* Tchernychev in its smaller and more uniform corallites. It may be distinguished from *S. arctica* Tchernychev by the poorer development of stereoplasm at the periphery and the stronger development of its tabulæ.

S. robusta has been found in the East Arm dolomite only at the south side of the entrance to Crossing Bay, Moose Lake.

Holotype, G.S.C. No. 10488; paratype, G.S.C. No. 10491.

Range and Relationship of the Favositidae. The stratigraphic range of the species of the Favositidae in the Late Ordovician and Middle Silurian of Manitoba is illustrated in Figure 3. The species have been grouped laterally according to the locus of the mural pores. The trend of evolution of the pore locus from the corners to the walls is illustrated by this diagram

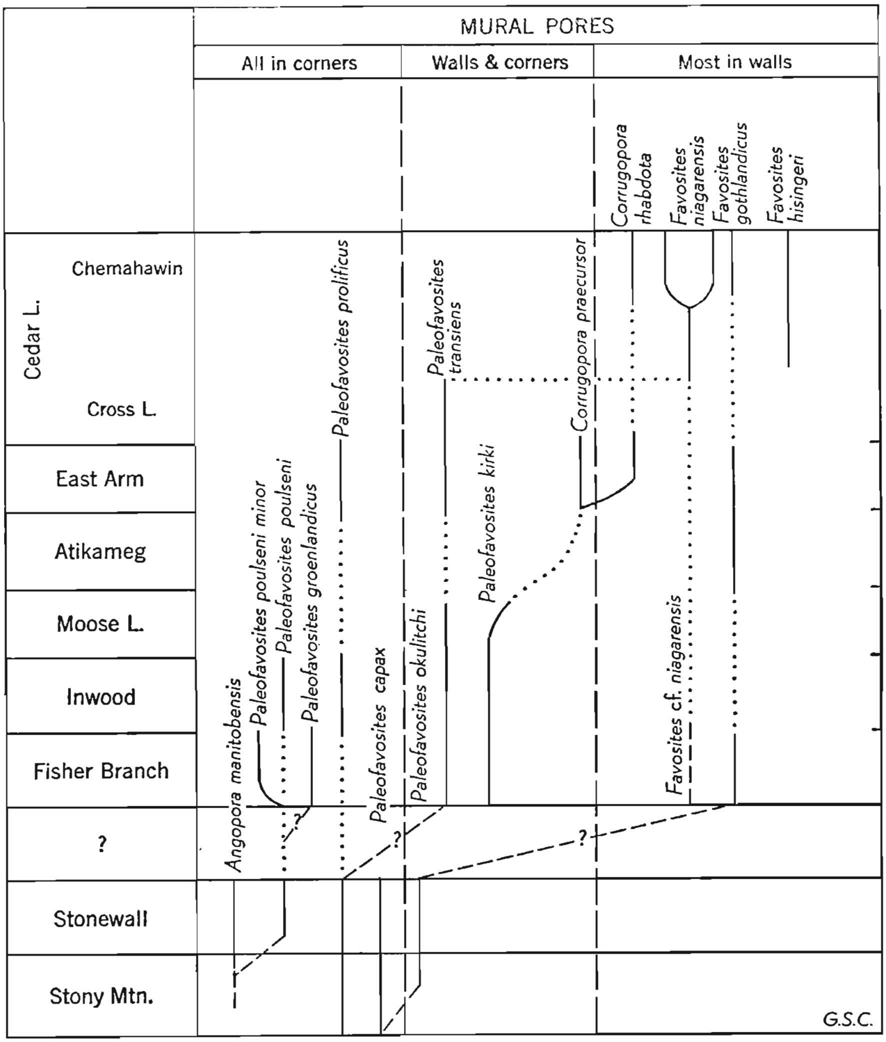


Figure 3. Range diagram of Favositidae.

and an attempt has been made to connect species in an ancestor-descendant relationship. The connecting lines have been drawn in a few cases on the basis of gradational forms (e.g., between *Angopora manitobensis* and *Paleofavosites poulseni*) but most have been drawn on the basis of two assumptions; (1) The size of the corallites has either increased or been stable; (2) Reduction of spine septa or septal stability has been more common than septal development. Increase in size is a common evolutionary change in animals and has been noted in the Favositidae (Tripp, 1933). Septal reduction appears to have taken place in the transition from *Paleofavosites poulseni* to *P. groenlandicus* and from *P. kirki* to *Corrugopora,* but in general, as the diagram suggests, the evolution of the Favositids with well-developed septa seems to be separate from that of those with poorly developed septa. Two lineages of Favositids with poorly developed septa can be differentiated on the size of the corallites (*prolificus-transiens-magarensis* and *capex-okulitchi-gothlandicus*). The diagram illustrates the evolutionary trend in the Interlake Favositids from those with pores in the corners, through those with pores in the corners and the walls, to those with pores only in the walls. The range of true *Favosites* is greater than is indicated in the diagram, as *F. forbesi* occurs in the Upper Ordovician of Anticosti.

Family, Halysitidae

Genus, *Halysites* Fischer von Waldheim

Halysites catenularia (Linnaeus)

Tubipora catenularia Linnaeus, 1797, Syst. Natr., 12th ed. p. 1270.
Halysites catenularius (Linnaeus). Thomas and Smith, 1954, Ann. and Mag. Natr. Hist., vol. 7, ser. 12, p. 766, Pl. XX, figs. 1a-c. Buehler, 1955, Peabody Mus. Natr. Hist. Bull. 8, p. 28.

Corallum fasciculate, composed of long cylindrical corallites; corallites oval in cross section, joined to each other in chain-like series so as to form vertical, anastomosing lamellæ enclosing interspaces of large size, thick-walled with a mean long diameter of 2.0 mm. (s=0.2 mm., N=16), separated by small, non-septate tubules 0.5 mm. in diameter; septa developed as 12 rows of spines, commonly joined in recrystallization to form low ridges; tabulæ flexuous, convex, or plane in the corallites, spaced about 20 in 1 cm., in the tubules highly convex and crowded.

These specimens resemble *Halysites labyrinthica* as described by Buehler. However, the specimens are referred to *H. catenularia* as the long diameter of their corallites is closer to that of this species. The two species appear to differ only in this respect. *H. catenularia* is found in the beds from the base to the top of the Interlake group. It is particularly abundant in the Cross Lake and Chemahawin members of the Cedar Lake formation.

Halysites compactus Rominger

Halysites compactus Rominger, 1876, Geol. Surv., Mich., Foss. Corals, p. 78, Pl. 29, fig. 3. Buehler, 1955, Peabody Mus. Natr. Hist. Bull. 8, p. 41, Pl. 4, figs. 5, 6, Pl. V, figs. 2, 3.

Corallum fasciculate, composed of cylindrical corallites joined along 2 of their edges; 'chains' of corallites joined after a short distance apart so that interspaces are reduced to a diameter no greater than that of the corallites, rarely eliminated entirely where the corallites are in contact on all sides; corallites oval in section with a mean long diameter of 1.4 mm. (s=0.1 mm., N=10), thick-walled; septa present as spines in rows on the corallite wall; no tubules between corallites observed even in thin section; tabulæ horizontal, flexuous, spaced about 15 in 1 cm.

This coral occurs at only a single locality, at the foot of Grand Rapids in the Fisher Branch dolomite.

Subclass, **Schizocoralla**

Family, HELIOLITIDAE

Genus, *Lyellia* Milne-Edwards and Haime

Lyellia affinis (Billings)

Plate 6, figure 3

Heliolites affinis Billings, 1865, Can. Natr., n.s., vol. 2, p. 427.
Lyellia affinis (Billings). Lambe, 1899, Contr. Can. Pal., vol. 4, p. 84, Pl. 5, figs. 1, 1a.
Whiteaves, 1906, Palæozoic Foss., vol. 3, pt. 4, p. 293.

Corallum small, hemispherical to pyriform, attaining a diameter of about 8 cm.; corallites circular, about 1.5 mm. in diameter, in contact or at distances up to one-half their diameter; walls rarely crenulated; interstitial spaces filled with vesicular tissue of small more or less convex plates; septa rudimentary 12 in number, appearing as slight ridges on the corallite wall, represented on the surface of the corallum by 12 tubercules; tabulæ complete, horizontal, closely set.

Lyellia affinis is abundant in the Fisher Branch formation, recurs in the East Arm dolomite and the two reefy members of the Cedar Lake formation and has been reported by Tyrrell from beds of the Atikameg dolomite.

Hypotype, G.S.C. No. 10413.

Subclass, **Zoantharia**

Order, TETRACORALLA

Suborder, **Zaphrentoidea**

Family, ZAPHRENTOIDIDAE

Genus, *Neozaphrentis* Grove

Neozaphrentis Grove, 1935, Am. Midland Natr., vol. 16, pp. 358-360.

"Small to large, conical to subcylindrical solitary corals, curved to nearly straight. Exterior rugose and may be concentrically wrinkled and undulatory; often annulated from rejuvenation or periodic growth. Calyx shallow to deep. Septa variable in thickness, smooth, non-carinate, straight or distally wavering; in two cycles but the secondaries may be rudimentary. Not more than 60 major septa, not marginally retracted, extending to the centre of the calyx where they may fuse, or disappearing a short distance before reaching the centre, which is then occupied by a small open or tabulated area, cardinal septum recessive in post-neanic stages, cardinal fossula well developed, variable in position, subcentral or extending to the margin. Tabulæ few or numerous, partitioning the whole of the corallum; dissepiments few and not arranged in definite zones. No columella or central columelloid structure resulting from the fusion of the septa" (Grove).

Most of the large corals in the Interlake group are of the zaphrentoid type. Although there have been many revisions of the Carboniferous species, the position of the Silurian members of the group is not as yet clear. Among those who have discussed the genus *Zaphrentis* in the last 50 years are: Simpson (1900), O'Connell (1913), Grove (1935), Schindewolf (1938), Stewart (1938), Lang, Smith and Thomas (1940), Wang (1950). The latest revision does not recognize the genus *Zaphrentis* and confines the similar genus *Zaphrentoides* to the upper Palæozoic. O'Connell has restricted the genus to those species with carinæ on the septa. Grove proposed the genus *Neozaphrentis* to include zaphrentids that have the simple structure of the species formerly referred to *Zaphrentis* but without carinæ. He indicated that the new genus ranged from Silurian to Permian. Wang has placed *Neozaphrentis* in synonymy with *Zaphrentoides* which is not present in the Silurian. The zaphrentids under study would fit Wang's diagnosis of *Zaphrentoides,* but rather than place them in a genus recognized as of Carboniferous age, the author has taken the conservative view and used Grove's genus.

Some species here referred to *Neozaphrentis* have septa slightly swirled at the centre, and in this resemble the genus *Dinophyllum* Lindstrom from the Silurian of Gothland. This coral has septal structures that place it in the order Streptelasmacea. Although in gross form the Interlake species differ from *Dinophyllum* in having no columella formed by the involution of the septa, thin sections suggest that their septa are composed of trabeculæ invested in lamellar tissue, a structure more reminiscent of *Dinophyllum* than *Zaphrentoides*. The septal structure of Silurian zaphrentids needs further investigation with better preserved material than is available in Manitoba. Such a study may show that the Silurian members of the genus *Neozaphrentis* should be transferred to the family Dinophyllidae.

Neozaphrentis manitobensis sp. nov.

Plate IX, figures 1, 2, 4; Figure 4, 2a-d

Corallum of medium size, trochoid, slightly curved, reaching a diameter of 3 cm. and a length of 5 cm., more commonly 1 cm. in diameter and 2 cm. long; exterior surface covered with septal grooves and transverse low ridges of growth; calyx flat or slightly concave at base, showing prominent cardinal fossula and septa reaching the centre on its floor, of unknown depth; primary septa thick in all sections, commonly bearing prominent axial light lamina, thinning toward centre where they commonly join, conspicuously swirled leaving a small open space in the centre, in number about 26, showing no acceleration; fossula and tetrameral symmetry generally obscured by the swirling in all but earliest sections;

secondary septa absent, even high in calyx; tabulæ broadly arched upward at the axis and deflected at the margin, mostly complete, spaced about 7 in 1 cm.

The developmental stages of this species are shown in the series of drawings (Figure 4). At all stages the septa are thick and almost fill the interseptal space. In the first section there appear to be about 21 septa with a tetrameral symmetry but no well-developed fossula. Many of the septa abut against each other. The progressive development of the swirling may be seen in the following sections. The close spacing of the septa on the right of the drawing makes the determination of septal formulæ difficult at this stage. The topmost section illustrates the full complement of 26 septa. The septal formula near the base of the calyx varies somewhat being C5A6K5A5C, C6A5K5A6C, or C6A6K6A6C.

The species *Neozaphrentis manitobensis* may be distinguished from others in the Interlake group by the length of the septa, their twisting in the centre, and the lack of secondary septa. Unlike some other Silurian zaphrentids, the swirling of the septa is not sufficient to produce a spongy axial column. The new species is similar to *Zaphrentis anticostiensis* Twenhofel in the swirling of the septa but differs in having no secondary septa nor any dissepiments at the base of the corallum.

A single specimen from a locality 4 miles south of Narcisse differs considerably from the above description. It is 3 cm. in diameter and has the whole corallum, except for the top of the calyx and basal tip, preserved. The calyx contains 36 primary septa, which do not reach the centre but leave a central tabulated area. Secondary septa are well developed and there is some indication of a fossula. These characters are not those of typical *N. manitobensis* yet a section lower in the corallum shows the thick swirled septa that distinguish this species. It seems probable that this is a more mature individual than the rest and had the other coralla continued their development they would have attained this form.

This species is found in the Cross Lake and Chemahawin members of the Cedar Lake formation and in the Fisher Branch dolomite. The types are from the Chemahawin dolomite on highway 6, southwest of Fairford, and the Cross Lake member at Crossing Bay, Moose Lake, and at Cross Lake Rapids.

Holotype, G.S.C. No. 10416; paratypes, G.S.C. Nos. 10415, 10489, and 11033.

Neozaphrentis tyrrelli sp. nov.

Plate IX, figures 3, 7; Figure 4, 3a-e

Corallum trochoid, slightly curved, attaining a diameter of 3 cm. and a length of at least 7 cm., known only from fragments; exterior surface covered with fine septal grooves, commonly free of transverse ridges other than very fine lines of growth, rarely showing broad rugæ; calyx flat-bottomed, floored by septa that leave a central tabulated area, showing an inconspicuous fossula, depth in mature specimens unknown, but in immature coralla about twice the diameter; primary septa thick at early stages,

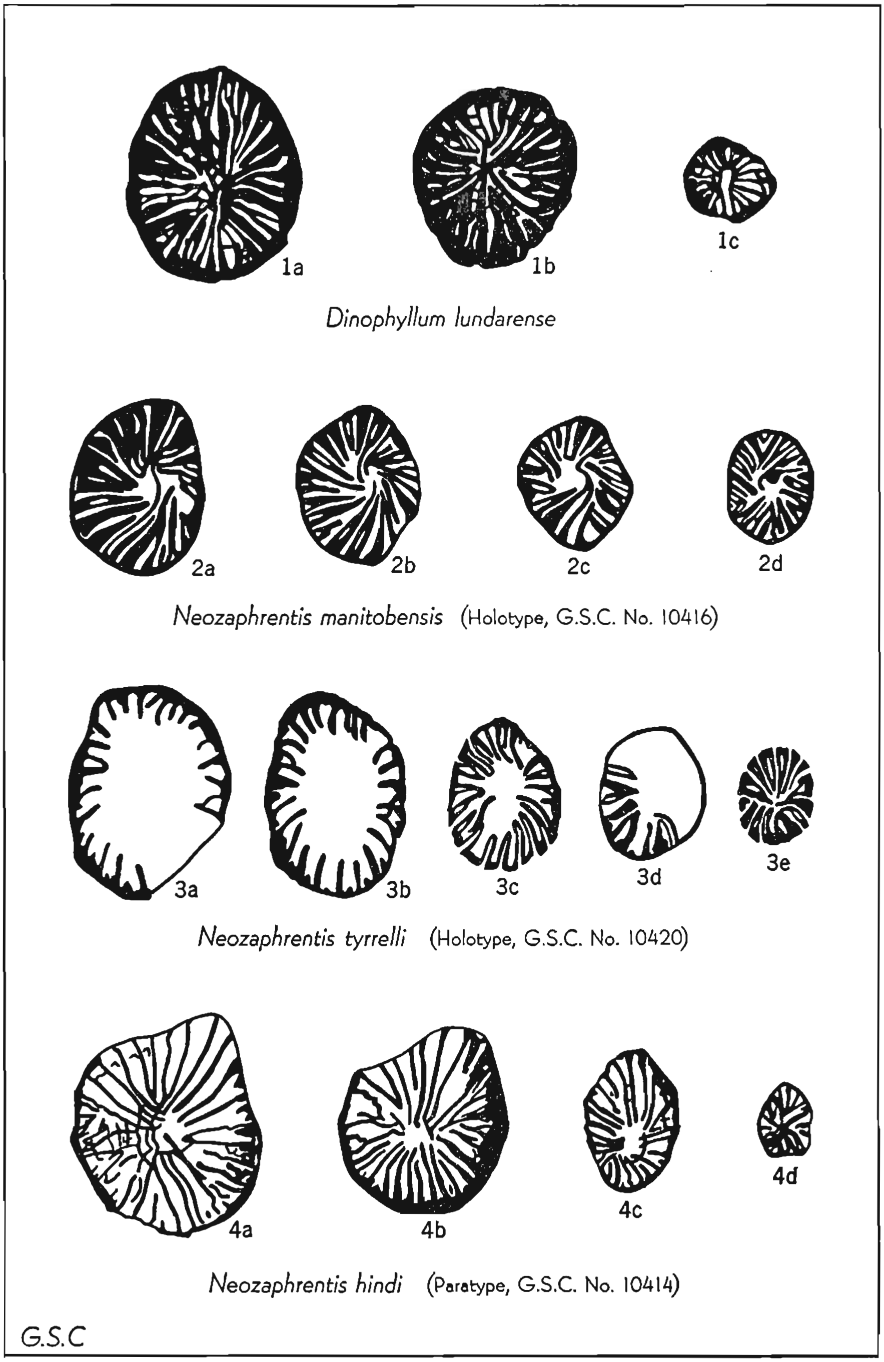


Figure 4. Serial sections of Tetracorals.

thinning at base of calyx, commonly marked by central light lamina, slightly sinuous in transverse section but showing no swirling of the axial edges, not reaching centre in any but earliest stages, 30 in number in large coralla, in smaller ones commonly 28 in number, not accelerated; fossula poorly marked; secondary septa developed early but not gaining prominence until near the base of calyx, subequal to primary septa on calicular wall; tertiary septa form as small ridges about 1 mm. deep on the walls of the largest calices; tabulæ thin, widely spaced (about 5 in 1 cm.), horizontal or concave, showing a tendency to rise at the margins rather than deflect, generally complete but may inosculate.

The stages of development of an immature corallum are shown in Figure 4. Only in the basal figure do the septa reach the centre. In the next higher section a fossula is evident in which may be seen the aborted cardinal septum. Thereafter the tetrameral symmetry and fossula become more obscure and the septa retreat farther from the axis. In all the sections the septa appear slightly sinuous.

N. tyrrelli is distinguished from other members of the genus in the Interlake group by the shortness of its septa, their generally straight course, and the concavity of the tabulæ. The smoothness of the exterior serves to distinguish this species from many others with conspicuous rugæ. Of the described Silurian species whose septa do not meet in the centre, *Zaphrentis keyserensis* Swartz and *Z. roemeri* Milne-Edwards and Haime have a more rugose exterior and the latter has more closely spaced tabulæ. *N. tyrrelli* has a less prominent fossula and fewer septa than *Zaphrentis latisinus* Hall. Its trochoid shape distinguishes it from *Z. patens* Billings.

N. tyrrelli is found in the Fisher Branch dolomite and the Inwood formation. The types are from the Fisher Branch dolomite on l.s. 9, sec. 31, tp. 25, rge. 2, W. Prin. mer., and from the Inwood formation $\frac{1}{4}$ mile west of the shore of Lake Winnipeg, 4.5 miles north of Grand Rapids.

Holotype, G.S.C. No. 10420; paratype, G.S.C. No. 10422.

The species is named in honour of J. B. Tyrrell whose early explorations through Manitoba before the turn of the century outlined the geology of this region.

Neozaphrentis hindi sp. nov.

Plate IX, figures 5, 6; Figure 4, 4a-d

Corallum trochoid, gently curved, large, attaining a diameter of about 3 cm. and a length of about 5 cm.; exterior surface covered with septal striations and fine growth lines, generally without rugæ; calyx probably floored by septa that reach the centre and swirl slightly, with an inconspicuous fossula; wall rather thin; primary septa thin, especially near the calyx, flexuous, the larger ones reaching the centre, uniting and swirling slightly, 32 in number commonly but as many as 38 in large specimens; showing tetrameral symmetry only in early stages; fossula never prominent; acceleration not noticed; secondary septa introduced just below the calyx; rapidly becoming prominent, subequal to the primaries in the calyx; tabulæ well developed, downwardly deflected at their margins, in some cases inosculating, spaced about 15 in 1 cm.

The development of septa in this species is shown in Figure 4. Near the base the tetrameral symmetry is apparent and the septa are thin and marked by a prominent axial lamina. Many of them join their neighbours so that only the major ones fuse in the centre. In higher sections the number of septa increases and the symmetry becomes less distinct. The major septa still meet in the centre and now show a tendency to swirl slightly and tangle along the axis. As the swirling develops the secondary septa become evident and reach prominence as the primary septa part at the base of the calyx. The topmost section shows the primary septa to be 29 in number.

The distinctive character of this species is the thin septa that form a twisted mass in the centre not dense enough to result in a columella. The thinness of the septa is such that they are commonly crushed during preservation. This species is similar to *Zaphrentis subvesicularis* Hall from the Niagaran rocks of Indiana but has a smoother surface and more strongly developed septa. In comparison with *Z. anticostiensis* Twenhofel, *N. hindi* has more conspicuous secondary septa and no dissepiments. Superficially the new species resembles *Z. stokesi* Milne-Edwards and Haime but contains only half the number of septa of that species.

N. hindi is most widespread in the Stonewall formation and more restricted in the Fisher Branch formation and the Inwood formation. It is one of the few species that are common to the Stonewall formation and the Interlake group. The types are from the Stonewall formation at Mile 25.5 of the Flin Flon highway and the Inwood formation at Grand Rapids.

Holotype, G.S.C. No. 10421a; paratypes, G.S.C. Nos. 10414 and 10421b.

This species is named in honour of H. Y. Hind, one of the early geologists and explorers who traversed this area.

Neozaphrentis symmetricus sp. nov.

Plate IX, figure 13

Corallum known only from fragments, reaching a diameter of 2 cm. and a length of several centimetres, ceratoid; exterior surface marked by septal furrows and fine transverse grooves; calyx flat at the base, floored by septa that reach the centre, showing a prominent pyriform fossula, most prominent near the axis, depth unknown; primary septa slightly sinuous, unswirled, unequal in length, few extended to centre, others straight and short or sinuous and joined to major septa, about 30 in number of which about 12 extend to centre; tetrameral symmetry, alar and counter septa prominent; no acceleration; secondary septa short; tabulæ almost horizontal, somewhat uparched in centre, closely set.

This species is known only from fragmentary material, most of which is the moulds of the base of the calyx. The specimens are distinctive enough from other species described and limited in their stratigraphic distribution to merit description. The species is common in the lower part of the Cedar Lake formation. An interesting specimen from the Atikameg dolomite, which belongs to this stock, shows the distinctive slightly sinuous septa uniting in bundles before approaching the axis of the corallum. Although the transverse section cut is just below the calyx, no secondary septa are developed. The fossula and tetrameral symmetry are obscure and there are fewer septa than in the Cross Lake specimens. This specimen probably represents an early form of the *N. symmetricus* lineage.

The species may be distinguished from others by the marked symmetry of its septa, their bundling, and the prominent fossula. The shape of the fossula relates this species to *Zaphrentis charactata* Foerste but the exterior surface that is characteristic of the latter species cannot be identified in *N. symmetricus*. The type locality is in the Cross Lake member of the Cedar Lake formation at the foot of Demicharge Rapids on Saskatchewan River.

Holotype, G.S.C. No. 10498; paratype, G.S.C. No. 11011.

Neozaphrentis (?) sp. A

Corallum trochoid, gently curved, reaching a diameter of about 8 mm. and a length of about 2·5 cm.; exterior surface marked by septal grooves and fine transverse striations; calyx poorly known, probably deep; primary septa about 20 in number, amplexoid, extending only a short distance from the wall on the tabulæ, gradually decreasing in depth upward, straight; acceleration and development unknown; symmetry radial; secondary septa possibly developed in the calyx but not observed; tabulæ widely spaced, only 2 or 3 in a corallum, horizontal, complete, deflected slightly at the margins, bent upward around septa.

This species may easily be distinguished from others in the Interlake group and from described species by its septa. The septa are the shape of a right-angle triangle with a short side along the tabula and the right angle at the wall. This type of septa suggests that the species might belong to the genus *Amplexoides*. The inflexion of the tabulæ around the septa produces the impression that the lower septum invaginates the upper one at each tabula. Only a few fragmentary coralla of this species are known, all from the Cedar Lake dolomite. Until better material is available this species is left unnamed.

Hypotype, G.S.C. No. 11024.

Genus, *Amplexoides* Wang

Amplexoides Wang, 1950, Phil. Trans. Roy. Soc. London, ser. B, vol. 234, p. 206.

"Small trochoid to subcylindrical corallum, septa short, with low ridges developed on the distant and complete tabular floors" (Wang).

For many years the Silurian species of this type have been assigned to the Carboniferous genus *Amplexus* even though palæontologists recognized that the extension of this genus was uncritical. Wang has proposed that these species be united in the new genus *Amplexoides* to be distinguished for *Amplexus* s.s. by the unforked condition of the septa.

Amplexoides severnensis (Parks)

Plate VII, figure 6

Amplexus severnensis Parks, 1915, Trans. Roy. Can. Inst., pp. 36-37, Pl. 3, fig. 12.

Corallum trochoid in early stages, becoming cylindrical in maturity, slightly curved in the immature part, reaching a diameter of 6 to 8 mm. and a length of at least 7 cm.; exterior surface marked by septal grooves and inconspicuous growth lines; calyx unknown; primary septa straight, thin, extended to axis of corallum in early stages, retracted along tabulæ in maturity until extended only a quarter of the way to axis, reduced between tabulæ to keels on wall 1 mm. wide, about 20 in number, in radial symmetry; fossula lacking; secondary septa intercalated between primaries, nowhere more than shallow ridges on the wall; tabulæ conspicuously horizontal and plane, slightly deflected at the margins, spaced about 15 in 1 cm.

The specimens from southern Manitoba differ little from those of the Ekwan limestone, but have fewer septa and a less conspicuous deflexion of the tabulæ at the margins. The basal part of the corallum is rarely preserved.

Amplexoides severensis is found at two horizons in the Interlake group. In the basal beds of the Inwood formation at Grand Rapids a good specimen was found and this horizon also carries the coral at the Sandridge sink-hole. *A. severnensis* also occurs in the base of the Cross Lake member of the Cedar Lake dolomite in the vicinity of Moose Lake. *Amplexoides* sp. similar to *A. severnensis* is found in the Atikameg dolomite. The species is confined to the Ekwan River limestone in the Hudson Bay lowlands.

Hypotype, G.S.C. No. 11051.

Amplexoides sp. A

Plate IX, figures 12, 15

Corallum subcylindrical, gently expanding from a diameter of 8 mm. to 10 mm. through 1½ cm. of one specimen, with a circular cross section; exterior covered with septal grooves and growth rugæ; calyx unknown; primary septa thin, straight, not reaching the centre in any specimens but leaving an open area 2 mm. in diameter, at maturity about 22 in number, slightly involute so that extremities abut against adjacent septa to form rudimentary inner wall; cardinal fossula, alar septa, and tetrameral symmetry conspicuous in early sections; secondary septa low ridges; no acceleration, septal formula at stage when 18 septa present C4A4K4A4C; tabulæ close set, 20 in 1 cm., plane or slightly flexuous.

These specimens are transitional between *Amplexoides* and *Neozaphrentis*. Because the septa are found to be slightly amplexoid, the corallum is cylindrical, and the septa do not reach the axis, these specimens are provisionally placed in *Amplexoides*. The species may be distinguished by its thin septa, which do not reach the axis but swirl in maturity, its tetrameral symmetry, and the small size of its corallum. The specimens grouped here have been collected from the Lundar quarry and from an outcrop a tenth of a mile along the road leading eastward from the highway to Fairford. At both localities the Chemahawin reef member of the Cedar Lake formation outcrops.

Hypotype, G.S.C. No. 10497.

Genus, *Synamplexoides* gen. nov.

Corallum fasciculate, composed of slender cylindrical corallites, unconnected except at their points of increase; septa well-developed lamellæ in early stages becoming amplexoid in maturity and retreating from centre; tabulæ complete, horizontal.

Grabau (1922) proposed the genus *Synamplexus* for Lindstrom's species *Amplexus viduus* from the province of Szechwan, China. The species was founded on poor material in which the septa were missing interiorly and only known from furrows on the exterior. So far as known, no illustrations of this species or genus have been published. However, it appears that Lindstrom wished to designate a colonial form of *Amplexus* that had very slender corallites growing in a fasciculate colony. It is possible that the new genus is synonymous with *Synamplexus* but until better descriptions of the Chinese material are available it seems advisable to establish a new genus for the Manitoba specimens. Wang (1950) has placed *Synamplexus* in synonymy with *Pycnostylus* without comment but it is possible that his opinion is based on an examination of Chinese specimens. If so, the genus *Synamplexoides* is certainly different from *Synamplexus*. A species that has been compared with *Amplexus viduus* is *Amplexus borussicus* Weisermell. This species might be characterized as a slender colonial *Amplexoides* but has denticulate septa that extend only a short distance on the tabulæ.

The genotype is *S. varioseptatus*.

Synamplexoides varioseptatus sp. nov.

Plate VIII, figures 4, 6, 8, 9

Corallum fasciculate, corallites separated by several times their own diameter, never in contact after gemmation, slender, ceratoid in the basal parts becoming cylindrical, 2 to 3 cm. long, attaining diameter of 8 mm., tapering in the early stages very gradually to a fine tabulated tube less than 1 mm. in diameter; exterior surface marked by septal grooves, without growth rugæ; calyx $2\frac{1}{2}$ mm. deep, rounded at base; septa 18 in number in mature corallites, in early stages when less than 12 present represented by continuous straight lamellæ that reach just to centre of corallite where cardinal and counter septa may be joined, arranged in bilateral symmetry; in maturity amplexoid and retracted from axis of corallite, arranged in radial symmetry; fossula and acceleration absent; secondary septa poorly developed as ridges, never extending out on tabulæ; tabulæ in immaturity remote, in maturity closely set (20 in 1 cm.), complete, horizontal, slightly undulant, rarely marginally deflected.

This species occurs abundantly in the stromatoporoid reef in the Chemahawin dolomite at Lundar. Its relationship to the *Clathrodictyon* cf. *cystosum* colonies is interesting. The two animals grew together; the coral forced constantly to keep its tentacles above the growing mass of the hydrozoan, grew to a thin slender shape. In several specimens there is evidence that the growing stromatoporoid overwhelmed the coral as several corallites end at the same level within the stromatoporoid. The relationship may have been symbiotic for the slender *Synamplexoides* would be incapable of supporting themselves were it not for the surrounding material.

The stromatoporoid hides the true nature of the coral colony so that only the abundance of corallites in subparallel aggregates indicates that they bud from one another. Although many serial sections were made through colonies, no proof of colonial growth was found. The problem is made more difficult by the multitude of interlacing tabulated tubes passing through the structure. There has been much discussion in the past concerning the nature of certain tubes that pass through stromatoporoids. Nicholson refers to "zooidal tubes" in many genera but there has been much doubt thrown upon the existence of these by the research of later students, notably Parks. Tabulate tubes that are found pursuing vermicular paths through stromatoporoids have been called *Caunopora* tubes. These tubes, whose true nature has not as yet been elucidated, may be the asseptate tubes found in uncertain relationship to *S. varioseptatus* and *Clathrodictyon* cf. *cystosum* in the Lundar quarry. The well-developed septa of *Synamplexoides* serves to distinguish the coral from these enigmatic associates of the stromatoporoids.

S. varioseptatus is found at the Lundar quarry and on the NE. ¼ sec. 29, tp. 29, rge. 8, W. Prin. mer., in both localities associated with *Clathrodictyon* cf. *cystosum* in the Chemahawin dolomite.

Holotype, G.S.C. No. 11047; paratypes, G.S.C. Nos. 11042 and 11043.

Genus, *Pycnostylus* Whiteaves

Pycnostylus Whiteaves, 1884, Palæozoic Foss., vol. 3, pt. 1, p. 2. Hill, 1940, Proc. Linn. Soc. New S. Wales, vol. 65, pp. 391-392.

Cyathopaedium Schuter, 1889, Abhang. geol Specialkarte Preus. Thuring. Staat., vol. 8, pt. 4, p. 260.

Cylindrophyllum Yabe and Hayasaka, 1915, Jour. Geol. Soc. Tokyo, vol. 12, p. 90. (non) *Cylindrophyllum* Simpson, 1900, N.Y. State Mus. Bull. 39, p. 217.

Yabeia Lang, Smith and Thomas, 1940, Index Paleozoic Coral Genera, p. 140, nom. nov. for *Cylindrophyllum* Yabe and Hayasaka (preoccupied).

The synonymy is essenially that of Hill (1940) with some additions. *Pycnostylus* has been placed in synonymy with *Fletcheria* Milne-Edwards and Haime by many European authors, and indeed the only difference between the two genera seems to lie in the character of the septa. The septa of *Fletcheria* are not extended on to the tabulæ according to Milne-Edwards and Haime. Whiteaves' original description includes the note that *Pycnostylus* differs from *Amplexus* only in having a fasciculate growth and Hill has included under the genus species in which the septa are extended on the tabulæ as ridges (i.e., are amplexoid). The type specimens of *P. guelphensis* and *P. elegans* do not show significant extension of the septa on the tabulæ but the septa in a few of the corallites seem to be deeper above than below the tabulæ. The septa of specimens from Manitoba referred to *P. guelphensis* may be extended as very slight ridges on the tabulæ or they may be confined to the wall. This suggests that the distinction betwen *Pycnostylus* and *Fletcheria* may be that the latter has slightly amplexoid septa and the former, plane septa. Because the writer was not able to examine European material to confirm or confute this view, the species *P. guelphensis* is retained under Whiteaves' genus.

Pycnostylus guelphensis Whiteaves

Plate VIII, figure 7

Pycnostylus guelphensis Whiteaves, 1884, Palæozoic Foss., vol. 3, pt. 1, p. 3, Pl. 1, 1a, 1b.

Corallum fasciculate; corallites in general cylindrical, parallel but slightly sinuous in their growth, not connected by processes, appressed against each other immediately after gemmation; mean diameter of corallites that have reached a cylindrical form 5.6 mm. (s=1.4 mm., N=24); exterior marked by septal grooves and fine growth lines; calyx unknown; primary septa rudimentary, thin, amplexoid, commonly represented by keels on the wall 1 mm. deep, more rarely extending on to the top of tabulæ as indistinct ridges, about 16 in number, symmetry radial; no fossula; secondary septa small ridges; tabulæ thin, generally horizontal and plane, rarely flexuous, spaced about 14 in 1 cm.; increase by calicular gemmation, 4 or 3 buds forming in a calyx.

This coral is confined to the Chemahawin reefs of the Cedar Lake formation.

Hypotype, G.S.C. No. 10411.

Genus, *Asthenophyllum* Grubbs

Asthenophyllum Grubbs, 1939, Jour. Paleontology, vol. 13, p. 546.

Ammended Definition. Corallum simple, turbinate or trochoid; calyx occupying about two-thirds of the length; septa radially disposed, extending uninterrupted to the bottom of the calyx where they reach the axis of the corallum, inserted according to the *Zaphrentis*-plan; secondary series of septa rudimentary; commonly slightly accelerated in the counter quadrants; tabulæ and dissepiments lacking; fossula absent or slightly developed.

This definition differs from that of Grubbs in excluding as necessary characters the rugæ and the twisting of the septa, and in allowing for the development of a fossula.

Numerous small tetracorals showing no tabulæ or dissepiments are represented in the Interlake group by coralla and calicular moulds. In the past many such corals have been assigned to *Petraia* or *Streptelasma*. Schindewolf's revision (1931) of *Petraia* has shown that it is characterized by secondary septa that are serially inserted and touch the primaries at their distal ends. No such septa were noted in the Interlake corals. Okulitch (1938) has separated those *Streptelasmas* without dissepiments into the genus *Lambeophyllum* but this genus is confined to the Black River stage. Grubbs genus is used in this study rather than extend the range of *Lambeophyllum.*

Asthenophyllum inwoodense sp. nov.

Plate X, figures 8-10; Figure 5

Corallum small, trochoid, almost straight but curved slightly at basal tip, attaining a diameter of about 10 mm. and a length of about 15 mm., generally smaller; exterior surface covered with well-marked septal grooves, and faint transverse growth lines, showing constrictions; calyx deep, reaching to within a short distance of the base of the corallum, formed as septa retreat from the axis, in some specimens showing a vague fossula at the base; wall thick at all stages below top of calyx; primary septa straight, reaching to the centre at the base of the corallum only, inserted in 4 loci, 12 to 18 number, accelerated in the counter quadrants to the extent of 1 or 2 septa, cardinal septum prominent in early stages; no fossula evident until near the base of calyx; secondary septa appear early within the wall, prominent near the base of the calyx, at top of the calyx subequal to primaries and denticulate on their free edge; no dissepiments, tabulæ, or columella; lamellar calcite of wall continuous with fibres of septa.

Serial sections were made of several specimens of this species (*see* Figure 5) but none of them shows clearly the early stages of septal insertion. The specimens were stained with Heeger's solution (Henbest, 1931) in order to discover any structure in the basal parts of the corallum. Those parts that took a blue stain were presumed to be the septa and those parts that remained unstained were presumed to be the stereome filling the spaces between the septa. To a certain extent the sketches in Figure 5 are interpretive and may prove to be incorrect when better material becomes available.

After the insertion of 6 metasepta, 2 metasepta appear very early in the cardinal quadrants. Some specimens show secondary septa accompanying them in the cardinal quadrants. Insertion of metasepta begins on the counter side of the alars but no secondary septa appear in these quadrants until nearly the full complement of metasepta has been reached. In the small specimens of this coral that were serially sectioned, the full complement of septa is 12 and at maturity the septal formula is C1A3K3A1C. After 12 septa have been inserted they shorten and a space that is the calyx opens between them.

Many specimens consist of calicular moulds and where such are preserved it is uncommon to find complete specimens also. Some of the moulds referred to this species agree well with the data obtained from serial and random sections. Some are larger and contain additional septa that have been inserted in the cardinal quadrants. A common septal formula at the top of such calices is C3A4K4A3C. The moulds show that the secondary septa appear fairly low on the calyx, represented by perforations that indicate their denticulate margins.

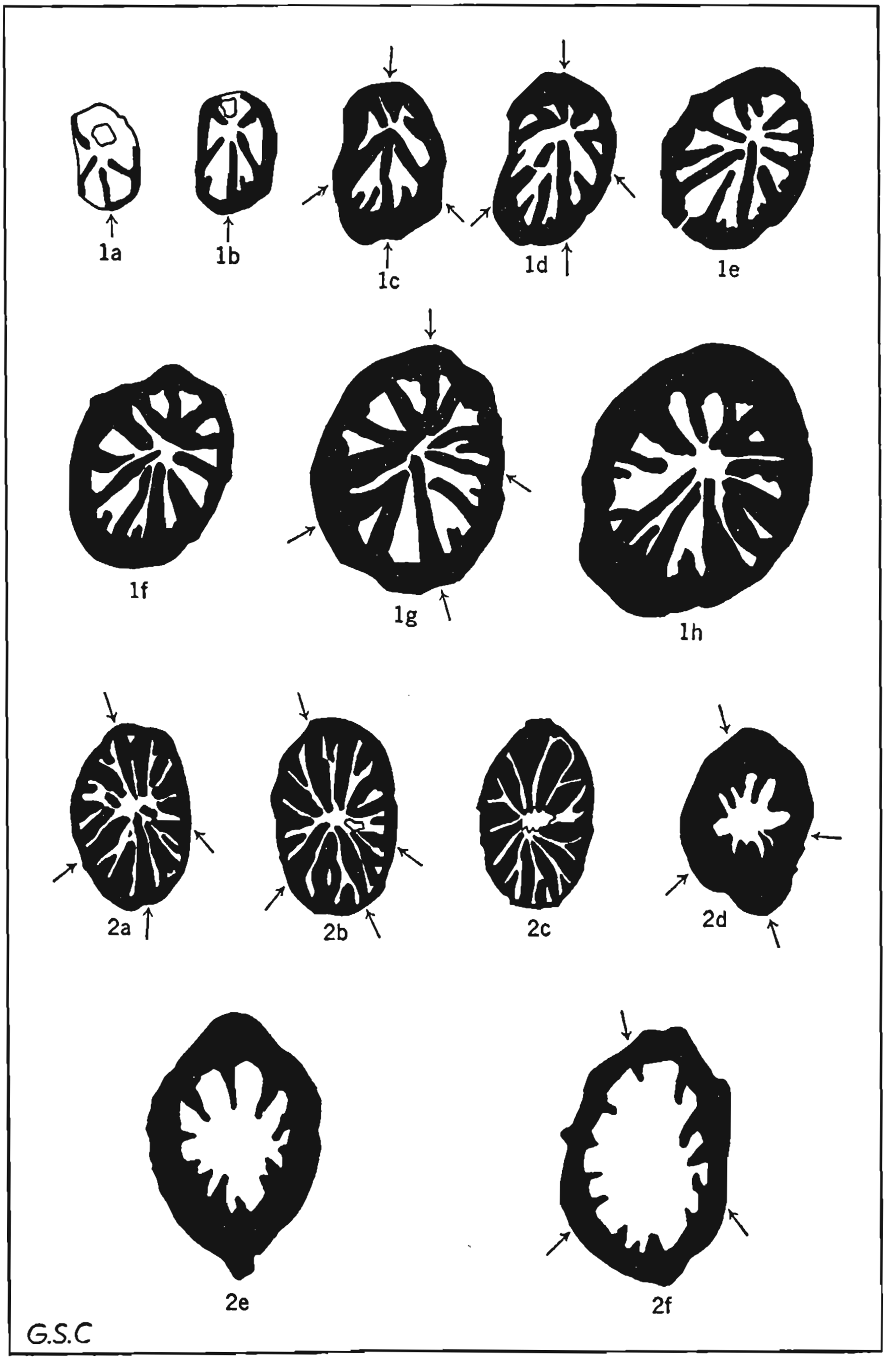


Figure 5. Serial sections of *Asthenophyllum inwoodense*.

A. inwoodense differs from *A. orthoseptatum* Grubbs, the genotype, in having fewer septa, no twisting of the septa, a smooth surface, and more marked acceleration. *A. inwoodense* has been collected from all the formations from the Fisher Branch dolomite to the Cross Lake dolomite inclusive. At the type locality, Inwood quarry, it occurs in great numbers embedded in the dolomite of the bioherms and in a free condition in some of the shales.

Holotype, G.S.C. No. 11012; paratypes, G.S.C. Nos. 10501, 11006, and 12867.

Asthenophyllum occidentale (Whiteaves)

Plate X, figures 6, 7; Plate XVI, figure 4

Petraia (*pygmaea* ? var.) *occidentalis* Whiteaves, 1906, Palæozoic Foss., vol. 3, pt. 4, p. 291, Pl. 24, figs. 2-5.

Corallum trochoid to ceratoid, straight to slightly curved, reaching a diameter of about 8 mm. and a length of about 15 mm.; exterior surface marked by septal furrows and poorly defined growth lines; calyx deep, pointed at the base, showing an inconspicuous fossula and rarely an inner wall formed by the involution of the septa; primary septa thick, slightly sinuous, swirling so as to abut against each other, failing to reach the centre in all but early stages, in some specimens so thickened as to be in contact, in others separated, about 18 in number in mature calices, generally about 14 in transverse sections; secondary septa developed early in a thick peripheral stereozone, not emerging from it until near the calyx, denticulate; fossula commonly well developed in transverse sections, containing aborted cardinal septum, abutted by many primary septa; tetrameral symmetry obscured by swirling of the septa; tabulæ and dissepiments lacking.

Whiteaves described this species as a possible variety of *Petraia pygmaea* Billings of Anticosti and indicated that it usually attained a larger size but had the same internal structures. The writer made a comparison by serial thin sections of these two species and found little similarity between them. Neither species can be referred to *Petraia*. Thin sections of topotypes of *Asthenophyllum occidentale* reveal a small coral with no tabulæ and dilated septa that may fill the lumen. The dilation of the septa and their tendency to touch along their whole length suggests that this species might be referable to the genus *Pycnactis*. However, the failure of the septa to meet in the centre and the prominence of the fossula make it impossible to assign this species to the genus.

The insertion of septa appears to follow the *Zaphrentis*-plan. For a short time the septa were joined in the axis of the corallum but by the time that about 12 septa were formed, they parted and began involution. Secondary septa appear early in the stereozone all around the corallum. The calicular moulds of this species show a sharp tip and a shallow obscure fossula. The swirling of the septa cannot be detected in such moulds.

The relationship between *A. occidentale* and *Pycnactis canadensis* is discussed under the latter species. *A. occidentale* may be distinguished from *A. inwoodense* by the greater dilation of its septa, their swirling, and the prominence of its fossula in some stages of growth. The ontogeny of neither form is well enough known to permit detailed comparison, but it appears that the secondary septa of *A. inwoodense* are inserted much earlier in the cardinal quadrants than those of *A. occidentale*. *Streptelasma kukensis* Teichert has a prominent axial stereozone and no fossula.

A. occidentale occurs in the Inwood formation, the Atikameg dolomite, and the East Arm dolomite. The type locality is in the Atikameg dolomite on the tramway at Grand Rapids.

Hypotypes, G.S.C. Nos. 10408, 11001, and 11037.

Asthenophyllum sp. A

Plate X, figure 11

This little coral is known only from calicular moulds and is thus left unnamed until better material is at hand.

Corallum small, trochoid to turbinate, slightly curved, attaining a diameter of 1 cm. and a length of $1\frac{1}{2}$ cm.; exterior surface unknown; calyx deep occupying at least two-thirds of the corallum, pointed at the base where the septa meet, without fossula; primary septa extended to the axis without involution, arranged in marked tetrameral symmetry, variable in number, 25 in the largest moulds, conspicuously accelerated in the counter quadrants to the extent of 1 septum in the early stages and 2 or 3 in maturity; secondary septa denticulate, not developed until high in the calyx of the larger specimens; tabulæ unknown, by analogy with similar moulds probably absent.

Its marked counter acceleration, tetrameral symmetry, and additional septa distinguish this coral from *A. inwoodense*. In the smallest specimen the septal formula is C2A3K3A2C but as the coral grows the acceleration becomes more conspicuous and at the top of the larger moulds the formula may be C4A6K7A4C. *Asthenophyllum* sp. A is found in the Cedar Lake formation only in the inter-reef beds. Its form and stratigraphic position suggest that it is an outgrowth of *A. inwoodense*. The best moulds were collected on the west shore of Cross Lake, 7 miles north of Demicharge Rapids.

Hypotype, G.S.C. No. 11039.

Suborder, **Streptelasmacea**

Family, DINOPHYLLIDAE

Genus, *Dinophyllum* Lindstrom

Dinophyllum Lindstrom, 1882, Bihang. Kongl. Svensk Vetensk-Akad. Handl. VI, (18), p. 21.

"Large trochoid or ceratoid corallum, prominent cardinal fossula, major septa reaching axis and involute, composed of stout trabeculæ with acutely pinnate fiber fascicles at a low angle of inclination and invested in lamellar tissue, tabulæ convex, no dissepiments" (Wang, 1950, p. 215).

Dinophyllum lundarense sp. nov.

Plate IX, figures 8-11; Figure 4, 1a-c

Corallum large, trochoid, slightly curved, reaching a diameter of about 3 cm. and a length of 5 cm.; exterior surface smooth, marked with vague septal furrows and growth lines; calyx rather deep ($1\frac{1}{2}$ cm.), cylindrical, with a prominent, sharp, round columella at the centre, with septa produced to the centre and swirling into the columella on its floor, showing a fossula formed by the down bending of the tabulæ and abortion of the cardinal septum; primary septa relatively thick in early stages, thinning later, fused in centre throughout corallum, conspicuously swirled in mature parts of corallum, numbering in mature specimens between 40 and 45, showing no acceleration, in mature specimens commonly abutting against one another so that not all reach the axis; secondary septa rudimentary, appearing near the base of the calyx as shallow ridges projecting not more than 1 mm. from the wall, denticulate; tabulæ densely set, in places inosculating but generally continuous, flexed upward into the columella in the axial parts, bent down slightly a few millemetres from the wall, spaced about 15 in 1 cm.

The septa swirling into a columella and the uparched tabulæ place this species in the genus *Dinophyllum* rather than *Neozaphrentis.* It has been found at the Lundar quarry, at Davis Point, and at Fort Island, all of which localities are stratigraphically near the top of the Cedar Lake formation. At Fort Island the species is represented by calicular moulds showing a prominent twisted columella. These specimens were identified by Tyrrell as *Cyathaxonia wisconsinensis* and those at Davis point were identified by Whiteaves as *Zaphrentis stokesi. D. lundarense* differs from *Z. stokesi* in possessing only half as many primary septa, but like it the Manitoba species has numerous convex tabulæ suggestive of *Dinophyllum.* From *Zaphrentis racinensis* Whitfield the new species may be distinguished by its lack of counter acceleration and greater number of septa. Lack of rugæ on the exterior distinguishes this species from *Z. subvesicularis* Foerste. From the genotype, *Dinophyllum involutum* Lindstrom, the new species may be distinguished by its more regular tabulæ and its almost circular columella.

The type specimens were collected at the Lundar quarry.

Holotype, G.S.C. No. 10473; paratypes, G.S.C. Nos. 10468, 10469, 10478, and 11053.

Family, PYCNACTIDAE

Genus, *Pycnactis* Ryder

Pycnactis Ryder, 1926, Ann. Mag. Natr. Hist., ser. 9, vol. 18, p. 386.
Cymatelasma Hill and Butler (partim.), 1936, Geol. Mag., vol. 73, p. 516.

"Simple, horn-shaped (trochoid) coral, in which the major septa are well developed and extend to the centre of the corallum while the minor septa are short; in which septa of both cycles are strongly dilated throughout their length. The cardinal septum is very conspicuous in brephic stages. Tabulæ and dissepiments are suppressed" (Ryder).

Pycnactis canadensis sp. nov.

Plate XVI, figures 1-3

Corallum small, trochoid, very gently curved, attaining a diameter of 1 cm. and a length of 3 cm.; exterior covered with well-defined septal grooves and obscure growth lines, in places slightly constricted; calyx 3 to 4 mm. deep, flat at the base where the septa meet, showing no fossula; primary septa well developed, dilated so as to lie against each other for most of their length, reaching the centre in most stages and fusing there, so that they may join with the opposing septum, slightly involute but forming no pseudocolumella, 18 to 20 in number in maturity, tetrameral symmetry marked in all sections below the calyx; counter acceleration slight, cardinal septum prominent in all stages; secondary septa formed very early, wedged in between the primary septa and in contact with them; tabulæ absent.

Plate XVI, figures 1-3 illustrate the ontogeny of this species. In figure 1, the lowest section, the cardinal septum and the tetrameral symmetry are evident. The septal formula here appears to be C3A3K3A3C. In figure 2 the swirling of the septa is conspicuous and begins to obscure the symmetry. The cardinal septum is still large, some of the septa can be seen to be fused to those adjacent at their free ends and one continues across to join the opposing septum. The introduction of secondary septa and the attainment of the full complement of 18 primary septa is illustrated in figure 3. Thereafter the corallum enlarges without septal involution and becomes oval in section. Not until the base of the calyx do the septa separate and well-defined lacunæ appear. It should be noted that Ryder incorrectly interpreted the septal insertion of *Pycnactis,* as has been pointed out by Butler (1937) (*but see also* Smith, 1945, p. 6).

This species is known from two specimens only; one from the Inwood formation at Grand Rapids and the other from the Moose Lake dolomite on Moose Lake. The union of the septa in the axis of the corallum, the absence of a fossula, and the greater dilation of the septa, are characters that distinguish *P. canadensis* from the species of *Asthenophyllum* described above. The similarity of the early stages of *P. canadensis* to those of *A. occidentale* indicates some relationship between them. In England the genus *Pycnactis* is the first member of an evolutionary series that progressed through thinning of the septa from the periphery inward, but the genus is apparently the only one of the lineage to reach North America.

The type locality is just north of the East Arm Narrows of Moose Lake.

Holotype, G.S.C. No. 11054.

Family STREPTELASMIDAE

Genus, *Streptelasma* Hall

Streptelasma cf. *integriseptatum* Parks

Corallum represented in the collections by transverse sections from 2 specimens, circular to elliptical in cross section, 2 cm. in diameter, at least 6 cm. long; depth of calyx unknown, base formed by a prominent streptocolummella and fossula reaching from the columella to the wall; primary septa straight, thin, until near the axis where deflected abruptly into the columella, embedded marginally in a broad peripheral stereozone, commonly uniting axially, 36 in number just below calyx, not accelerated, streptocolummella 4 mm. in diameter, elongated in the cardinal-counter plane; secondary septa present in the peripheral stereozone up to base of calyx, above projecting a short distance into the calyx; symmetry radial; fossula conspicuous in all stages, rectangular in shape, containing a much reduced cardinal septum, bordered by two subparallel primary septa; tabulæ uparched in axis, imperfectly known.

The specimens from Manitoba are very similar to the figures and descriptions of *S. integriseptatum* from Shamattawa River (Parks, 1915). The position of the counter and alar septa with regard to the columella is identical. The chief differences are the presence of secondary septa, and the fewer primary septa of the southern Manitoban specimens. Parks admits that secondary septa may be present in the thick peripheral stereozone of his specimens.

The only specimens of this coral come from the railway cut at Mile 19.8 of the railway from The Pas to Flin Flon in the dolomite of the Stonewall formation.

Genus, *Palaeophyllum* Billings

Palaeophyllum Billings, 1858, Geol. Surv., Canada, Rept. of Prog. 1857, p. 168.

This genus has been most simply described as a fasciculate form of *Favistella*. Lang, Smith, and Thomas (1940) and Wang (1948, 1950) believe this genus is more closely related to *Streptelasma*.

Palaeophyllum pasense sp. nov.

Plate XVI, figure 7

Corallum large, up to 8 cm. across; corallites free and cylindrical or appressed on one or more sides and polygonal, grouped in the form of chains so that any corallite is appressed on 2 sides by its neighbours; 3 to 4.5 mm. in diameter, direction of growth roughly parallel but tortuous; external surface of corallites covered with well-defined septal grooves; calices floored by a flat tabulum encroached upon at the margins by the septa for about 1 mm., showing at the base no conspicuous fossula, depth unknown; primary septa well developed as thin straight laminæ, extending just to the centre of corallite, not joined, 15 in number, arranged with an inconspicuous bilateral symmetry; secondary septa ridges; no acceleration; tabulæ convex upward; spaced about 15 to 1 cm.

In its halysitoid growth, this species of *Palaeophyllum* is similar to *P. halysitoides* (Troedsson) (*non* Radugin, 1936) but may be distinguished from it by its fewer septa that meet in the axis of the corallite. *P. pasense* differs from both *P. calcina* (Nicholson) and *P. rugosum* Billings in having fewer septa. *P. stokesi* (Milne-Edwards and Haime) has been identified from the Stony Mountain formation but may be distinguished from the new species by its greater number of septa and their twisting in the axis of the corallum. Species of *Palaeophyllum* with a halysitoid growth are generally confined to the Richmondian stage with the possible exception of species described by Soshkina (1937) and Radugin (1936) from the Urals.

Palaeophyllum pasense has been found in the Stonewall formation on a side road ¼ mile east of Mile 25 of the Flin Flon highway north of The Pas, and on l.s. 14, sec. 31, tp. 25, rge. 2, W. Prin. mer., associated with *Favistella alveolata* in beds that are probably referable to the upper Stony Mountain formation but may prove to belong to the Stonewall formation.

Holotype, G.S.C. No. 10403.

Palaeophyllum pasense parvum subsp. nov.

Plate VII, figure 5

Corallum fasciculate, composed of corallites in a halysitoid growth pattern; corallites appressed on 2 or 3 sides, 1.7 mm. to 2.0 mm. in diameter, marked exteriorly by strong septal grooves; calyx unknown; primary septa 10 in number, straight, thin, extended just to centre of corallite, untwisted, unfused, radially arranged; no fossula observed; secondary septa small ridges; tabulæ uparched in centre; spaced about 20 in 1 cm.

This subspecies agrees in all qualitative characters with *P. pasense* and differs only in size of corallites and number of septa. It is the smallest described species of *Palaeophyllum*. The fact that it has been found at only one locality, the railway cut at Mile 19.5 of the Flin Flon railway in the Stonewall formation, suggests that the variety may be a dwarfed *P. pasense*. The shaliness of the dolomite at this locality may have been the result of conditions unfavourable to the robust growth of this coral.

Holotype, G.S.C. No. 10482; paratype, G.S.C. No. 10494.

Family, DISPHYLLIDAE

Genus, *Cyathophyllum* Goldfuss

Cyathophyllum sp.

Corallum trochoid, imperfectly known, reaching a diameter of 1.5 cm. and a length of 3 cm.; exterior surface and calyx unknown; primary septa thin, 27 in number, straight except near the axis, there slightly involute; secondary septa extended to border of tabularium, thin; fossula absent; tabulæ in centre of corallum, surrounded by zone of dissepiments 2.3 mm. wide.

This coral is known from 2 poorly preserved specimens that cannot be identified specifically. The occurrences, at Davis Point and 2 miles southwest of Fairford, are confined to the Chemahawin dolomite.

Suborder, **Cystiphyllacea**

Family, CYSTIPHYLLIDAE

Genus, *Tryplasma* Lonsdale

Tryplasma Lonsdale, 1845, in Murchison, de Verneuil, and von Keyserling, The geology of Russia in Europe and the Ural mountains, p. 613.

"Short or long, simple subcylindrical; or compound loosely dendroid or phaceloid dugose corals with septa composed of vertical rows of spines. Tabulæ complete, relatively horizontal, moderately to widely spaced. Dissepiments absent" (Stumm, 1952, p. 842).

Tryplasma gracilis (Whiteaves)

Plate VI, figures 1, 8

Aphyllostylus gracilis Whiteaves, 1904, Ottawa Natr., vol. 18, No. 6, p. 113. 1906, Palæozoic Foss., vol. 3, pt. 4, p. 279.

Tryplasma gracilis (Whiteaves), Stumm, 1952, Jour. Pal., vol. 26, p. 843.

Corallum fasciculate, consisting of slender, subcylindrical, radiating corallites, rarely in contact; corallites from 2 to 3 mm. in diameter, marked exteriorly by growth rugæ but no septal furrows; septa minute, spiniform, straight, arrangement in longitudinal rows conspicuous when tabulæ remote, commonly irregularly arranged; tabulæ complete, flexuous, spaced about 14 in 1 cm.

This coral may be found in abundance at the Stonewall quarries, its type locality. It is also present in the northern outcrops of the Stonewall formation and is an important index fossil to this formation.

Hypotypes, G.S.C. Nos. 10409 and 12866.

Genus, *Cystiphyllum* Lonsdale

Cystiphyllum cf. *niagarensis* (Hall)

In the Chemahawin dolomite at a few outcrops poorly preserved coralla of the genus *Cystiphyllum* occur. Only in the specimens from Lundar is the preservation good enough to allow them to be tentatively referred to the species *C. niagarensis*. The cylindrical corallum of one specimen is preserved for a length of 3 cm. and has a diameter of about 1 cm. The exterior is marked by faint septal grooves. Cyst-like dissepiments fill the interior, sloping inward toward the axis and becoming smaller toward the periphery. In places flat plate-like tabulæ occur.

BRACHIOPODA

Class, INARTICULATA

Genus, *Monomerella* Billings

Monomerella laurentina (Twenhofel)

Plate XII, figure 27

Dinobolus laurentinus Twenhofel, 1928, Geol. Surv., Canada, Mem. 154, pp. 168-169, Pl. 12, figs. 4-7.

Specimens from Manitoba, although in a poor state of preservation, are very similar in form and size to those from Anticosti. Recrystallization has filled in the umbonal chambers of most of the specimens leaving only the impressions of the platforms and the shape of the valves as guides in identification. The lack of platform vaults together with the good development of the umbonal chambers indicates that the species has more of the generic characters of *Monomerella* than of *Dinobolus*. A transition probably exists between these two closely related genera. *Dinobolus laurentinus* is closer to *Monomerella*.

If the suggested transfer is made, the range of *Monomerella* is extended from Niagaran to Upper Ordovician. At Anticosti specimens of *M. laurentina* are found in the English Head, Vaureal, and Ellis Bay formations; and in Manitoba in the Stony Mountain, Stonewall, Fisher Branch, and Inwood formations. A ventral valve collected from the Stonewall quarry is larger and has a wider platform than the other specimens and in this approaches *D. laurentinus ellisensis* Twenhofel. As this subspecies is known only from dorsal valves, accurate comparison is not possible. Specimens from Stonewall referred by Whiteaves (1906) to *Dinobolus parva* may be conspecific with those referred here to *M. laurentina*.

Hypotype, G.S.C. No. 10435.

Genus, *Trimerella* Billings

Trimerella cf. *acuminata* Billings

A single mould of the interior of a ventral valve of a *Trimerella* was collected from the Cross Lake member on the south bank of Saskatchewan River opposite Cross Lake Rapids. The length of the platform vaults and umbonal chambers, which reach past the hinge line, and the shape of the beak area indicate that the specimen is close to *T. acuminata* Billings. It has a more acute apical region than *T. ekwanensis* Whiteaves and the vaults are better defined. The anterior part of the valve has not been preserved.

An extremely small ventral valve of a *Trimerella* was collected from the upper Cedar Lake dolomite and is probably an immature form of *T. acuminata* because it has similar structures to the specimen from the Cross Lake dolomite. The width of the specimen is 6½ mm.

Class, ARTICULATA

Genus, *Dolerorthis* Schuchert and Cooper

Dolerorthis redrockensis sp. nov.

Plate XII, figures 28, 29, 31

Shell small, semicircular to subquadrate in plan, considerably wider than long, greatest width at the hinge line; anterior margin broadly rounded, lateral margins subparallel; cardinal angles slightly acute; ventral beak low, dorsal beak inconspicuous; biconvex but very thin; ventral valve convex near umbo, flattening anteriorly or slightly concave; dorsal valve almost flat, slightly convex, apparently without fold or sulcus; surface covered with subequal costellæ, increasing by intercalation once at about midvalve and again in most specimens at the commissure, about 22 major costellæ reaching umbo; growth lines not preserved.

Ventral interior unknown.

Dorsal interior: cardinal process fine, simple, extending as a septum to past midvalve; brachiophores diverging at an angle of 60 degrees.

The following are measurements of the holotype and 4 other specimens from the type locality at Redrock Rapids on Saskatchewan River;

	Holotype mm.	mm.	mm.	mm.	mm.
Length	7·1	4·6	9·8	8·0	7·4
Width	8·7	7·2	9·1	10·8	9·8

This species may be distinguished from most described species of *Dolerorthis* by the smallness of its shell. It differs from *D. psyma* Lamont and Gilbert in its greater width at the hinge line and its greater number of costellæ. It is not as transverse as *D. reedsi* Lamont and Gilbert. The length of the hinge line also serves to distinguish this species from *D.* (?) *minuta* Shaw. *D. redrockensis* has been collected from two outcrops of the East Arm dolomite: the type locality where external moulds and casts were found, and the railway cut ¼ mile east of Orok where a single dorsal interior was found.

Holotype, G.S.C. No. 10434; paratypes, G.S.C. Nos. 11035, 11036, and 11049.

Genus, *Hesperorthis* Schuchert and Cooper

Hesperorthis davidsoni (Verneuil)

Plate XI, figure 3

Orthis davidsoni Verneuil, 1848, Geol. Soc. France, Bull., vol. 5, 2nd ser., p. 341, Pl. 4, fig. 9.

Hesperorthis davidsoni (Verneuil) Schuchert and Cooper, 1932, Peabody Mus. Natr. Hist., Mem., vol. 4, pt. 1, p. 86, Pl. 4, figs. 22, 23, 24.

Shell of medium size, semicircular to subelliptical, broadly rounded anteriorly, wider than long, greatest width at approximately midvalve; cardinal angles obtuse; ventral beak very high, incurved slightly; cardinal area gently curved, apsacline; delthyrium long, narrow; unequally biconvex; ventral valve deep, deepest anterior to umbo; dorsal valve shallow; surface costate; costæ coarse, about 24 in number, all reaching the beak.

Ventral interior: teeth small, dental plates receding, produced on floor of valve, incurving; anterior part showing strong reflection of surface costæ, each fold divided by a smaller one.

Dorsal interior: obscure in the small collection from Manitoba.

Measurements of 2 dorsal valves: lengths 12 and 10 mm.; widths 15 and 14 mm., respectively. Measurements of a single ventral valve: length 14 mm., width 15 mm., height 6 mm.

In all characters the Manitoba specimens are similar to the European specimens. They differ from *Hesperorthis pyramidalis* (Twenhofel) in their fewer costæ, their less transverse shape, and in having their greatest height anterior to the beak. *H. davidsoni* is found in two outcrops on Fort Island in Cedar Lake in the upper part of the Cedar Lake formation.

Hypotype, G.S.C. No. 10437.

Genus, *Platystrophia* King

Platystrophia sp.

In the Cross Lake member of the Cedar Lake formation at Cross Lake Rapids 2 poorly preserved *Platystrophias* were collected. Several other impressions of a coarsely plicate brachiopod were found in the member and are probably referable to this genus. The following description is based on the 2 fairly complete internal moulds.

Shell very small, subquadrate, considerably wider than long, cardinal angles obtuse, broadly rounded, lateral margins rounded, anterior slightly indented; subequally biconvex; curvature of valves low; fold and sulcus low; surface coarsely costate, 3 costæ in sulcus and 4 in fold, about 5 on lateral slopes.

Measurements of the specimens are:

Length—5.8, 5.0 mm.
Width—7.8, 7.0 mm.
Thickness—4.0 mm.

These specimens do not agree with any described species of *Platystrophia* but are not well enough preserved to warrant erection of a new species. In some respects they resemble *P. daytonensis laurelensis* McEwan but they have more plications in the fold than has this species.

Genus, *Dalmanella* Hall and Clarke

Dalmanella (?) sp.

Plate XI, figures 5, 6

Shell of large to medium size, subcircular in plan, hinge line short, greatest width at about midvalve; ventral beak rather prominent, erect; dorsal beak unknown; gently and subequally biconvex; costellæ fine, evenly spaced, subequal, rather irregular and nodose, about 11 in 5 mm. at the anterior commissure, increasing by bifurcation.

Ventral interior: dental laminæ stout, short, extending as faint, incurving ridges a short distance into the valve; diductor scars large, distinctly cordate, divided by a low, vague median ridge.

Dorsal interior: cardinalia unknown; adductor field oval, cordate.

The measurements of typical specimens are:

Length—12, 17, 19, 14, 9, 17 mm.
Width—12, 17, 21, 16, 11, 20 mm.
Thickness—6.5 mm.

The lack of any information on the essential structures of the dorsal valve precludes classification of these specimens other than to the families Dalmanellidae and Wattsellidae. The similarity of the structures of the ventral valve to those of *Dalmanella edgewoodensis* Savage, suggests that the specimens be assigned provisionally to the genus *Dalmanella* (in the sense of Cooper, 1944). Until better preserved dorsal interiors are collected specific identification of these specimens must be deferred. These brachiopods are common in the Fisher Branch dolomite and penetrate into the base of the Inwood formation.

Hypotypes, G.S.C. Nos. 10446 and 10447.

Genus, *Virgiana* Twenhofel

Virgiana decussata (Whiteaves)

Pentamerus decusatus Whiteaves, 1891, Can. Rec. Sci., p. 295, Pl. 3, figs. 3, 4.
Conchidium decussatum (Whiteaves). Hall and Clarke, 1893, Pal. New York, vol. 8, pt. 2, p. 235, Pl. 65, figs. 1, 2, Pl. 66, figs. 1, 15. Whiteaves, 1906, Palæozoic Foss., vol. 3, pt. 4, pp. 293-295, Pl. 26, figs. 1, 2. Kindle, 1915, Geol. Surv., Canada, Mus. Bull. 21, pp. 14-17, Pl. 2, 3, 4.

The features of this large pentamerid brachiopod have been described in the reports listed above and little can be added to these descriptions. The reader is referred to Kindle for a good account of the wide variations that may be found in this species. Because such great variations in form occur within a population of *V. decussata,* it is doubtful whether any valid separation between it and *V. mayvillensis* Savage can be made. Comparison of the Manitoba specimens with published figures of *V. mayvillensis* suggests that the latter may have coarser costæ.

The immature individuals of *V. decussata* are more transverse and have a relatively larger spondylium than the adult individuals. In these characters they resemble *Clorinda.*

V. decussata is abundant in the Fisher Branch dolomite and restricted to that unit. It must have lived in banks similar to modern oyster beds for in places the shells of this brachiopod make up the whole substance of the rock. The specimens reported by Wallace (*see* Kindle, 1915) from Hilbre must have been from drift as the rocks at this locality are hundreds of stratigraphic feet above the Fisher Branch formation to which the fossil is restricted.

Genus, *Brachyprion* Shaler

Brachyprion acanthopterus (Whiteaves)

Plate XI, figures 20, 21, 24, 25

Stropheodonta acanthoptera Whiteaves, 1891, Can. Rec. Sci., p. 294.

Shell medium to large in size, slightly wider than long or about equal in length and width; hinge line extended into long, thin spines, curved slightly posteriorly in some specimens, reaching a length of 11 mm.; lateral margins straight, parallel; anterior margin evenly rounded, tending to slight nasuteness; beaks low, inconspicuous; convexity moderate, distributed evenly along the length of the valves, with an average radius of curvature about 12 mm.; cardinal area about 1 mm. in width, narrowing regularly to cardinal angles; surface marked by fine costellæ, alternating but showing little difference in prominence between orders, 4 to 5 major costellæ and 20 to 25 minor ones in 5 mm. at the anterior commissure.

Ventral interior: dental plates very poorly developed; edges of delthyrium widely diverging; floor of delthyrial foramen marked by short longitudinal ridge, divided anteriorly into 2 low ridges surrounding a small pit about 2 mm. from beak; fine, low median ridge independent of this structure shown by a few specimens.

Dorsal interior: cardinal process of 2 small lobes, diverging slightly anteriorly, projecting into delthyrium; brachiophores diverging at a higher angle, slightly incurved; no median septum observed.

Measurements of the holotype: length—19.5 mm., width—18.5 mm., height—(?) 3 mm. Measurements of Whiteaves' paratype: length—15.5 mm., width—16.0 mm., height—4.0 mm. Means of the measurements of a large collection of *B. acanthopterus* from the Cedar Lake formation are: length—17.5 mm. ($s=2.54$ mm., $N=84$), width—19.6 mm. ($s=2.94$ mm., $N=76$).

The great abundance of this species makes it possible to collect a series of specimens showing wide variation in shape and convexity. The unimodal nature of the plots of measurements of these collections show that the specimens are from a single population; 38 out of 88 specimens measured showed a width-length ratio of 1.1. Although the modal radius of curvature is about 12 mm., radii as low as 7 mm. and as high as 20 mm. were measured.

This species may be distinguished from others in the Interlake group by its size and even convexity. Specimens from the Chemahawin member are considerably smaller than the specimens from the rest of the formation but are not separable as a distinct population. Application of the t-test shows that the Cedar Lake formation specimens of *B. acanthopterus* are significantly greater in size than *B. paskoiacensis* to justify separation of the species. In most other characters the two species are similar. The small specimens of the Chemahawin member appear to be a facies fauna of *B. acanthopterus* rather than a recurrence of *B. paskoiacensis*. This view is based upon the occurrence of a few larger *B. acanthopterus* in the dwarfed fauna and the stratigraphic position of the smaller specimens.

Holotype, G.S.C. No. 5779; hypotypes, G.S.C. Nos. 10438 and 10439.

Brachyprion inflatus sp. nov.

Plate XI, figures 22, 23

Shell of medium size, subcircular in outline, wider than long, with the greatest width at the hinge line; anterior margin evenly rounded, almost semicircular; lateral margins not distinctly set off; cardinal angles extended into spines of unknown length; beaks low and inconspicuous; lateral profile, highly convex; shell surface inclined nearly at right angles to length of shell at ventral beak, curved sharply through angle of almost 180 degrees during growth; radius of curvature of valve about 8 mm.; greatest convexity one-third the distance from beak to anterior; dorsal valve less strongly concave; surface marked by fine costellæ, very lightly impressed, lacking conspicuous alternation, 12 to 13 occurring in 5 mm. at the anterior commissure.

Interiors poorly preserved; dental laminæ very poorly developed.

The following are the measurements of the holotype from the Cross Lake member of the Cedar Lake formation on the south shore of Portage Bay, Cross Lake: length—17 mm., width—20 mm., height—9 mm. The means of the measurements of the populations collected are: length—15.9 mm. (s=1.7 mm., N=9), width—18.1 mm., (s=3.0 mm., N=9).

B. inflatus may be distinguished from all other species of this genus in the Interlake group by its high convexity. It is similar in many respects to *B. elegantulum* Twenhofel but is over double the size. It lacks the geniculation of *B. robustum* Twenhofel and is proportionately longer.

This new species is confined to the Cross Lake member. Two similar but considerably larger specimens from the Inwood formation are doubtfully referred to this species.

Holotype, G.S.C. No. 10457.

Brachyprion paskoiacensis sp. nov.

Plate XI, figures 8, 16, 17

Shell of medium size, subtriangular in outline, slightly wider than long, widest at the hinge; anterior evenly rounded; lateral margins slightly convergent; cardinal angles extended into short spines, not well preserved in specimens at hand; beaks low, inconspicuous; convexity moderate, extended evenly along the length of the valve; radius of curvature 12 mm.; surface marked by fine costellæ, subequal in size, showing faint alternation, 5 major costellæ occurring in 5 mm. at the anterior commissure; coarse pseudopunctæ in rows shown by some specimens.

Ventral interior: dental plates small, highly divergent; diductor impressions set in a cavity, sharply defined postero-laterally, vaguely defined anteriorly, extending one-third of the length of valve; median septum low, vague; low pit in delthyrial cavity similar to that of *Brachyprion acanthopterus* shown by some specimens.

Dorsal interior: median ridge low; brachiophores widely divergent, short.

Measurements of holotype: length—16 mm., width—17 mm., height—5 mm. Means of the measurements of the specimens collected: length—15.5 mm. (s=2.1 mm., N=19), width—17.6 mm. (s=2.7 mm., N=19).

This species is found in beds belonging to the Fisher Branch and Inwood formations. A similar specimen was collected from the Moose Lake dolomite. The type locality for the new species is in the middle of sec. 16, tp. 48, rge. 13, W. Prin. mer., on the south bank of Grand Rapids. The trivial name is derived from the Indian name for the lower Saskatchewan River.

B. paskoiacensis is similar to *B. acanthopterus* but can be distinguished by its smaller size. It differs from species of comparable size in the alateness of the cardinal angles, the lack of much discrepancy in the prominence of the costellæ, and the even convexity. It is larger than *B. latisculptilis* Savage and has no prominent median costella. From *B. leda* Billings it may be distinguished by its relatively greater length.

Holotype, G.S.C. No. 10440; paratype, G.S.C. No. 10449.

Brachyprion paskoiacensis geniculatus subsp. nov.

Plate XI, figures 18, 19

This subspecies is similar in proportions and size to *B. paskoiacensis* but differs in its lateral profile. It is gently convex anteriorly and has a flattened area posteriorly that extends for about two-thirds of the valve length. The subspecies is found associated with the more normally curved specimens but is not abundant. It is confined to the Fisher Branch dolomite and the type locality is on the northeast corner of l.s. 1, sec. 8, tp. 25, rge. 2, W. Prin. mer. Measurements of the holotype (G.S.C. No. 10443): length—16 mm., width—18 mm., height—4 mm.

Brachyprion philomena (Billings)

Strophomena philomena Billings, 1860, Can. Natr. Geol., vol. 5, p. 56.
Brachyprion ventricosum Shaler, 1865, Mus. Comp. Zool. Bull., vol. 1, p. 63.
Brachyprion philomena (Billings). Twenhofel, 1928, Geol. Surv. Canada, Mem. 154, p. 189, Pl. 22, fig. 14, Pl. 23, figs. 8, 9, 10.

Shell large, subtriangular in outline, slightly wider than long; hinge line extended into short ears; lateral margins convergent; anterior margin evenly rounded or slightly extended and nasute; beaks low; highly convex; ventral valve flat posteriorly, broadly geniculate through about 45 degrees at the anterior; dorsal valve evenly and gently concave; surface marked by fine costellæ conspicuously alternating in size, about 4 or 5 major costellæ in 5 mm. at the anterior commissure and twice as many minor ones.

Ventral interior with short, widely divergent dental lamellæ, no median septum. Dorsal interior obscure.

The mean length and width of the specimens collected is 25.7 mm. and 27.4 mm., respectively.

This species may be distinguished from *B. paskoiacensis*, which it closely resembles, by its large size. The proportions of *B. philomena* are much different from those of *B. robustus* Twenhofel, the only species from the Interlake group rivalling it in size. The most conspicuous difference between the Anticosti and Manitoba specimens of *B. philomena* is the tendency of the latter to be slightly nasute. The species is found rarely in the Fisher Branch and Inwood formations.

Brachyprion robustus Twenhofel

Plate XI, figure 26

Brachyprion robustum Twenhofel, 1928, Geol. Surv., Canada, Mem. 154, p. 190, Pl. 16, figs. 12-15.

Shell large, semicircular in outline, considerably wider than long; hinge line extended into spines 2 to 3 mm. in length; lateral margins convergent; anterior broadly rounded to slightly flattened; beaks low, inconspicuous; convexity moderate to high; ventral valve flat posteriorly, becoming broadly geniculate anteriorly; dorsal valve more evenly concave; surface marked by fine alternating costellæ, 5 major costellæ occurring in 5 mm. at the anterior commissure.

Ventral interior: median septum fine, prominent. Dorsal interior: cardinal process stout, two-lobed.

The measurements of the collected specimens (means): length—18.3 mm. (s=2.5 mm., N=16), width—24.7 mm. (s=2.5 mm., N=16).

The specimens from Manitoba are half as large again as the specimens described from Anticosti, but the proportions are exactly the same as those illustrated by Twenhofel. *B. robustus* is characterized by its proportionately greater width (its width-length ratio is 1.3 or 1.4 in contrast with the ratio of 1.1 of the other *Brachyprions* of the Interlake group) and generally larger size. The species occurs at the top of the Cedar Lake formation.

Hypotype, G.S.C. No. 10458.

Genus, *Öpikina* Salmon

Öpikina (?) *stonewallensis* sp. nov.

Plate X, figures 1-4

Shell of medium size, subquadrate to subcircular, wider than long; cardinal angles slightly rounded; greatest width just anterior of hinge line; gently concavo-convex, curvature distributed evenly along length of valves; surface covered with fine, regular costellæ, increasing by intercalation, of several orders, about 12 in 5 mm. at the anterior commissure; growth lines prominent near the commissure, in some specimens imbricate; shell substance thin.

Ventral interior: dental plates small; diductor scars rather small, extending to mid-valve; adductor scars small, elongate; surface finely pustulose.

Dorsal interior: cardinal process prominent, extending above hinge line as 2 slightly divergent lobes; brachial supports laterally directed from base of cardinal process, thin, blade-like; median septum low; lateral septa sharp, extending past mid-valve; first lateral septa incurved anteriorly; second lateral septa straight; adductor field subquadrate; surface densely pustulose.

Measurements of the holotype from an outcrop west of highway 7, 4.2 miles north of Fisher Branch are: length—16 mm., width—21 mm.

Measurements typical of other specimens are:

Length—15,	13,	13,	10,	16,	7,	14,	15,	14,	16,	14	mm.
Width —19,	21,	19,	15,	21,	16,	24,	20,	20,	22,	20	mm.

The features of the dorsal interior of this species place it closest to the genus *Öpikina* Salmon. The species lacks the geniculation of most described members of this genus and the pattern of the pseudopunctæ cannot be ascertained on the moulds and casts that make up the material for this description. The tenuity of the shell has allowed crushing of the fossils in preservation and the impression of the internal structures on the exterior moulds of some of the valves. The shape of the shell, the low curvature of the valves, and their lack of geniculation, these features separate *Ö.* (?) *stonewallensis* from other described species of *Öpikina.*

Ö. (?) *stonewallensis* occurs in considerable abundance in the upper quarry beds at Stonewall but is commonly found in a fragmentary condition. The only other outcrop from which this species was collected is also in Stonewall formation, the type locality mentioned above.

Holotype, G.S.C. No. 10448; paratypes, G.S.C. Nos. 10441, 10442, and 11058.

Genus, *Leptaena* Dalman

Leptaena parvula Kindle

Leptaena parvula Kindle, 1915, Nat. Mus., Canada, Bull. 21, p. 14, Pl. 1, figs. 5-9.

Shell small, rectangular in plan, wider than long; lateral margins subparallel; anterior flattened; cardinal angles extended into short, acute ears; posterior central part flat; geniculation shallow anteriorly and laterally, not abrupt; surface marked by 8 fine costellæ and over-all, irregular wrinkles in rough zigzag pattern, becoming more regular near cardinal angles.

Interiors of both valves not represented in the writer's collections.

The impressions left by these brachiopods are easy to recognize. The irregular zigzag wrinkles of the surface crossed by fine costellæ distinguish this species from all others except *L. sinuosus* Kindle. No specimens showing the characteristic sinus of *L. sinuosus* were found. *L. parvula* occurs near the top of the Cedar Lake formation, both in reef and inter-reef beds, throughout the area.

Genus, *Megamyonia* Wang

Megamyonia nitens (Billings)

Plate XI, figures 9-11

Strophomena nitens Billings, 1860, Can. Natr. Geol., vol. 5, p. 53, fig.1.
Leptaena nitens (Billings). Whiteaves, 1895, Pal. Foss., vol. 3, pt. 2, p. 120.
Leptaena (?) *nitens* (Billings). Twenhofel, 1928, Geol. Surv., Canada, Mem. 154, p. 186, Pl. 18, figs. 13, 14.
Megamyonia nitens (Billings). Brown, 1952, in Baillie, Man. Mines Branch Pub. 52-6, p. 33.

Shell of medium size, subrectangular, considerably wider than long; cardinal angles slightly extended; lateral margins very slightly convergent; anterior broadly rounded; concavo-convex; anterior and lateral margins geniculate through about 75 degrees, valve posterior to geniculation flat; surface marked by fine costellæ, increasing by intercalation, median costellæ pronounced in young stages.

Ventral interior; cardinalia obscure; adductor scars elongate, small; diductor scars, large, flabellate, extending to midvalve.

Dorsal interior: cardinal process bilobed; median septum very low, short.

Measurements of several specimens are:

Length—	17,	15,	15,	16,	15,	16,	13,	13	mm.
Width —	25,	22,	24,	24,	24,	24,	19,	20	mm.

The lack of an internal ridge bordering the diductor scars in the ventral valve and of crenulation of the valves separates *Megamyonia* from *Leptaena*. The transverse shape and the geniculation of its shell distinguish this species from all others from Manitoba. The writer has collected *M. nitens* only from the upper dolomite at the Stonewall quarries where it is abundant. The species is also found in the underlying Stony Mountain formation.

Hypotypes, G.S.C. Nos. 10451, 10452, and 10453.

Genus, *Fardenia* Lamont

Fardenia elegans (Prouty)

Plate X, figure 5; Plate XI, figure 4

Schuchertella elegans Prouty, 1923, Maryland Geol. Surv. Silurian, p. 429, Pl. 17, figs. 12, 13, 14.

Shell of small to medium size, subcircular to subelliptical, wider than long, greatest width considerably anterior to hinge; anterior margin evenly rounded; cardinal angles obtuse, rounded; ventral beak projecting beyond hinge line, conspicuous; dorsal beak less conspicuous; lateral profile biconvex, both valves of low convexity, distributed evenly from hinge to anterior margin; low ventral sulcus and dorsal fold developed in some specimens near umbo, dying out anteriorly; surface covered with fine costellæ, straight anteriorly, curving slightly posteriorly near cardinal angles, sharp, alternating; where minor costellæ indistinct, major costellæ apparently separated by broad interspaces; 6 major costellæ in 3 mm. at the commissure; growth lines very fine, most prominent between costellæ.

Ventral interior: dental laminæ thin, projecting into valve, diverging at about 90 degrees.

Dorsal interior: cardinal process bifid, connecting with widely divergent brachiophores.

Measurements of typical specimens are:

Length—	9,	12,	9,	6,	12,	11	mm.
Width —	10,	13,	10,	8,	14,	15	mm.

Specimens doubtfully referred to *F. elegans* appear in the Inwood formation. Most of the specimens of this species were collected from two outcrops in the Moose Lake dolomite where they occur in abundance, piled on top of one another on the bedding planes. The specimens from Manitoba differ only slightly in ornament from those described by Prouty from the Rochester shale of Maryland. The ornament appears to be variable in the specimens collected by the writer.

Hypotype, G.S.C. No. 10459.

Fardenia ellipsoides sp. nov.

Plate XI, figures 12-15

Shell of medium size, subelliptical, wider than long, attaining greatest width about midlength; lateral margins divergent posteriorly; anterior broadly rounded; cardinal angles obtuse to a varying amount from about 95 degrees to about 120 degrees; beaks low, inconspicuous; lateral profile gently biconvex, greatest convexity in dorsal valve, curvature evenly distributed along length; surface covered with sharply defined costellæ, curving upward slightly on posterior margins; major costellæ prominent, bordered by broad, flat interspaces showing 3 fine costellæ, about 12 extended to umbo; single major costella arising at midlength from each interspace, indistinguishable from primaries at commissure; fine growth lines in interspaces of some specimens.

Ventral interior: dental laminæ prominent, short, diverging at high angle; diductor scars very faint; posterior lobe of adductor scar small; anterior lobe larger.

Dorsal interior: brachiophores diverging at high angle (140 degrees), uniting at their apices to form an obscure cardinal process.

Measurements of the holotype from the Atikameg dolomite on Dunsekikan Island in Lake St. Martin are: length—13.9 mm., width—18.2 mm. Means of the measurements of the population collected are: length —12.9 mm. (s=2.4 mm., N=33), width—16.9 mm. (s=3.7 mm., N=31).

This species appears first in the southern exposures of the Inwood formation but does not occur in formations older than the Atikameg dolomite in the northern part of the area. *F. ellipsoides* does not occur in formations younger than the Atikameg dolomite.

The length of the hinge line shows considerable variation. In some shells it is very short yet in others it lacks little of being the greatest width. The species may be distinguished from others of the genus by its elliptical shape and the wide interspaces between the costellæ. *F. ellipsoides* is similar to *F. interstriata* (Hall) but the New York species lacks the broad interspaces. This conspicuous difference in ornament also distinguishes the new species from *F. curvistriata* (Savage).

An anomalous occurrence of a brachiopod very similar to, if not identical with, *F. ellipsoides* was encountered in an outcrop on the southwest corner of sec. 35, tp. 23, rge. 1, W. Prin. mer. This exposure is stratigraphically in the Stonewall formation and if the single slab from which these brachiopods were collected was in place, the range of *F. ellipsoides* must be extended considerably. More material must be collected from this outcrop to confirm this extension.

Holotype, G.S.C. No. 10460; paratypes, G.S.C. Nos. 10461, 10462, and 10465.

Fardenia transversalis sp. nov.

Plate XII, figures 18-20

Shell, minute, subquadrate, considerably wider than long, widest at the hinge; lateral margins convergent; anterior margin, gently rounded, slightly flattened; cardinal angles extended into slight ears or rectangular; beaks low, inconspicuous; lateral profile gently biconvex, greatest convexity in ventral valve, greatest convexity of both valves near the umbo; low sulcus developed early in dorsal valve, broadening rapidly to become indistinguishable at the anterior; surface covered with sharp, subequal costellæ, separated by rather broad interspaces; 20 major costellæ present posteriorly, about same number intercalated near the anterior; growth lines more conspicuous on costellæ than between, a deeply incised one common near anterior margin.

Ventral interior: dental plates well developed, highly diverging, stopping abruptly anteriorly.

Dorsal interior: brachiophores highly diverging; cardinalia obscure. Surface ornament is strongly reflected on the interiors.

Measurements of the holotype from the Inwood formation at Grand Rapids are: length—4.8 mm., width—7.8 mm. Means of the measurements of the population collected are: length—4.9 mm. ($s=0.7$ mm., $N=12$), width—7.7 mm. ($s=1.1$ mm., $N=12$).

This small brachiopod is fairly abundant in the beds of the Fisher Branch and Inwood formations. In size and form it resembles several *Fardenias* from the Silurian system of North America. *F. transversalis* never attains the width of *F. reedsi* Amsden, which is regularly 14 to 15 mm. wide. From *F. perconcinna* (Grubbs) it may be distinguished by its greater number of costellæ and the abrupt ending of its dental plates, which are not extended on to the floor of the valve. Comparison should be made between this species and *Schuchertella* (?)*striatissima* Poulsen, rather inadequately described from the Silurian of Greenland.

Holotype, G.S.C. No. 10450; paratype, G.S.C. No. 11032.

Genus, *Camarotoechia* Hall and Clarke

Camarotoechia indianensis (Hall)

Plate XI, figures 1, 2

Rhynchonella indianensis Hall, 1863, Trans. Albany Inst., vol. 4, p. 215. 1879, 28th Ann. Rept. New York State Mus., p. 163, Pl. 26, figs. 12-22.
Camarotoechia indianensis (Hall). Hall and Clarke, 1894, Pal. New York, vol. 4, p. 190.

Shell of small to medium size, subtriangular to subpentagonal in outline; ventral beak erect, prominent, sharp; dorsal beak low, broadly rounded lateral profile unequally biconvex, greatest convexity in dorsal valve; fold and sulcus prominent, sharply set off from lateral slopes; plications low, rounded, all extended to umbo, none bifurcating or emplanted, 3 plications on the ventral sinus and 4 on the dorsal fold, 4 to 7 on the lateral slopes of either valve, those near the hinge line very faint; growth lines obscure.

Ventral interior: dental laminæ vertical, extending only a short distance into valve.

Dorsal interior: adductor scars extending to midvalve, divided by a low median septum extending 3 mm. from beak; septum divided posteriorly, forming with the crural plates a short, small, cruralium.

Means of the measurements of the specimens collected are: length—9.0 mm. (s=1.3 mm., N=31), width—10.2 mm. (s=1.4 mm., N=28), thickness—6.0 mm. (N=9).

C. indianensis has been collected from the Fisher Branch, Inwood, and Moose Lake formations and recurs in considerable abundance in the Cedar Lake formation. In specimens from the Fisher Branch dolomite the lateral slopes may show as many as 7 plicæ but those near the lateral commissure can only be distinguished with difficulty. In specimens from the Inwood and higher formations these plicæ at the margin disappear and 4 or 5 plicæ only are found on the lateral slopes. The younger specimens are more typical of *C. indianensis* from the Waldron shale. Although Hall in his description of 1879 indicates that only 9 to 12 plications occur in this species, his illustrations show that up to 15 may be present. The specimens from the Fisher Branch dolomite might be separated as a subspecies. *C. indianensis* may be distinguished from *C. ekwanensis* Whiteaves by its proportionately greater length.

Hypotypes, G.S.C. Nos. 10454 and 10455.

Camarotoechia winiskensis Whiteaves

Plate XI, figure 7.

Camarotoechia (?) *winiskensis* Whiteaves, 1906, Pal. Foss., vol. 3, pt. 4, p. 272, Pl. 25, figs. 5, 6.
Allorhynchus winiskensis (Whiteaves). Hume, 1925, Geol. Surv., Canada, Mem. 145, p. 61.

Shell of medium size, in plan subelliptical, wider than long, flattened somewhat anteriorly; ventral beak erect, sharp, prominent; dorsal beak rounded, inconspicuous; lateral profile biconvex moderately, convexity of valves approximately equal; fold and sulcus broad, not sharply set off from lateral slopes, beginning at about midvalve; surface covered with numerous fine plicæ, up to 40 in number, arising by emplantation, 8 to 12 occurring in the fold and sulcus, 12 to 20 on the lateral slopes.

Ventral interior: dental laminæ fine, slightly divergent, extending only a short distance into the valve.

Dorsal interior: median septum short, extending only a few millemetres into valve, thickening posteriorly and branching to form small cruralium.

Measurements of several specimens from Manitoba are:

Length	—15,	13,	11,	12,	16,	17,	11	mm.
Width	—17,	15,		13,	19,	21,	13	mm.
Thickness	— 9,			7	mm.			

This species makes its first appearance in the East Arm dolomite and becomes fairly abundant in the Cross Lake dolomite. A specimen doubtfully referred to the species was collected from the top of the Cedar Lake formation. Representatives of *C. winiskensis* from the Interlake group are larger and more finely striate than those from the Winisk River. Their internal structures confirm the reference by Whiteaves of this species to the genus *Camarotoechia*. The Interlake specimens show a resemblance to the younger forms of *C. jonesi* Northrup but no specimens in the writer's collections attains the robustness nor the depth of sulcus of the mature forms of *C. jonesi*.

Hypotype, G.S.C. No. 10436.

Genus, *Clintonella* Hall and Clarke

Clintonella bailliei sp. nov.

Plate XII, figures 8-12

Shell minute, subelliptical to subcircular in plan, wider than long in most specimens, broadly rounded at anterior; ventral beak prominent, slightly incurved, perforated by a large V-shaped delthyrium; dorsal beak low; subequally biconvex, moderately thick to globose, convexity distributed evenly along the valves; poorly defined broad sulcus on ventral valve and corresponding fold on dorsal; surface evenly costate; costæ angular, about 15 on each valve, all extending from beak to commissure, 2 in ventral sinus, 3 on dorsal fold.

Ventral interior: teeth prominent, incurving, supported below by thick receding dental laminæ; laminæ produced as fine ridges on floor of valve, variable in development, in some specimens represented only by thickening of valve beneath tooth, in others well formed.

Dorsal interior: hinge plate divided by narrow cleft, supporting stout brachiophores: median septum short, stout, angular-crested, projecting short distance into valve as slight ridge between adductor field; anterior adductor scars large, subelliptical; posterior lobes smaller, subcircular.

Means of the measurements of a population collected from the type locality at Mile 5.5 of the Churchill branch of the Canadian National railway are: length—4.2 mm. (s=0.46 mm., N=20), width—4.3 mm. (s=0.49 mm., N=20), thickness—3.2 mm. (s=0.45 mm., N=20).

The internal structures and costæ of this species indicate its relationship to *Clintonella vagabunda,* the genotype. It can be distinguished from this species and also from *Homeospira lowi* by the fineness and regularity of its surface ornament. The range of *C. bailliei* includes the East Arm and Cross Lake dolomites. In both of these formations it may be abundant enough to form a coquina. Specimens of the species are particularly abundant and well preserved at the type locality. The species is named in honour of A. D. Baillie.

Holotype, G.S.C. No. 11031; paratypes, G.S.C. Nos. 11014 and 11015.

Genus, *Hindella* Davidson

Hindella prinstana (Billings)

Athyris prinstana Billings 1862, Pal. Foss., vol. 1, p. 145, figs. 122a-b.
Hindella prinstana (Billings). Hall and Clarke, 1894, Pal. New York, vol. 8, pt. 2, p. 64, Pl. 41, fig. 28, Pl. 49, fig. 1.

Shell small, subelliptical in outline; ventral valve elongate; dorsal valve subcircular; cardinal slopes meeting lateral margins at slight angle giving shell 'shouldered' appearance; anterior broadly rounded; ventral beak prominent, incurved; dorsal beak low; subequally biconvex, rather globose in profile; slight broad fold at anterior of dorsal valve, corresponding sinus in ventral valve; surface marked by few concentric growth lines.

Ventral interior: dental plates prominent, short, produced as faint ridges on floor of valve.

Dorsal interior: median septum fine extending considerable distance into valve.

The shape of this small brachiopod serves to distinguish it from other Meristelloid species in absence of evidence of the loop. *H. prinstana* is found at a single locality in beds of the Fisher Branch formation on the southeast shore of the north lobe of Moose Lake at latitude 100° 10′ west.

Genus, *Meristina* Hall

Meristina manitobensis sp. nov.

Plate XII, figures 25, 26, 30

Shell small, subtriangular in outline, length and width almost equal, or slightly wider than long; ventral beak prominent, slightly incurved; dorsal beak low; lateral profile moderately and subequally biconvex; low broad sinus developed on the anterior part of some ventral valves, others flattened anteriorly; fold in dorsal valve poorly developed; surface marked with fine growth lines.

Ventral interior: dental laminæ long, reaching to midvalve, slightly convergent in front of umbo, divergent anteriorly around shallow excavation of muscle scars; details of muscle scars obscure; vaguely defined median ridge present in few specimens anterior to dental laminæ.

Dorsal interior: hinge plate divided, supported by low median septum, forming with it minute subrostral chamber; septum extended anteriorly almost to midvalve.

Measurements of typical specimens are as follows:

Length	—12,	10,	10,	6.5,	11	mm.
Width	—12,	11,	10,	7.5,	14	mm.

This species is characterized by its triangular, more or less transverse shape, and its small size. It is not so inflated as *M. globosa* Prouty but is otherwise similar. It differs from *M. profunda* Grabau in the lighter impression of the muscle scars. The size and ventral interior serve to distinguish *M. manitobensis* from *M. roemeri* Foerste. Nearly all the specimens of this species collected are moulds of the ventral interior but some exteriors and a single dorsal interior were found. The species is common in and confined to the Cedar Lake formation. The type locality is an outcrop in the centre of sec. 36, tp. 29, rge. 9, W. Prin. mer.

Holotype, G.S.C. No. 11038; paratypes, G.S.C. Nos. 10463, 10464, and 11004.

Genus, *Homeospira* Hall and Clarke

Homeospira lowi (Whiteaves)

Plate XII, figures 14-17

Rhynchospira lowi Whiteaves, 1906. Pal. Foss., vol. 3, pt. 4, p. 277, Pl. 25, figs. 8, 9.

Shell small, subcircular to subpentagonal in plan, width and length equal; ventral beak erect, prominent, perforated by circular foramen; dorsal beak rounded, giving circular outline to dorsal valve; subequally, moderately biconvex; small sinus near umbo in dorsal valve divided anteriorly by prominent fold, in some specimens fold divided at anterior by small sinus; coarsely plicate; 3 or 4 small folds on flanks of dorsal valve, inner ones of some specimens divided by small infold; prominent median sinus on ventral valve, not reaching umbo, bordered by 2 prominent folds, in some specimens divided by small median fold at commissure; 2 to 3 small folds on flanks of ventral valve,

Ventral interior: dental plates lacking.

Dorsal interior: brachiophores divergent at high angle for several millimetres, directed ventrally; median septum supporting hinge plate, extending 1.5 mm. anteriorly; spiralia poorly preserved, performing about 3 volutions, apparently directed medially.

Measurements typical of Interlake specimens of this species are:

Length	—7.2,	6.7,	5.5	mm.
Width	—	7.0,	5.0	mm.
Thickness	—2.6,		3.2	mm.

H. lowi is restricted to the Atikameg dolomite in southern Manitoba and makes an excellent index to this formation for it is common in nearly all outcrops and is easy to recognize by its characteristic plications. The species was originally described without reference to interior structures. Some of the specimens from the Interlake group are interior casts whose structures indicate that the species belongs to the genus *Homeospira* rather than *Rhynchospirina*. The long, widely divergent crural bases and stout median septum indicate its affinity to *Homeospira*.

Hypotypes, G.S.C. Nos. 10456, 11013, 11019, and 11020.

Genus, *Hyattidina* Hall and Clarke

Hyattidina junea (Billings)

Athyris junea Billings, 1866, Cat. Sil. Foss. Anticosti, p. 46.

Hyattella junea (Billings). Hall and Clarke, 1894, Pal. New York, vol. 8, pt. 2, p. 62, Pl. 40, figs. 29, 30, 31.

Hyattidina congesta junea (Billings). Twenhofel, 1928, Geol. Surv., Canada, Mem. 154, p. 223, Pl. 30, figs. 4, 5, 6.

Shell minute to small, subpentagonal to subcircular, width and length subequal, outline flattened anteriorly; ventral beak erect, showing small slit-like delthyrium; dorsal beak low, inconspicuous; moderately and subequally biconvex; median sinus and 2 lateral sinuses on ventral valve developed to varying degree; corresponding folds on dorsal valve; surface smooth or covered with very fine radial lines and concentric growth lines.

Means of the measurements of several specimens from the Interlake group are: length—5.8 mm. (s=0.9 mm., N=16), width—5.9 mm. (s=1.2 mm., N=14).

The expression of the fold and sinus in the specimens from the Interlake group is highly variable. Specimens in intimate association are found that have no fold or sinuses, only a median fold and sinus, and the typical double fold and sinus. Those specimens with smooth shells are probably immature ones. In collections from a single locality specimens showing the typical form are common so that identification is not difficult. The Interlake representatives of *H. junea* are slightly smaller than those from Anticosti. They are characteristic of, and restricted to, the Inwood formation.

Genus, *Meristospira* Grabau

Meristospira Grabau, 1909, Michigan Geol. Surv., Pb. 2, Geol. Ser. 1, p. 158.

Shell meristoid; ventral beak elevated, slightly incurved; median sinus on one or both valves. Ventral interior: dental laminæ strong, restricted to rostral region; median septum absent or faint. Dorsal interior: hinge plate strong, supported by socket plates, curving into cavity of ventral valve, pierced by visceral foramen just below beak; median septum present, independent of hinge plate.

Meristospira dunbari sp. nov.

Plate XII, figures 21-24

Shell rather small, subtriangular in outline, anteriorly sulcate to a varying degree, tapering posteriorly to acute beak; ventral beak high, slightly recurved; dorsal beak less prominent, recurved so as to hide delthyrium; subequally biconvex, globose; greatest convexity of both valves near umbo; shallow fold with well-defined axis starting in both valves near midlength, continuing to anterior commissure; surface smooth or marked by faint growth lines.

Ventral interior: dental laminæ vertical, high, reaching to base of valve, not produced forward on floor of valve, diverging slightly anteriorly; muscle scars obscure.

Dorsal interior: hinge plate thick, divided in centre, supporting stout brachiophores; brachiophores horizontal for about 1 mm. from hinge plate, then deflected into ventral valve abruptly; spiralia unknown; median septum thin, high, extending from the division of hinge plate to about mid-valve.

Measurements of typical specimens are:

Length	—9.6,	9.3,	9.8,	8.2	mm.
Width	—8.8,	9.6,	8.7,	7.8	mm.
Thickness—		6.3	mm.		

The affinity of this species to *Meristospira* is indicated by its meristelloid shape, dental laminæ and prominent median septum, which is not connected to the hinge plate. *M. dunbari* differs in many respects from *M. michiganensis* Grabau, the genotype and only other described species of the genus. The anterior margin of the Interlake species is commonly indented by the sinuses on both valves whereas the margin of the genotype is produced anteriorly. The median septum is more pronounced and the dental plates more divergent in the Manitoban species. *Meristospira dunbari* may be distinguished from *Meristina manitobensis* internally by its short dental plates and externally by its double sinus. Externally *Meristospira dunbari* is rather similar to *Glassia variabilis* Whiteaves but is more globose and has better defined sinuses on both valves.

M. dunbari is found only at the top of the East Arm dolomite in the Interlake group but is abundant at that horizon. The type locality is a small point on the southeast corner of Reader Lake. There most of the specimens are casts of the interior of the shell but good casts of the exterior may be collected at Redrock Rapids.

The species is named in honour of C. O. Dunbar of Yale University.

Holotype, G.S.C. No. 10444; paratypes, G.S.C. Nos. 10445, 11017, and 11018.

Genus, *Howellella* Kozlowski

Howellella cf. *crispa* (Hisinger)

Poorly preserved specimens that are probably referable to this species were found at the top of Cedar Lake formation at two localities. The specimens show the low broad plications characteristic of the species. There are 6 folds on the ventral valve and 5 on the dorsal.

CEPHALOPODA

Subclass, **Nautiloidea**

Order, ACTINOCERATIDA

Genus, *Kochoceras* Troedesson

Kochoceras cf. *productum* Troedesson

Plate XIII, figure 1; Plate XV, figures 9, 10

Huronia cf. *septata* Parks. Okulitch, 1943, Roy. Soc., Canada, Trans., sec. 4, vol. 37, p. 64, Pl. 2, fig. 7.

Material: one phragmocone preserving the siphuncle in place, several isolated and weathered siphuncles, all from the lower dolomite bed of the Stonewall quarries.

Conch orthoconic, tapering very gradually from 48 mm. to 45 mm. in lateral diameter in a length of 50 mm.; at least 80 mm. long, probably much longer; conspicuously flattened ventrally so that the cross section is the minor segment of a circle; lateral angles sharply rounded; dorsoventral diameter 20 mm. where lateral diameter 45 mm. at the adoral end of the largest specimen; surface and adapical end of conch not preserved.

Septa deeply concave, forming an angle of about 45 degrees with the long axis of the conch, meeting the lateral wall of the conch 10 mm. orad of their contact with the siphuncle, spaced so that 8 occur in 50 mm. and the average distance between septa is 6 mm.; siphuncle situated along ventral wall, depressed dorsoventrally, flattened conspicuously along ventral side, having a lateral diameter of 34 mm. and a dorsoventral diameter of 15 mm. at the adoral end of the largest specimen; segments resemble those of *Huronia,* slightly concave at lower end of septal necks; connecting rings projecting 4 mm. into the cameræ; 12 annulations in 80 mm. in the longest siphuncle; interior of siphuncle unknown.

The specimens collected by Okulitch from the dolomite in the pit at the Stonewall quarries were referred by him to *Huronia* cf. *septata* Parks. The ventral flattening of both the conch and the siphuncle indicate the affinity of these specimens with *Kochoceras* rather than *Huronia.* They resemble *K. productum* to a greater degree than any other species of the genus in the spacing and shape of the siphuncle segments and the general form of the conch. The septa are closer set in the specimens from Stonewall and are more convex. These differences are probably sufficient to justify the erection of a new species when more satisfactory material becomes available. The specimens here referred to *K.* cf. *productum* may be synonymous with those called *Tripleuroceras robsoni* by Whiteaves (*see* below).

Hypotype, G.S.C. No. 11055.

"*Tripleuroceras*" *robsoni* Whiteaves

Tripleuroceras robsoni Whiteaves, 1898, Ottawa Natr., vol. 12, p. 123. 1906, Pal. Foss., vol. 3, pt. 4, p. 281, Pls. 31, 32. Foerste, 1926, Denison Univ. Bull. Sci. Lab. Jour., vol. 21, pp. 310-311.

The specimens described by Whiteaves could not be located in the Survey collections and no other specimen that can be referred to this species has since been collected from the type locality at Stonewall. Foerste points out that the species is probably not a true *Tripleuroceras* as it has not the actinosiphonate structure within its siphuncle. There is a certain similarity in Whiteaves' description of his specimens to those described in this report as *Kochoceras* cf. *productum.* This similarity extends to the general shape and size, the shape of the septa, and the large size and nummuloidal design of the siphuncle. If, when Whiteaves' specimens are found, they prove to be conspecific with *K.* cf. *productum,* then Whiteaves' specific name may be used under the generic name of *Kochoceras.*

Genus, *Elrodoceras* Foerste

Elrodoceras exile sp. nov.

Plate XIII, figure 2; Plate XIV, figure 1

Material: seven poorly preserved conchs of this species have been collected from the East Arm and Cedar Lake formations.

Conch orthoconic throughout preserved parts, enlarging slowly with an apical angle of about 8 degrees, slender; specimen of greatest length 35 mm. long with diameters of 4.6 mm. adapically and 6.6 mm. adorally; cross section almost circular or slightly compressed; surface features not preserved.

Sutures relatively widely spaced, about 1½ to 2 mm. apart, or about 5 in a length equal to the diameter of the conch, showing slight lateral lobes; septa deeply concave.

Siphuncle situated slightly ventrad of axis, its connecting rings swollen to a diameter of about 1½ mm. between septa but not narrowly restricted in passing through them; siphuncle filled with deposits typical of *Elrodoceras* (Teichert, 1933).

Although typical *Elrodoceras* are cyrtoconic in the adapical parts of the conch, authors have not hesitated to place in the genus species that have little indication of this. The expanded nature of the siphuncle, its position, and the endosiphuncular structure, indicate that this species is referable to *Elrodoceras.* It differs from the genotype, *E. indianensis*

(Miller), and all other described species in its slender form and small size. The type locality is on Moose Lake at sec. 9, tp. 26, rge. 20, W. Prin. mer. in the East Arm dolomite.

Holotype, G.S.C. No. 10428; paratype, G.S.C. No. 11016.

Genus, *Megadiscosorus* Foerste

Megadiscosorus remotus (Foord)

Plate XV, figure 1

Discosorus remotus Foord, 1887, Cat. Foss. Ceph. Brit. Mus., vol. 1, p. 197.
Discosorus (?) *remotus* Foord. Foerste, 1924, Contrib. Geol. Mus. Univ. Michigan, vol. 2, p. 75, Pl. 4, figs. 6A-B.
Megadiscosorus remotus (Foord). Foerste, 1925, Geol. Surv., Canada, Mem. 125, p. 92, Pl. 12, figs. 3a, 3b.

A single siphuncle of 5 segments is referred to this species. It is slightly depressed in section (more so in adoral segments), slightly flattened on the ventral side, and very slightly curved. The length of the 5 segments is 20 mm. dorsally, and their dorsoventral diameters are 9 mm. adorally and 5 mm. adapically. The corresponding lateral diameters are 6 mm. and 11 mm. The axis of each segment of the siphuncle is inclined at an angle of about 20 degrees to the axis of the siphuncle as a whole. This specimen represents a more adapical part of the siphuncle than the type, but has very similar proportions. It is from the East Arm dolomite at Mile 5.5 of the Churchill branch of the Canadian National railway.

Hypotype, G.S.C. No. 10426.

Genus, *Sactoceras* Hyatt

Sactoceras marginale sp. nov.

Plate XIII, figure 3

Material: two conchs from the northeast bay of Big Island, Moose Lake, have been assigned to this species. A similar specimen was found in the same formation at Redrock Rapids.

Conch orthoconic, expanding rapidly with an apical angle of about 10 degrees. One specimen shows an increase in dorsoventral diameter of from 4.5 mm. to 7.5 mm. in 17 mm. of length. Cross section depressed to extend that where the dorsoventral diameter is 10 mm., the lateral diameter is 12 mm., dorsum and venter both broadly rounded; sutures apparently straight and at right angles to axis of conch, not well preserved; septa moderately concave, spaced so that 12 occur in 15 mm. of length, or about 8 in a length equal to the dorsoventral diameter; siphuncle eccentric, about 2 mm. from ventral wall, swollen considerably between septa to maximum diameter of 2 mm.; connecting rings adnate to overlying segment through most of their expansion; posterior area of adnation not so great as anterior; septal necks not identified but either short and recurved or obsolete; segments considerably oblique due to eccentric position of siphuncle; no deposits identified within siphuncle.

The genus *Sactoceras* has acted as a catch-all for cyrtochoanitic cephalopods with small siphuncles. Commonly it is defined to include only species with annulosiphonate deposits but species with simple siphuncles have been admitted. The position of the siphuncle is also variable in this genus. Although the position of the siphuncle is subcentral in many species, Teichert (1933) refers to its position in his definition of the genus as 'randlich'. The cross section of the conch may be either depressed or compressed according to Foerste (1930). *Sactoceras marginale* seems to fit into the definition of the genus in the broad sense but is not very similar to more typical *Sactoceras* with subcentral siphuncle and annulosiphonate deposits. The small size and depression of the conch, and the structure and position of the siphuncle are distinguishing features of the new species. Both *S. scrulatum* Foerste and *S. vadocameratum* Foerste have subcentral siphuncles and are much larger forms. *S. marginale* resembles *S. tyriense* Strand in the marginal position of the siphuncle and the depression of the conch but does not have the annulosiphonate deposits of that species. The sutures of the septa of the new species are at right angles to the conch axis and not oblique as are those of *S. depressum* Foerste.

Holotype, G.S.C. No. 10479; paratype, G.S.C. No. 10480.

Order, MICHELINOCERATIDA

Genus, *Metaspyroceras* Foerste

Metaspyroceras meridionale (Whiteaves)

Spyroceras meridionale Whiteaves, 1906. Pal. Foss., vol. 3, pt. 4, p. 281, Pl. 30, fig. 9.

Material: only a single specimen of this species was collected by the writer from the quarries at Stonewall in the Stonewall formation.

Conch depressed dorsoventrally, expanding from a dorsoventral diameter of 21 mm. to 25 mm. in a length of 35 mm.; corresponding lateral diameters 24 mm. and 27 mm. respectively; curvature of conch not detectable in short specimen at hand; surface marked by 8 sharp ribs and 7 gently rounded interspaces in a length of 47 mm.; ribs almost at right angles to axis of conch, more widely spaced adorally; sutures sloping apicad ventrally, higher by about 4 mm. dorsally; cameræ about 4 mm. in thickness, showing no relationship to spacing of ribs; concavity of septa about 2.5 mm.; siphuncle unknown.

On the evidence of the sutures and the slight curvature of the type this species has been transferred to Foerste's genus *Metaspyroceras*.

Genus, *Ephippiorthoceras* Foerste

Ephippiorthoceras minutum sp. nov.

Plate XV, figures 2, 3

Material: two almost complete conchs, one showing several cameræ and the siphuncle, the other showing 12 cameræ and the living chamber, and several fragments of other conchs. The specimens were all collected from the upper and lower dolomites at the Stonewall quarries from the Stonewall formation.

Conch orthoconic, expanding rather rapidly with an apical angle of between 15 and 20 degrees, showing evidence of slight contraction towards the aperture; living chamber in mature specimen 12 mm. in dorsoventral diameter, 14 mm. in length; cross section of conch slightly compressed so that where dorsoventral diameters are 12 mm. and 7.3 mm., the lateral diameters are 11 mm. and 6.7 mm., respectively; surface apparently smooth.

Sutures showing broad lateral lobes, sharper dorsal and ventral saddles, ventral saddle sharper than dorsal saddle; depth of saddles above lobes about 1 camera, sutures close set, about 10 occurring in 13 mm. or about 9 in a length equal to the diameter of the conch; camera at base of living chamber thinner than those preceding, showing maturity of conch; septa moderately concave, more markedly concave in dorsoventral direction reflecting course of sutures; siphuncle nearly marginal, about 1 mm. from venter, slightly swollen between septa, less than 1 mm. in diameter.

The course of the sutures and the slightly expanded, eccentric siphuncle indicate the affinity of this species with others of the genus *Ephippiorthoceras*. It is much smaller than most described species and has a more eccentrically placed siphuncle. In size and position of siphuncle *E. minutum* resembles *E. subarcuatum* (D'Orbigny) but has a greater rate of enlargement and is less compressed. The new species also shows considerable resemblance to *E. sigmoidale* Fritz but its sutures do not show the characteristic sigmoidal curve. It may be distinguished from *E. modestum* Troedesson by its closer septal spacing and larger apical angle. Nearly all other species of *Ephippiorthoceras* are large forms with subcentral siphuncles.

Holotype, G.S.C. No. 10431; paratype, G.S.C. No. 10432.

Genus, *Kionoceras* Hyatt

Kionoceras sp.

Two conchs from the Cedar Lake dolomite belong to this genus but are too poorly preserved for specific identification. Both are very small, about 7 mm. in one diameter and about 9 mm. in the other. The apical angle is about 10 degrees. The surface is marked by about 15, simple, longitudinal ribs separated by wide flat interspaces. The siphuncle is central but its structure is obscure. The septa are moderately concave and spaced about 2 mm. apart. The specimens are characterized by the smallness of their conchs and the paucity of longitudinal markings. Both specimens may represent immature parts of larger cephalopods.

Order, ONCOCERATIDA

Genus, *Cyrtorizoceras* Hyatt

Cyrtorizoceras sp.

Plate XV, figure 6

Material: a small collection of fragmentary cephalopods from the Atikameg dolomite at Mile 18 of the Churchill branch of the Canadian National railway contains such poorly preserved specimens that specific identification is impossible. The material consists of several moulds of the living chamber and fragments of the phragmocone.

Conch small, breviconic, slightly curved, rapidly enlarging, 35 mm. long in a complete specimen, compressed in cross section but showing various sectional shapes due to distortion; living chamber slightly curved, not contracted noticeably at aperture, about $1\frac{1}{2}$ cm. high and $1\frac{1}{2}$ cm. and 1 cm. in dorsoventral and lateral diameters respectively; sutures close set, about 1 mm. apart, showing gentle dorsal and ventral saddles; septa highly concave; siphuncle situated on ventral margin, only slightly swollen between septa.

All the above features are obscure and no single specimen shows them all.

Hypotype, G.S.C. No. 10430.

Genus, *Oocerina* Foerste

Oocerina canadensis sp. nov.

Plate XV, figure 8

Material: this species is represented in the collections by the holotype only, a phragmocone from the quarry 1 mile north of Inwood in the Inwood formation.

Conch very slightly curved; venter convex and dorsum concave to a lesser degree; slowly expanding from a dorsoventral diameter adapically of 16 mm. to a corresponding diameter of 17.5 mm. in a length of 22 mm. compressed laterally to an oval cross section; sutures showing faint ventral saddles, broad lateral lobes, sharp, deep, dorsal saddles; crest of dorsal saddles 5 mm. orad of trough of lateral lobes; sutures spaced so that 9 cameræ occur in 26 mm. or about 6 septa occur in a length equal to the conch diameter; siphuncle situated 2 mm. from ventral wall, expanded abruptly between septa to diameter of 3 mm.; connecting rings adnate to adoral septa through most of their expansion; actinosiphonate deposits not preserved in siphuncle; septa deeply concave through about 5 mm.

This new species may be distinguished by its prominent dorsal saddles. No actinosiphonate deposits similar to those of the genotype have been found but other species whose siphuncular structures were obscure have been placed in this genus. If the conch were not slightly curved, the species might better be placed in *Ephippiorthoceras*. In general contour *O. canadense* resembles *O. shamattawaense* Foerste and Savage but has more prominent dorsal saddles. The siphuncle is not so inflated as that of *O. severnense* Foerste and Savage.

Holotype, G.S.C. No. 10423.

Genus *Blakeoceras* Foerste

Blakeoceras robustum sp. nov.

Plate XIV, figures 4-6

A piece of a large phragmocone from the base of the fragmental dolomite of the Inwood formation at Grand Rapids appears to belong to a new species of *Blakeoceras*. The conch is apparently orthoconic but may have had a slight curvature in the adapical part, which is not preserved. The rate of enlargement is low for it cannot be detected in the 7 cameræ preserved. The cross section of the conch is compressed with dorsoventral and lateral diameters of 57 mm. and 45 mm. respectively. The surface was probably smooth but is not preserved in this specimen. Sutures cross the conch laterally oblique to the axis and are spaced so that 6 occur in 33 mm. The septa are moderately concave. The siphuncle has been well preserved and is one of the most striking structures of the specimen. It has a diameter of 9 mm. and is formed apparently by the septal necks alone. Its outline between septa is distinctly concave, a feature characteristic of the siphuncle of *Blakeoceras*. The septa curve gently on approaching the siphuncle and continue adapically recurved to the next septum. The interior of the siphuncle is lined with actinosiphonate deposits that leave in the centre a free canal only 4 mm. in diameter. Each vertical lamina, of which over 50 were counted in one section, thickens toward this endosiphuncular canal. In transverse section the siphuncle is roughly hexagonal but two opposite sides are more flattened than the other four. The siphuncle rests against what is probably the ventrolateral wall but has been disturbed and originally occupied a position near the venter.

Another specimen from this locality may be an immature individual of the same species. It consists of a living chamber 70 mm. long attached to a very rapidly enlarging phragmocone that probably extended for about 50 mm. but is now only 35 mm. long. At the base of the living chamber where the dorsoventral diameter is 50 mm. the lateral diameter is 31 mm. Near the adapical end of the phragmocone these diameters are 24 mm. (approximately) and 8 mm. respectively, and near the top of the living chamber, 62 mm. and 43 mm. respectively. The venter of the living chamber is slightly convex but the dorsum is almost straight. The sutures are not well preserved but appear to be about 5 mm. apart. The entire surface is covered with fine transverse striæ at right angles to the axis except where they bend down on the venter into a broad, shallow hyponomic sinus. No siphuncle could be detected. If, as seems likely, this specimen is an immature individual of *Blakeoceras robustum*, then the species is slightly cyrtoconic at least in its immature stages.

The remarkable structure of the siphuncle places this species closest to the genus *Blakeoceras* Foerste. The only other known Silurian species is *B. llandoveri* (Blake) from Great Britain and this is more highly curved than the species from Manitoba.

Holotype, G.S.C. No. 10484; paratype, G.S.C. No. 10433.

Genus, *Amphicyrtoceras* Foerste

Amphicyrtoceras cf. *reedsi* Foerste

Plate XIV, figures 2, 3

Material: an almost complete but rather crushed conch from the Inwood formation and some fragmentary conchs from the Akitameg dolomite.

Conch cyrtoconic; venter regularly, gently curved through a radius of curvature of about 80 mm.; dorsal side gently concave adapically, becoming slightly convex at base of living chamber and continuing this convexity to aperture; conch contracted slightly from greatest diameter just above the base of living chamber to aperture; total length of conch 75 mm. along the dorsum; length of living chamber 35 mm. along the dorsum; cross section now slightly compressed due to crushing, probably originally round or depressed; dorsoventral diameters at the base of the living chamber and at the aperture 29 mm. and 24 mm. respectively; sutures straight but rising slightly ventrally; septa spaced so that cameræ are 2 to 3 mm. in width; siphuncle close to but not in contact with venter, composed of barrel-shaped segments, 5 mm. in diameter in the largest specimen; septal necks short and highly recurved; connecting rings cylindrical.

These specimens lack the depression of typical *Amphicyrtoceras* but otherwise have all the characteristics of this genus. The slender form of the conch, its probably nearly circular cross section, and general size place it close to *A. reedsi* Foerste from the Racine dolomite. The dorsal curvature of the Manitoban species is not so great and the rate of expansion slightly greater than that of this species.

Hypotype, G.S.C. No. 10427.

Genus, *Mandaloceras* Hyatt

Mandaloceras parvulum (Whiteaves)

Plate XVI, figures 5, 6

Gomphoceras parvulum Whiteaves, 1891, Can. Rec. Sci., vol. 4, p. 298, Pl. 3, figs. 5, a, b, c. 1906, Pal. Foss., vol. 3, pt. 4, p. 296, Pl. 35, figs. 2, a, b.

Mandaloceras parvulum (Whiteaves). Foerste, 1929, Denison Univ. Bull. Sci. Lab. Jour. vol. 24, p. 373.

The specimens that the writer has collected from the type locality are all fragmentary and do not show the shape of the aperture satisfactorily. One complete living chamber measures 7.5 mm. in lateral diameter, 8.8 mm. in dorsoventral diameter, and 11.4 mm. in height. The siphuncle is small and almost in contact with the ventral wall. These conchs may be distinguished from those of *Phragmoceras nelsoni*, which also occur in the Inwood formation at Grand Rapids, by their thinner straighter form and the contraction of their living chamber adorally. If the aperture is preserved there can be no confusion between the species, as that of *Mandaloceras* is Y-shaped, but if only a piece of the phragmocone is preserved, it may be difficult to distinguish them.

Hypotype, G.S.C. No. 5706c.

Genus, *Oxygonioceras* Foerste

Oxygonioceras (?) *cuneatum* (Whiteaves)

Cyrtoceras (?) *cuneatum* Whiteaves, 1906, Ottawa Natr., vol. 20, p. 133, figs. A, B. 1906, Pal. Foss., vol. 3, pt. 4, p. 282.

Oxygonioceras cuneatum (Whiteaves). Foerste, 1926, Denison, Univ. Bull. Sci. Lab. Jour., vol. 21, pp. 63-65.

The types of this species have been lost and so far as the writer is aware no others have been collected from the type locality. Foerste describes an *O.* cf. *cuneatum* from the Niagaran series of Illinois but it appears to be specifically different. Unfortunately the siphuncle of the species from Stonewall is unknown and for this reason the species cannot be placed generically with any certainty. The type locality is at Stonewall in the Stonewall formation.

Order, DISCOSOROIDEA

Genus, *Lowoceras* Foerste and Savage

Lowoceras imbricatum sp. nov.

Plate XV, figure 11

Material: several specimens from near the base of the Inwood formation at Grand Rapids and 4½ miles north of Grand Rapids.

Conch slightly curved through about 45 degrees, rapidly enlarging in 40 mm. of the length from a dorsoventral diameter of about 10 mm. to one of 20 mm., laterally compressed in cross section; lateral diameter 12 mm. where dorsoventral diameter 22 mm.; surface smooth.

Sutures moderately curved, apparently meeting venter obliquely, forming saddles, about 2 mm. apart in a fragment of an immature conch, 4 mm. apart in a more mature conch; dorsal saddles poorly defined; septa most convex dorsoventrally, almost flat laterally.

Siphuncle nearly central in position adapically, becoming ventral adorally, lying about 2 mm. from venter, flattened dorsoventrally, nummulitic, composed of series of imbricate, inflated connecting rings separated dorsally by wide, moderately shallow septal necks, increasing in lateral diameter from 3.5 mm. to 6.5 mm. in 40 mm.; septal necks very short ventrally; axis of connecting rings at angle of about 45 degrees to axis of siphuncle; adoral margins of connecting rings broadly V-shaped ventrally; adorally 6 connecting rings and intervening septal necks occupy 1.7 mm., adapically 7 occupy the same interval.

The development of the septal necks on the dorsal surface of the siphuncle shows the affinity of this species to *Lowoceras* rather than *Stokesoceras* or *Discosorus*. It differs from the genotype, *L. southamptonensis* Foerste and Savage in having more inflated and crowded connecting rings in the siphuncle.

Holotype, G.S.C. No. 10429.

Genus, *Stokesoceras* Foerste

Stokesoceras cf. *romingeri* Foerste

Material: a single siphuncle from the East Arm dolomite on the northwest side of Big Island, Moose Lake.

The siphuncle is 18 mm. long and includes 8 segments inclined slightly to its axis. The end segments are incomplete but the rate of enlargement appears to have been low. A cross section of the middle complete segments is circular and 7 mm. in diameter. The specimen is similar to the adapical part of siphuncles of *S. romingeri*, described by Foerste from the Burnt Bluff dolomite of Michigan. An *S.* cf. *romingeri* has been reported from the Thornloe limestone of Lake Timiskaming.

Genus, *Phragmoceras* Broderip

Phragmoceras parvum Hall and Whitfield

Plate XV, figure 4

Phragmoceras parvum Hall and Whitfield, 1875, Geol. Surv., Ohio, Pal., vol. 2, p. 151, Pl. 8, fig. 10.

Material: a specimen showing all the conch except the top of the living chamber from the Cedar Lake formation at Anchor Point, and some fragmentary specimens that may be referable to this species from the Chemahawin and Cross Lake members. A description of the almost complete specimen follows.

Conch strongly curved through an angle of about 90 degrees, rapidly expanding through a total length along midline of 45 mm. from a dorsoventral diameter of 4 mm. to one of 30 mm. at the top of the living chamber just below the aperture; compressed; venter and dorsum broadly rounded; aperture not preserved in best specimen but as determined from other specimens very narrow at constricted part, dorsal aperture small, simple, ventral aperture destroyed in all specimens; estimated ventral and dorsal heights of living chamber, 15 mm. and 22 mm., respectively.

Sutures rising slightly dorsad, 6 in 7 mm. of length just below the living chamber; septa only little curved; siphuncle unknown.

The septa of this specimen are spaced more closely than those of the specimens from the Niagaran rocks of the Great Lakes region. The specimen from the Interlake group shows some resemblance to *P. lineolatum* Whiteaves but is not as broadly expanded at the top of the living chamber and the ventral curvature is not as strong.

Hypotype, G.S.C. No. 10425.

Phragmoceras nelsoni sp. nov.

Plate XV, figures 5, 7

Material: one complete specimen (the holotype) and several fragmentary specimens from the Inwood formation at Grand Rapids.

Conch small, almost straight, dorsum slightly convex, venter slightly concave, rapidly enlarging from a dorsoventral diameter of 13 mm. at 8 cameræ below the living chamber to 19 mm. at the base of the living chamber and 30 mm. at the aperture (estimated), slightly compressed laterally; lateral diameters corresponding to the dorsoventral diameters of 13 mm. and 19 mm., 12 mm. and 15 mm. respectively; living chamber 27 mm. high midlaterally, with greatest lateral and dorsoventral diameters below the aperture, 18 mm. and 26 mm.; dorsal lobe of aperture large, merging gradually with constricted part, broadly flattened on dorsal side, bounded below by a groove in the internal mould reminiscent of that in species of *Tubiferoceras* but not nearly so conspicuous or deep; ventral lobe broken away, apparently small; living chamber marked at the base by numerous, small longitudinal ridges; surface covered with numerous fine, transverse ridges, slightly undulatory but not well enough preserved to indicate the sinus.

Sutures at right angles to axis of conch, close set, spaced in the holotype 9 in 16 mm.; septa of low convexity; siphuncle situated close to venter, expanded between septa to diameter of 2 mm., composed of short septal necks sharply recurved, and long inflated connecting rings.

Important features distinguishing this species are the erect, only slightly curved form of the conch, its almost circular cross section, the close spacing of the septa, and the nature of the dorsal lobe of the aperture. There are only a few small, gently curved species of *Phragmoceras* with which it can be compared. *P. nelsoni* bears considerable resemblance to the upper part of the conch of *P. ruedemanni* Foerste but lacks definite evidence of the coiling of the adapical parts of the phragmocone. Although in many respects similar to *P. vantuyli* Foerste and Savage, it has a more circular cross section. *P. canadensis* Whiteaves is larger, has a more depressed living chamber, and ribs continuing on to the phragmocone from the base of the living chamber. *P. nelsoni* might best be referred to *Tubiferoceras* on the basis of the internal ridge under the aperture and the erect form of the conch. It differs from all described species of this genus in that the spout does not project from the dorsal contour of the living chamber but is more like that of a typical *Phragmoceras*. The reduction of the distinctiveness of the dorsal aperture has been described in *T. savagei* Foerste but is even better shown by *P. nelsoni*.

This species is named in honour of S. J. Nelson of the University of Alberta.

Holotype, G.S.C. No. 10424.

Order, BARRANDEOCERATIDA

Genus, *Bickmorites* Foerste

Bickmorites insignis (Whiteaves)

Plate XIII, figure 4; Plate XVI, figure 8

Trochoceras insigne Whiteaves, 1898, Ottawa Natr., vol. 12, p. 124. 1906, Pal. Foss., vol. 3, pt. 4, pp. 282-3, Pl. 41.

Tyrrelloceras insigne (Whiteaves). Foerste, 1925, Denison, Univ. Bull, Sci. Lab. Jour., vol. 21, p. 56.

Bickmorites insigne (Whiteaves). Flower, 1946, Bull. Amer. Pal., vol. 29, No. 116, p. 498.

Because there is some confusion as to the generic designation of this species, a redescription of the types is included here. The Geological Survey collections contain the 3 specimens that Whiteaves had before him. The holotype (G.S.C. No. 2781) was figured by Whiteaves as plate 41 of Palæozoic Fossils and is an interior mould showing little of the exterior surface except the nodes, but showing the septa. The coiling is gyroconic with the whorls in contact, not separated as in Whiteaves' figure. The paratype (G.S.C. No. 2780) is a cast of the exterior surface and shows no internal structures. It includes only $1\frac{1}{2}$ volutions whereas the holotype has more than 2 volutions. The third specimen is a poorly preserved mould of the exterior of $1\frac{1}{2}$ volutions.

The holotype conch is 570 mm. long, measured along the venter, of which distance 140 mm. are believed to be the living chamber as they are asseptate. The maximum diameter across the umbilical area is about 140 mm. The conch is compressed laterally but the dorsum and venter are broadly rounded. The rate of expansion of the holotype may be judged from the following series of dorsoventral diameters measured at distances of one-half a whorl from the adoral end: 43 mm. at adoral end (estimated), 29 mm. (one-half volution apicad), 22 mm., 14 mm., 8 mm. (at the adapical end). Corresponding dorsoventral and lateral diameters may be measured on the paratype and are as follows: 23 mm. and 19 mm., 18 mm. and 14 mm. (estimated).

The sutures rise into ventral and dorsal saddles whose crests are about 5 mm. above the troughs of the lobes near the living chamber and about 3 mm. above at midlength of the conch. The surface is marked by 3 types of ridges. The most prominent are broad folds separated by concave interspaces, trending at right angles to the axis of the conch dorsally but curving apicad along the sides and hooked into an adapical direction on the ventral shoulder. The venter is bare of these large folds. These folds are about 10 mm. from crest to crest in the mature part of the conch but are set about 5 mm. apart in the immature parts. A series of longitudinal ridges are most marked between the folds and at the apical end of the conch. Several orders of these fine ridges cover the surface densely. On the venter there are about 5 such longitudinal ridges that are more prominent than the rest. The least marked surface ornament is a series of fine ridges that cross the longitudinal ridges and are roughly parallel with the large folds. These are continued on to the venter where they are stronger and form with the other ridges a reticulate pattern.

The siphuncle is not known in any of these specimens. About 4 sutures occur in a length equal to the dorsoventral diameter of the conch.

This species differs from *Tyrrelloceras* (?) *striatum* Foerste and Savage in having prominent longitudinal ridges on the lateral sides and in having more lobate sutures. The former distinction may depend on state of preservation for the holotype does not show the longitudinal markings on the more mature parts of the conch. The ventral aspect of these species is almost identical.

Bickmorites insigne is known only from the type locality, the Stonewall quarry in the Stonewall formation.

ARTHROPODA

Class, TRILOBITA

Genus, *Encrinurus* Emmrich

Encrinurus hypoleprus sp. nov.

Plate XII, figures 1, 2, 4

Cephalon without frontal border, crescentic, apparently without tubercles; glabella broadly expanded anteriorly, separated from cheeks by deep dorsal furrow, notched at sides by 3 indistinct furrows, not highly inflated; cheeks highly convex; eyes behind middle of cephalon, elevated on knobs; genal angles rounded.

Thorax tapering very gradually, greatest width about midlength, composed of 11 segments.

Pygidium triangular, length and width about equal or slightly wider than long, posterior rounded; axis not conspicuously elevated, about two-fifths of width of whole, of up to 16 segments, the first 2 complete, those posterior incomplete or only faintly marked in central region; pleural segments curving evenly to border, protruding there as short blunt spines, 8 to 9 in number; tubercles absent on pleural and axial segments.

Dimensions of the holotype (G.S.C. No. 11062) are: total length—21.3 mm., total width (thorax)—11 mm., cephalon length—6.0 mm., cephalon width—10.6 mm., glabella width—5.6 mm., pygidium length—5.5 mm.

Dimensions of typical pygidia are:

Length—	10.0,	12.0,	7.0,	6.0	mm.
Width —	11.0,	13.0,	9.0,	5.5	mm.
Width of axis—	4.5,	5.0,	3.5,	2.5	mm.

This species differs from many of the genus *Encrinurus* in its lack of tubercles on the pygidium and the apparent lack of them on the cephalon. Those specimens that show the cephalon do not have a well-preserved surface and small prominences may have been removed during dolomitization. The shape of the pygidium and the number of pleural and axial segments that can be counted on it show considerable variation. On most specimens only 12 or 13 segments can be counted on the axis. The apparent variation is in part due to poor preservation, which obscures the fine segments near the posterior of some specimens. The axial segments of the holotype are more complete than those of other pygidia grouped in this species. The pygidia bear considerable resemblance to those of *E. nereus* Hall but are relatively broader and have the posterior segments incomplete. This new species also shows similarity to *E. indianensis* Kindle but its more or less incomplete posterior segments and its lack of tubercles distinguish it. The similarity of *E. hypoleprus* to *E. laevis* Angelin is obscured by the differences in published descriptions of the pygidium of this species as to the number of segments on the axial and pleural parts and the completeness of the axial segments. Several descriptions state that the number of segments on the axial and pleural lobes are almost equal (*see* Vogdes, 1907) and if this is true, *E. hypoleprus* can be easily distinguished from it. Angelin's figures show his species has a more tapering form.

An almost complete dorsal shield (the holotype) was found in the Cross Lake dolomite and many pygidia and a single cephalon were collected from the Cedar Lake dolomite. The type locality is on the south bank of Saskatchewan River, north 40 degrees west of the main discharge of Cross Lake Rapids.

Holotype, G.S.C. No. 11062; paratypes, G.S.C. Nos. 11040 and 11050.

Encrinurus cf. *tuberculifrons* Weller

Two pygidia were collected from the Cedar Lake formation and the Inwood formation, both of which resemble *E. tuberculifrons*. They lack tubercles but differ from *E. hypoleprus* in having about 6 pleural segments and about 15 axial segments. The axial segments are less complete than those shown in the illustrations of *E. tuberculifrons*.

Genus, *Arctinurus* Castelnau

Arctinurus sp.

Plate XII, figure 3

Two pygidia that are almost complete and a fragmentary cephalon of the genus *Arctinurus* were collected from the Cedar Lake dolomite. The posterior parts of the pygidia and most of the cephalon are missing so that specific identification of the fragments must be deferred until better material is available.

Hypotype, G.S.C. No. 11059.

Genus, *Acidaspis* Murchison

Acidaspis perarmata Whiteaves

Plate XVI, figure 9

Acidaspis perarmata Whiteaves. 1891. Canadian Rec. Sci., vol. 4, p. 300, Pl. 3, fig. 6.

This species is known only from the holotype, an almost complete dorsal shield, from Long Point, Lake Winnipegosis. The trilobite occurs in the undifferentiated beds of the Cedar Lake formation.

Holotype, G.S.C. No. 5813.

Class, CRUSTACEA

Superorder, *OSTRACODA*

The ostracod fauna of the Interlake group belongs to the boreal province of the Silurian and occurs in the Baltic countries, Manitoba, Lake Timiskaming, the Hudson Bay Lowland, and the Arctic islands. Nearly all the ostracods may be assigned to the genus *Leperditia* and most of the species identified by Jones (1891) from the lower Saskatchewan River Valley can be identified in the collections of the writer. Little faunal succession can be found in the appearance of ostracods in the Interlake group and only the broadest correlations can be drawn from their study.

Complete synonymies of the species mentioned below may be found in Bassler and Kellett (1934).

Genus, *Leperditia* Rouault

Leperditia hisingeri Schmidt

Plate XII, figure 6

Leperditia hisingeri Schmidt, 1873, Mem. Acad. Imp. St. Petersbourg, ser. 7, vol. 31, No. 2, p. 16, figs. 22, 23. Jones, 1891, Contrib. Can. Micro-Pal. pt. 3, p. 82, Pl. 13, figs. 1, 9.

This species has a relatively short hinge line that amounts to about two-thirds of the total length. The posterior part is considerably higher than the anterior part, making the whole test obliquely suboval. Both dorsal angles are sharp and on the flattened margin of the test. The eye spot is prominent in nearly all specimens.

L. hisingeri is a commonly found ostracod in the Silurian system of the Arctic and associated regions. In Europe it occurs in the Baltic countries, Gotland, and Norway. In North America it is recorded from Beechy Island, the Wabi formation of Lake Timiskaming, and the Hudson Bay Lowlands. Teichert (1937) reports a *L.* cf. *hisingeri* from the Silurian rocks of Southampton Island. In Manitoba the species appears in the Moose Lake dolomite and disappears at the top of the Interlake group.

Plesiotype, G.S.C. No. 8752.

Leperditia hisingeri fabulina Jones

Plate XII, figure 13

Leperditia hisingeri fabulina Jones, 1891, Contrib. Can. Micro-Pal., pt. 3, p. 83, Pl. 10, figs. 5, 7, Pl. 12, fig. 15, Pl. 13, figs. 2, 3, 5.

Jones distinguished this variety from the species by its proportionally longer hinge line. Because the variety tends to be lower and more elongate, the ventral margin is not as oblique to the hinge line as that of the species s.s. The length of the hinge is about three-quarters of the total length. *L. hisingeri fabulina* is found throughout the Interlake group but appears to be more common in the lower formations. It has been recognized in the Wabi formation of Lake Timiskaming and in the Severn River limestone of the Hudson Bay Lowlands.

Cotype, G.S.C. No. 6052.

Leperditia hisingeri egena Jones

Leperditia hisingeri egena Jones, 1891, Contrib. Can. Micro-Pal., pt. 3, p. 83, Pl. 12, fig. 8.

This variety was distinguished by its lack of surface markings, dorsal angles, and marginal rim. Otherwise, it has the form of *L. hisingeri fabulina* and the possibility should be considered that these ostracods are merely poorly preserved specimens of the variety *fabulina*. *L. hisingeri egena* was originally described from the Moose Lake dolomite but specimens that are conveniently referred to this variety are also found in the Inwood formation.

Leperditia phaseola (Hisinger)

Plate XII, figure 7

Cytherina phaseolus Hisinger, 1831, Anteckn. Phys. Geogn., vol. 5, pp. 110-135, Pl. 8, fig. 3.

Leperditia phaseolus (Hisinger), Jones, 1891, Contrib. Can. Micro-Pal., pt. 3, p. 85, Pl. 13, figs. 7, 8.

An elongate form, relatively symmetrical outline, and poor development of the dorsal angles, are features that characterize this species. *L. phaseola* may be distinguished from *L. hisingeri* by its lesser height and by the more symmetrical curvature of its ventral margin.

Leperditia phaseola is widespread in occurrence in the Gothlandian of the Baltic region and has also been found in the Arctic Silurian. In southern Manitoba it first appears in the Moose Lake dolomite; it is quite abundant in the East Arm dolomite, in which it was noted by Jones at Redrock Rapids; and is not found in formations above the Cross Lake dolomite.

Plesiotype, G.S.C. No. 8755.

Leperditia caeca Jones

Leperditia caeca Jones, 1891, Contrib. Can. Micro-Pal., pt. 3, p. 88, Pl. 12, figs. 6, 7, 9.

This species comprises *Leperditias* of relatively short hinge line, high test, poorly developed dorsal angles, and approximately symmetrical subquadrate outline. The surface is smooth and destitute of eyespots and muscle scars. The species has been identified definitely only from Manitoba but Lee (1912) has found ostracods that he doubtfully refers to this species from the Silurian rocks of the Arctic. In Manitoba *L. caeca* has been collected from the Inwood formation at Grand Rapids and from the lower Cedar Lake dolomite near Flying Post Rapids and at Cranberry Bay on Cross Lake.

Leperditia whiteavesii Jones

Leperditia whiteavesii Jones, 1891, Contrib. Can. Micro-Pal., pt. 3, pp. 87-88, fig. 6, Pl. 12, figs. 11-14.

This species is characterized by its relatively short hinge line and great height, by the poor development of its dorsal angles, and by the presence of a well-defined eye-spot. The right valve has a ventral curvature that is almost symmetrical but the left valve is more oblique and higher behind. The dorsal angles are not as prominent as in *L. hisingeri* nor as inconspicuous as in *L. caeca*. The species has been reported only from Manitoba and appears to be confined to the Cedar Lake dolomite.

Genus, *Dihogmochilina* Teichert

Dihogmochilina latimarginata (Jones)

Plate XII, figure 5

Isochilina grandis latimarginata Jones, 1891, Contrib. Can. Micro-Pal., pt. 3, pp. 78-80, Pl. 10, figs. 1-4.

Dihogmochilina latimarginata (Jones), Teichert., 1937, Rept. 5th Thule Exp., vol. 1, No. 5, pp. 153-154, Pl. 22, figs. 1, 2.

This species is the genotype of the genus *Dihogmochilina*, established by Teichert to comprise ostracods similar to *Isochilina* but having a forked sulcus behind the eye-spot and the muscle scar located between the forks. The species is easily distinguished by its wide flat border, obliquely suboval outline, and well-developed dorsal angles. It reaches a greater size than any other ostracod in the Interlake group and specimens 2½ cm. in length are not uncommon.

Jones records the species from the Moose Lake beds of Grand Rapids but in the writer's collections the species does not appear below the East Arm dolomite. It is abundant in all formation of the Interlake group above the East Arm dolomite. *D. latimarginata* has also been found in the Severn River limestone of the Hudson Bay Lowlands and in the Silurian rocks of Southampton Island.

Holotype, G.S.C. No. 6055a.

PLATES I TO XVI

PLATE I

Figure 1. *Clathrodictyon osteolatum* Nicholson. Fragment of a coenosteum, x1, G.S.C. No. 10466, Chemahawin member, Cedar Lake formation, from Davis Point, collected by J. B. Tyrrell. (Page 51.)

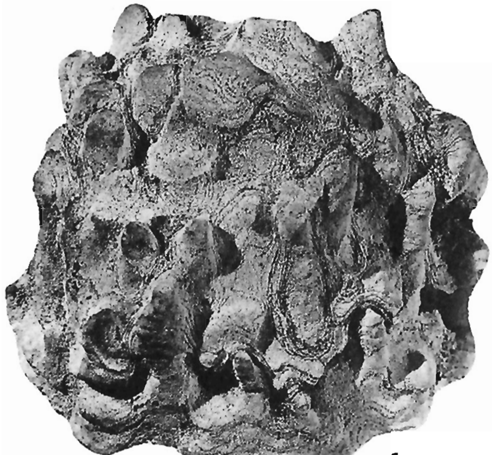
Figure 2. *Actinostroma* sp. Thin section across a column, x5, G.S.C. No. 11029, East Arm dolomite, from southeast corner Reader Lake. (Page 49.)

Figure 3. *Stromatopora* cf. *constellata* Hall. Polished longitudinal section, x5, G.S.C. No. 11026, Chemahawin member, Cedar Lake formation, from sec. 12-13, tp. 31, rge. 10, W. Prin. mer. (Page 52.)

Figure 4. *Stromatoporella* sp. Thin section showing both longitudinal and transverse sections, x5, G.S.C. No. 11021, Stonewall formation, from Stonewall quarry. (Page 52.)

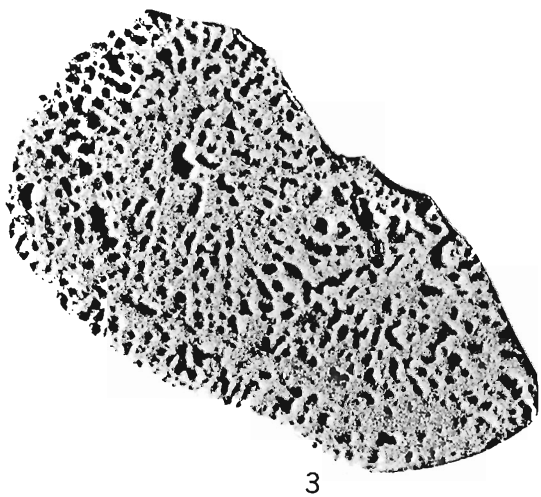
Figure 5. *Actinodictyon keelei* Parks. Longitudinal thin section, x5, G.S.C. No. 11025, East Arm dolomite, from Mile 5·5, Churchill branch, Canadian National railway. (Page 52.)

PLATE I



1

2

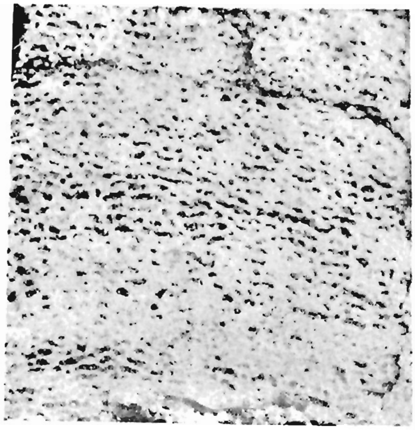


3

4

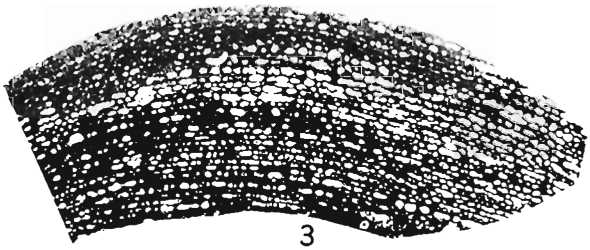
5

PLATE II



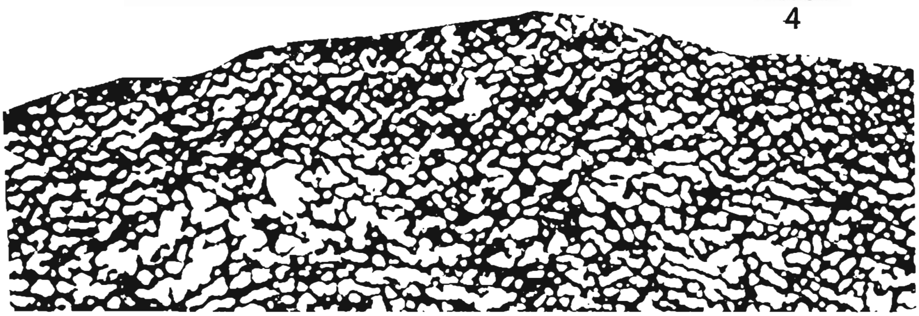
1

2



3

4



5

PLATE II

Figure 1. *Clathrodictyon cystosum* Parks. Polished longitudinal section, x5, G.S.C. No. 11057, Chemahawin member, Cedar Lake formation, from Chemahawin, Saskatchewan River. (Page 49.)

Figure 2. *Clathrodictyon* cf. *regulare* Rosen. Polished longitudinal section, x5, G.S.C. No. 11056, Chemahawin member, Cedar Lake formation, from sec. 29, tp. 29, rge. 8, W. Prin. mer. (Page 51.)

Figure 3. *Clathrodictyon striatellum* (D'Orbigny). Longitudinal thin section, x5, G.S.C. No. 11027, Cross Lake member, Cedar Lake formation, from Moose Lake Settlement. (Page 51.)

Figure 4. *Clathrodictyon drummondense* Parks. Longitudinal thin section, x5, G.S.C. No. 11028, Inwood formation, from base of Grand Rapids. (Page 50.)

Figure 5. *Clathrodictyon fastigiatum* Nicholson. Longitudinal thin section, x5, G.S.C. No. 11030, East Arm dolomite, from Moose Lake, sec. 4, tp. 57, rge. 20, W. Prin. mer. (Page 50.)

PLATE III

Figure 1. *Favosites niagarensis inaequalis* subsp. nov. Corallum, paratype, x1, G.S.C. No. 10477, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 57.)

Figure 2. *Favosites niagarensis inaequalis* subsp. nov. Corallum, holotype, x1, G.S.C. No. 10471, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 57.)

Figure 3. *Favosites niagarensis lundarensis* subsp. nov. Corallum, paratype, x1, G.S.C. No. 10476, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 57.)

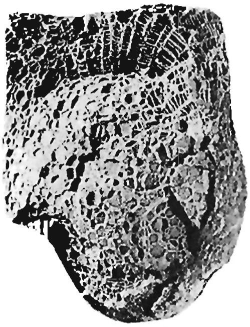
Figure 4. *Paleofavosites okulitchi* nom. nov. Side view of a few corallites showing pores, x3, G.S.C. No. 12865, Stonewall formation, from Mile 26·7, Flin Flon highway. (Page 61.)

Figure 5. *Favosites niagarensis lundarensis* subsp. nov. Corallum, holotype, x1, G.S.C. No. 10475, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 57.)

Figure 6. *Paleofavosites okulitchi* nom. nov. Corallum, x1, G.S.C. No. 10404, Stonewall formation, from Stonewall quarries. (Page 61.)

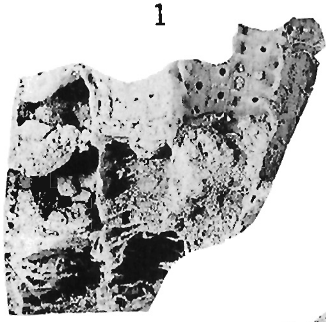
Figure 7. *Favosites hisingeri* Milne-Edwards and Haime. Corallum, x1, G.S.C. No. 10470, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 58.)

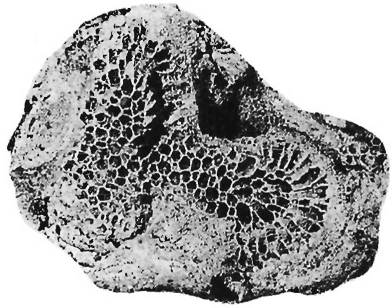
PLATE III

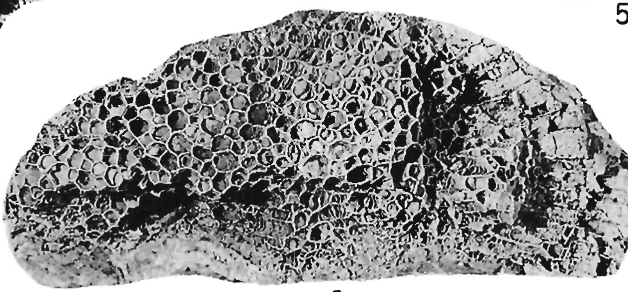

1


2


3


4


5


6

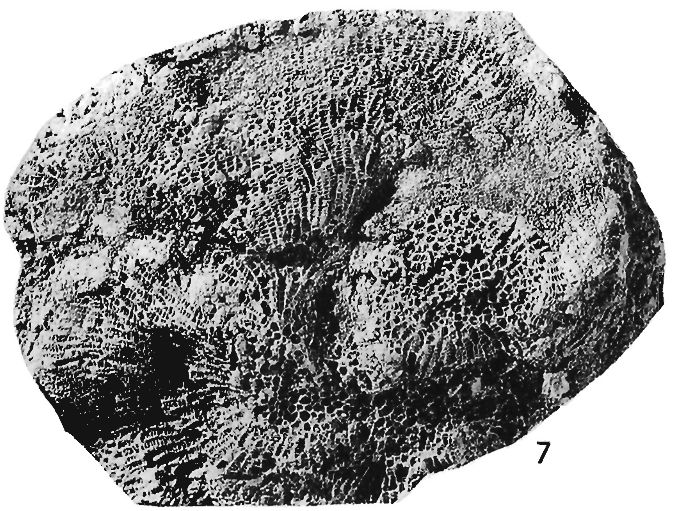

7

PLATE IV

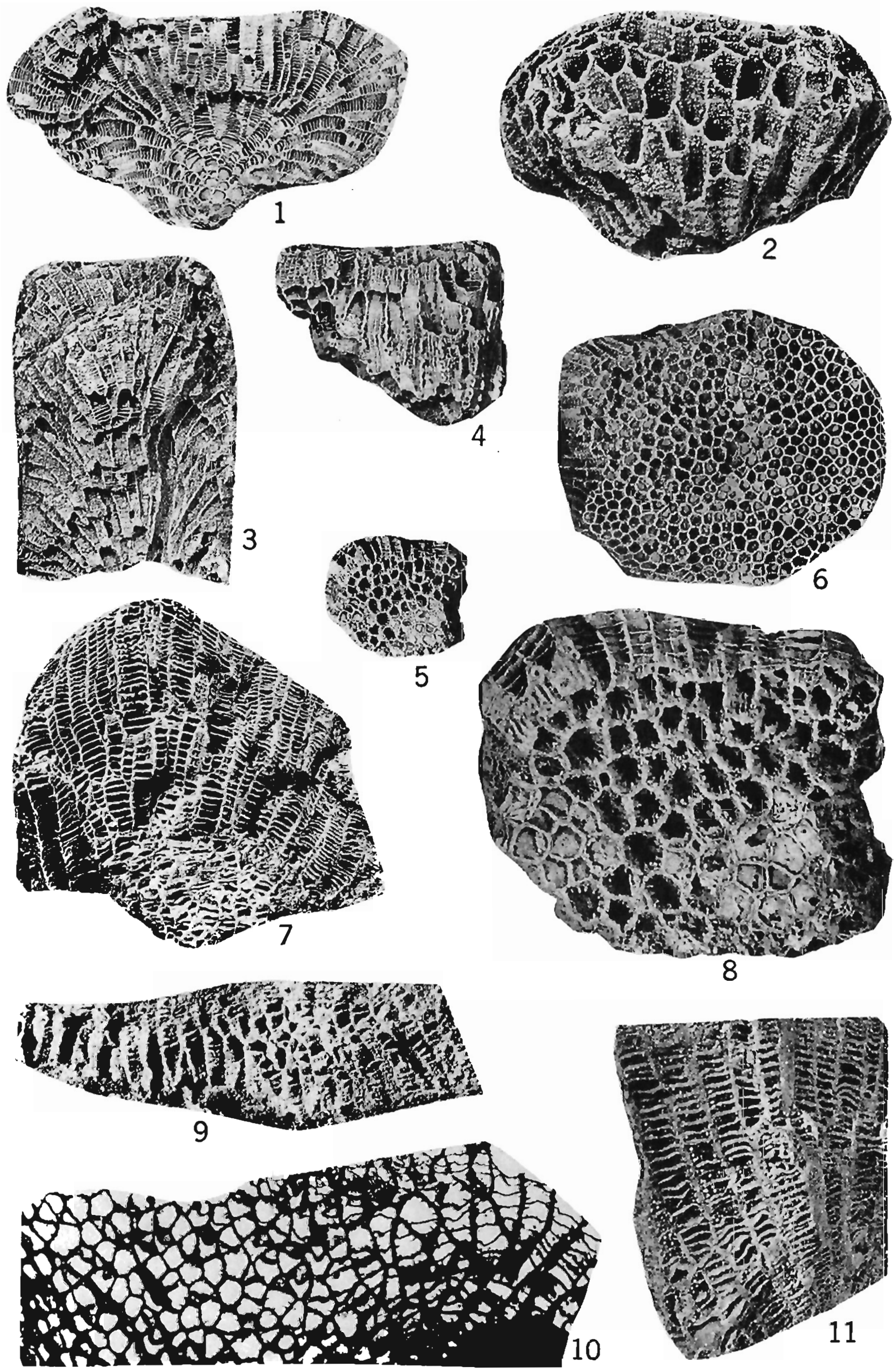


PLATE IV

Figure 1. *Paleofavosites prolificus* (Billings). Corallum, x1, G.S.C. No. 10410, East Arm dolomite, sec. 4, tp. 57, rge. 20, W. Prin. mer. (Page 60.)

Figure 2. *Paleofavosites transiens* sp. nov. Side view of holotype, x2, G.S.C. No. 10490. Cross Lake member, Cedar Lake formation, from south shore of Portage Bay, Cross Lake. (Page 62.)

Figure 3. *Paleofavosites transiens* sp. nov. Side view of a columnar corallum, x1, G.S.C. No. 10405, Cross Lake member, Cedar Lake formation, from south shore of Portage Bay, Cross Lake. (Page 62.)

Figure 4. *Angopora manitobensis* sp. nov. Corallum, detail of side, x2, G.S.C. No. 11041, Stonewall formation, from Stonewall quarry. (Page 67.)

Figure 5. *Angopora manitobensis* sp. nov. Corallum, holotype, x1, G.S.C. No. 11048, Stonewall formation, Stonewall quarry. (Page 67.)

Figure 6. *Paleofavosites poulseni* Teichert. Corallum, top view, x1, G.S.C. No. 10483, Stonewall formation, from Mile 19, Flin Flon railway. (Page 62.)

Figure 7. *Favosites gothlandicus* Lamarck. Side view of corallum, x1, G.S.C. No. 10499, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 54.)

Figure 8. *Angopora manitobensis* sp. nov. Corallum, holotype, x3, G.S.C. No. 11048, Stonewall formation, from Stonewall quarry. (Page 67.)

Figure 9. *Paleofavosites poulseni minor* subsp. nov. Corallum, holotype, x3, G.S.C. No. 10492, side view showing spine septa, Fisher Branch dolomite, from Grand Rapids. (Page 63.)

Figure 10. *Paleofavosites poulseni minor* subsp. nov. Longitudinal and transverse thin sections, x4, G.S.C. No. 11008, Fisher Branch dolomite, from Grand Rapids. (Page 63.)

Figure 11. *Paleofavosites poulseni* Teichert. Detail of side of corallites showing pores and septa, x3, G.S.C. No. 10500, Fisher Branch dolomite, from Seven Mile Point, Lake Atikameg. (Page 62.)

PLATE V

Figure 1. *Multisolenia tortuosa* Fritz. Side view of corallum fragment, x2, G.S.C. No. 11046, Cross Lake member, Cedar Lake formation, from the small island in southeast corner Cross Lake. (Page 66.)

Figure 2. *Multisolenia tortuosa* Fritz. Top view of same specimen as Figure 1, x2.

Figure 3. *Multisolenia tortuosa* Fritz. Longitudinal thin section showing pores, x3, G.S.C. No. 10485, Cross Lake member, Cedar Lake dolomite, from the small island in southeast corner Cross Lake. (Page 66.)

Figure 4. *Multisolenia tortuosa* Fritz. Transverse thin section, x3, G.S.C. No. 10486, Cross Lake member, Cedar Lake formation, from small island in southeast corner Cross Lake. (Page 66.)

Figure 5. *Angopora manitobensis* sp. nov. Transverse thin section, x3, G.S.C. No. 11007, Stonewall formation, from Stonewall quarry. (Page 67.)

Figure 6. *Multisolenia confluens* sp. nov. Longitudinal thin section, x4, G.S.C. No. 10495, Fisher Branch dolomite, from l.s. 1, sec. 8, tp. 25, rge. 2, W. Prin. mer. (Page 66.)

Figure 7. *Multisolenia confluens* sp. nov. Top view of corallum, holotype, x1, G.S.C. No. 10412, Fisher Branch dolomite, from southwest corner Seven Mile Point, Lake Atikameg. (Page 66.)

Figure 8. *Multisolenia confluens* sp. nov. Transverse thin section, x4, G.S.C. No. 10496, Fisher Branch dolomite, from l.s. 1, sec. 8, tp. 25, rge. 2, W. Prin. mer. (Page 66.)

PLATE V

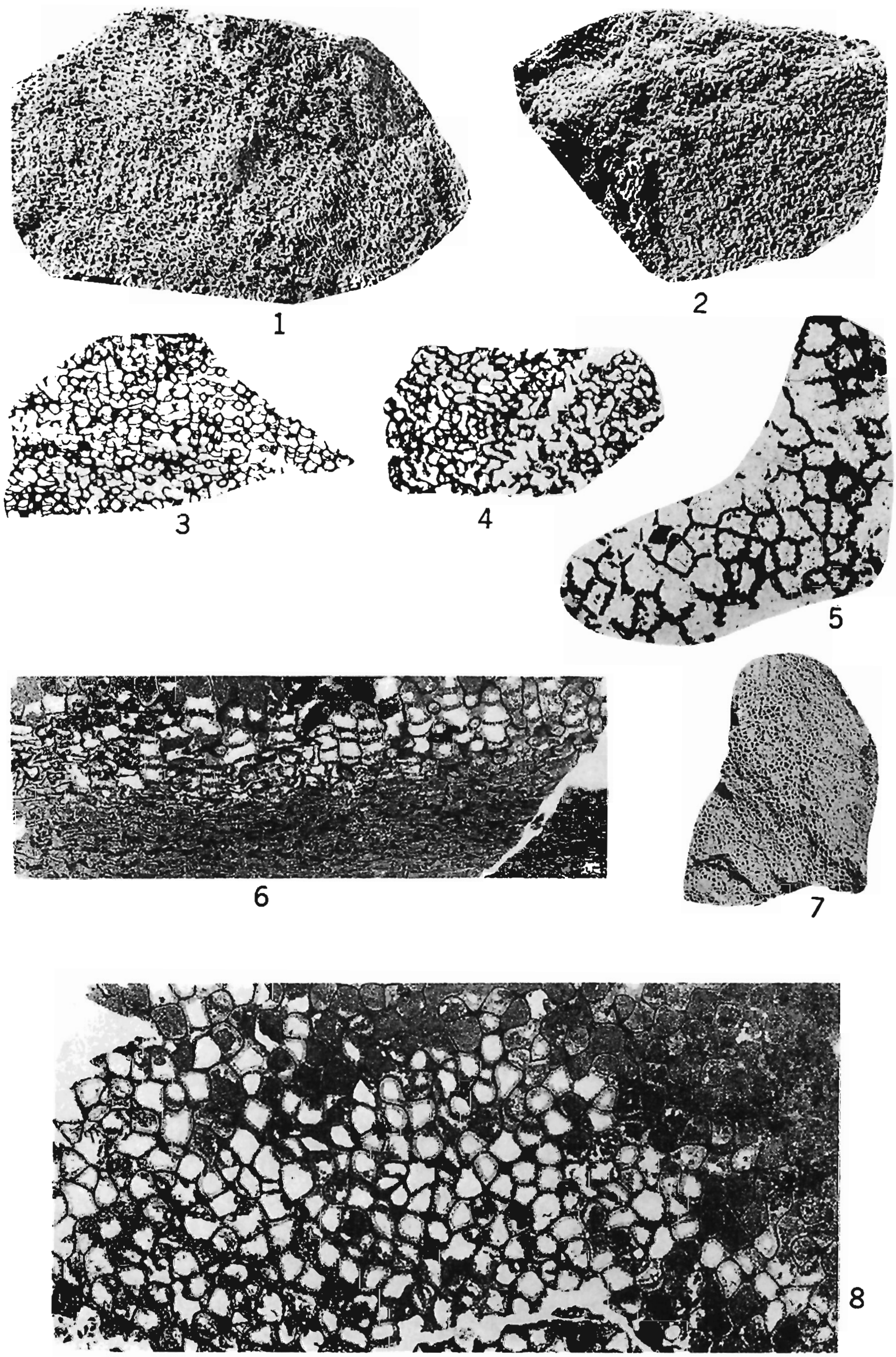
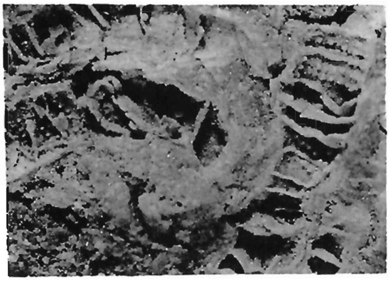
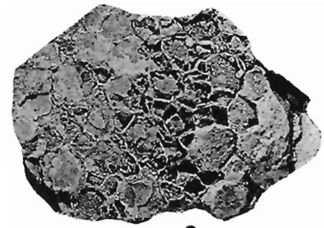


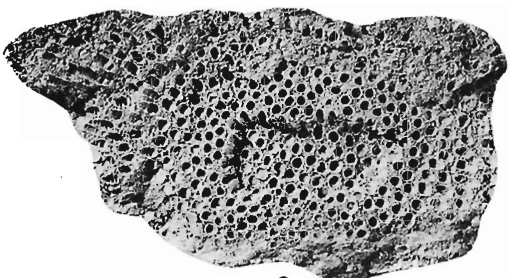
PLATE VI



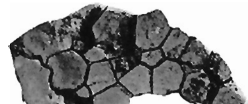
1



2

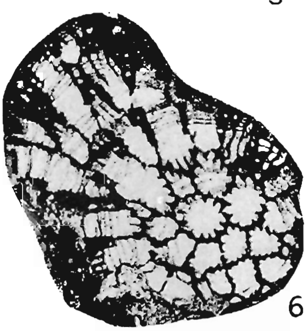


3

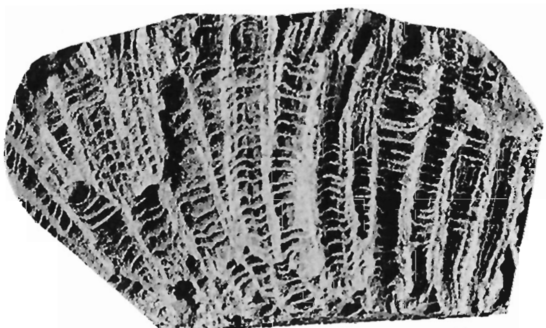


4

5

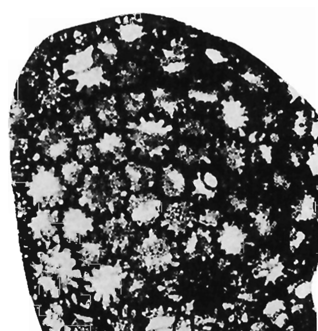


6



7

8



9

PLATE VI

Figure 1. *Tryplasma gracilis* (Whiteaves). Detail of side of several corallites, x4, G.S.C. No. 12866, Stonewall formation, Stonewall quarry. (Page 91.)

Figure 2. *Favosites gothlandicus magnus* subsp. nov. Top of corallum, holotype, x1, G.S.C. No. 10472, Fisher Branch dolomite, from l.s. 6, sec. 16, tp. 25, rge. 2, W. Prin. mer. (Page 56.)

Figure 3. *Lyellia affinis* (Billings). Large corallum, x1, G.S.C. No. 10413, collected by J. B. Tyrrell, Fisher Branch dolomite, from Grand Rapids. (Page 72.)

Figure 4. *Favosites gothlandicus magnus* subsp. nov. Transverse cross section, x1, G.S.C. No. 10474, Fisher Branch dolomite, from sec. 3, tp. 25, rge. 2, W. Prin. mer. (Page 56.)

Figure 5. *Corrugopora rhabdota* sp. nov. Corallum, holotype, x1, G.S.C. No. 10406, East Arm dolomite, from Mile 5·5, Churchill branch, Canadian National railway. (Page 68.)

Figure 6. *Corrugopora rhabdota* sp. nov. Thin section showing pores, x4, G.S.C. No. 10481, East Arm dolomite, from Mile 5·5, Churchill branch, Canadian National railway. (Page 68.)

Figure 7. *Corrugopora rhabdota* sp. nov. Detail of walls of several corallites, x3, G.S.C. No. 10401, East Arm dolomite, from Mile 5·5, Churchill branch, Canadian National railway. (Page 68.)

Figure 8. *Tryplasma gracilis* (Whiteaves). Corallum, x1, G.S.C. No. 10409, Stonewall formation, from Stonewall quarry. (Page 91.)

Figure 9. *Corrugopora rhabdota* sp. nov. Transverse thin section, x4, G.S.C. No. 10481, East Arm dolomite, from Mile 5·5, Churchill branch, Canadian National railway. (Page 68.)

PLATE VII

Figures 1, 3. *Paleofavosites kirki* sp. nov. Polished surfaces of top and side of holotype corallum, x1, G.S.C. No. 11005, Inwood formation, from Grand Rapids. (Page 63.)

Figure 2. *Corrugopora praecursor* sp. nov. Transverse thin section, x3, G.S.C. No. 11010, East Arm dolomite, from southeast corner Reader Lake. (Page 68.)

Figure 4. *Corrugopora praecursor* sp. nov. Corallum, holotype, x1, G.S.C. No. 10402, East Arm dolomite, from southeast corner Reader Lake. (Page 68.)

Figure 5. *Palaeophyllum pasense parvum* subsp. nov. Polished transverse section, holotype, x3, G.S.C. No. 10482, Stonewall formation, from Mile 19·5, Flin Flon railway. (Page 90.)

Figure 6. *Amplexoides severnensis* (Parks). Top of corallum showing amplexoid septa, x2, G.S.C. No. 11051, Inwood formation, from north bank Grand Rapids. (Page 79.)

Figure 7. *Corrugopora praecursor*, sp. nov. Detail of holotype, x4, G.S.C. No. 10402, East Arm dolomite, from southeast corner Reader Lake. (Page 68.)

Figure 8. *Paleofavosites groenlandicus* Poulsen. Side view of corallites showing spine septa, x4, G.S.C. No. 11022, Fisher Branch dolomite, from Grand Rapids. (Page 64.)

Figure 9. *Paleofavosites transiens* sp. nov. Top view of corallum, holotype, x1, G.S.C. No. 10490, Cross Lake member, Cedar Lake formation, from south shore Portage Bay, Cross Lake. (Page 62.)

Figures 10, 11. *Paleofavosites kirki* sp. nov. Transverse and longitudinal thin sections, x3, G.S.C. Nos. 11044, 11045, Inwood formation, from Grand Rapids. (Page 63.)

PLATE VII

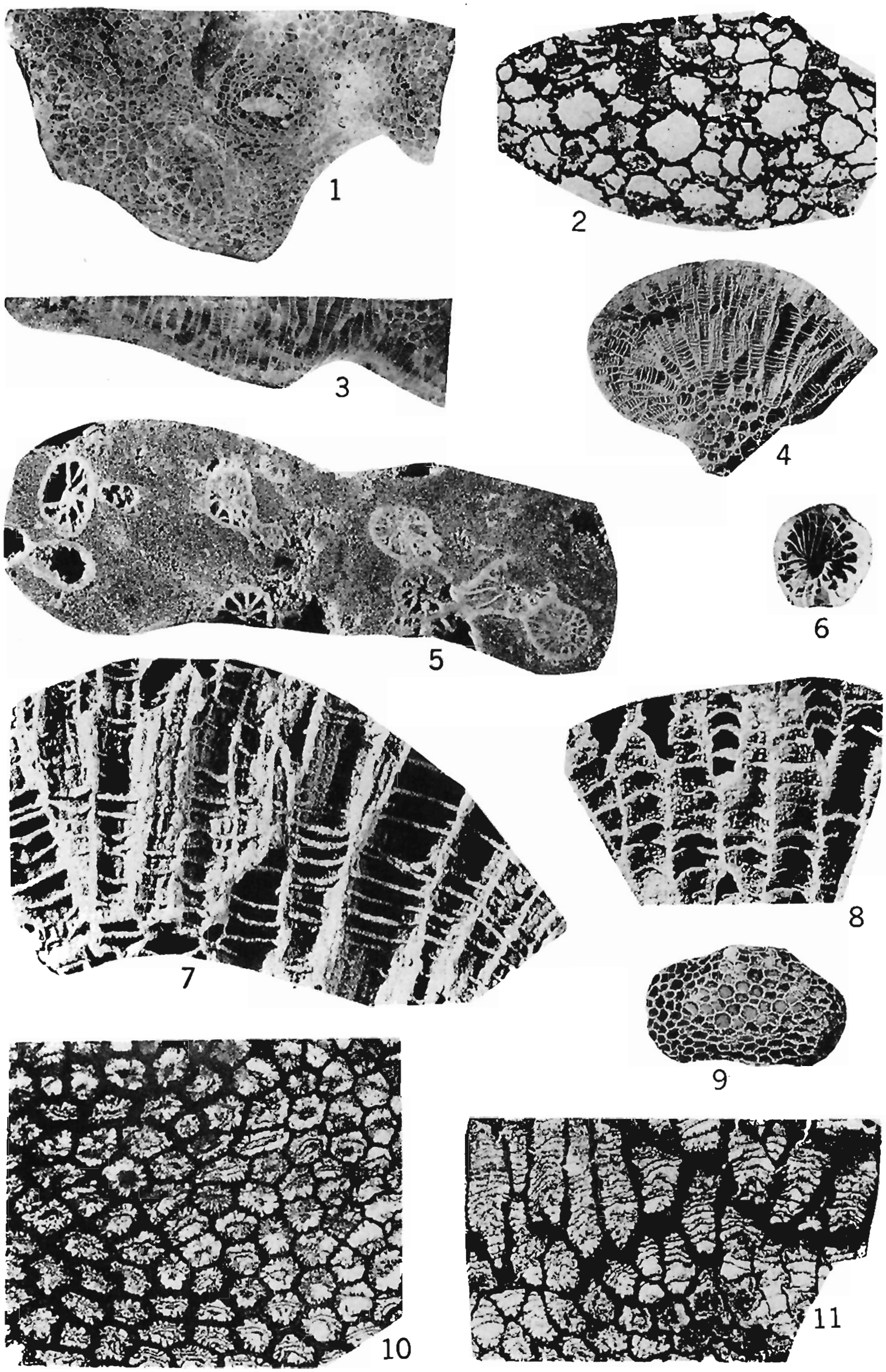


Plate VIII

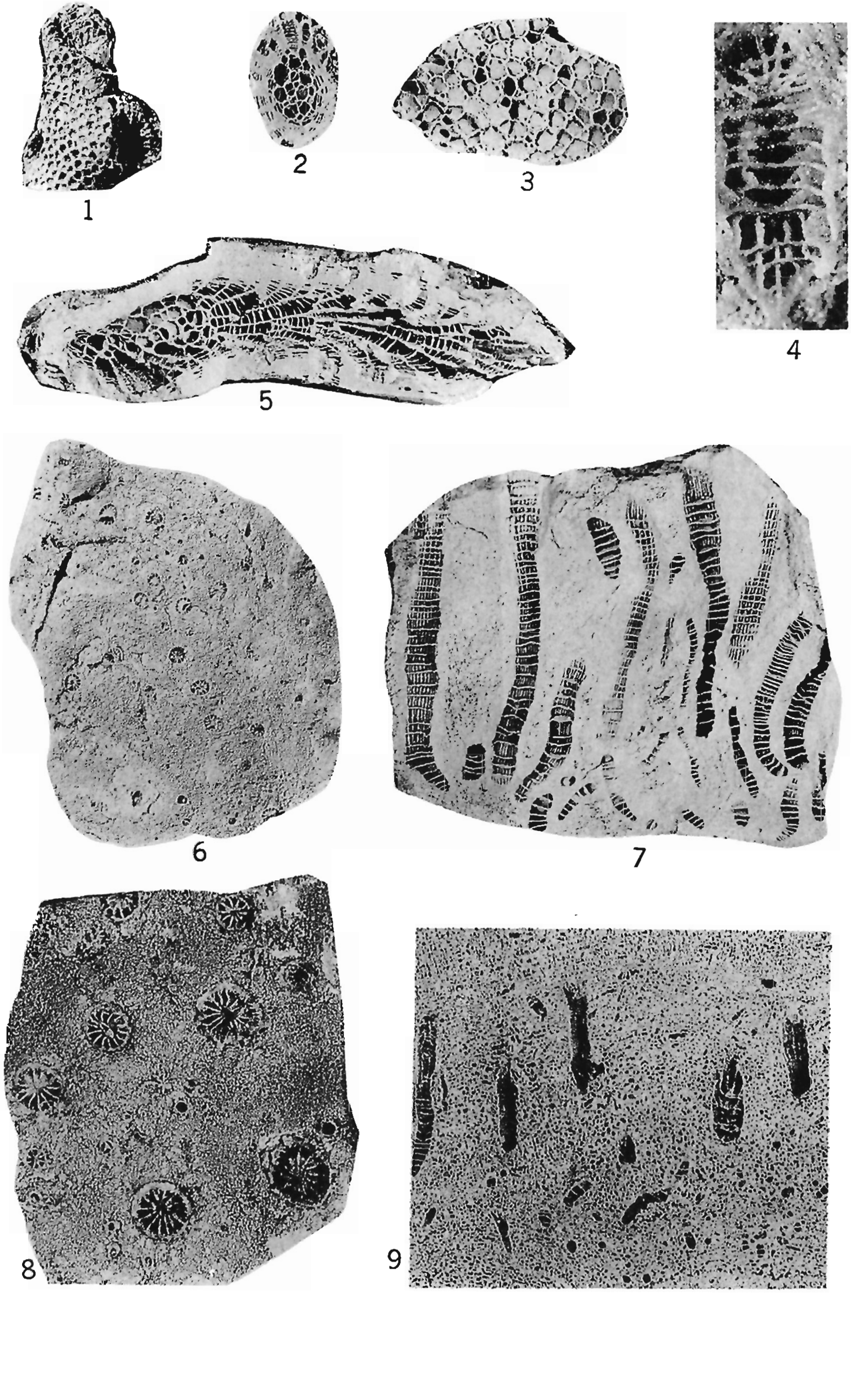


PLATE VIII

Figure 1. *Striatopora robusta* sp. nov. Corallum, holotype, x1, G.S.C. No. 10488, East Arm dolomite, from sec. 4, tp. 57, rge. 20, W. Prin. mer. (Page 69.)

Figure 2. *Striatopora robusta* sp. nov. Transverse polished section, holotype, x2, G.S.C. No. 10488, East Arm dolomite, from sec. 4, tp. 57, rge. 20, W. Prin. mer. (Page 69.)

Figure 3. *Paleofavosites okulitchi* nom. nov. Top view of corallum, x1, G.S.C. No. 12865, Stonewall formation, from Mile 26·7, Flin Flon highway. (Page 61.)

Figure 4. *Synamplexoides varioseptatus* sp. nov. Detail of side of corallite in holotype, showing amplexoid septa, x4, G.S.C. No. 11047, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 80.)

Figure 5. *Striatopora robusta* sp. nov. Longitudinal section, paratype, x2, G.S.C. No. 10491, East Arm dolomite, from sec. 4, tp. 57, rge. 20, W. Prin. mer. (Page 69.)

Figure 6. *Synamplexoides varioseptatus* sp. nov. Corallum, holotype, x1, G.S.C. No. 11047, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 80.)

Figure 7. *Pycnostylus guelphensis* Whiteaves. Several corallites, x1, G.S.C. No. 10411, Chemahawin member, Cedar Lake formation, from Davis Point, collected by J. B. Tyrrell. (Page 82.)

Figure 8. *Synamplexoides varioseptatus* sp. nov. Top view of corallites growing through *Clathrodictyon cystosum*, paratype, x2, G.S.C. No. 11042, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 80.)

Figure 9. *Synamplexoides varioseptatus* sp. nov. Side view showing the relationship between the corallites and the stromatoporoid, x1, G.S.C. No. 11043, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 80.)

PLATE IX

Figure 1. *Neozaphrentis manitobensis* sp. nov. Calyx, x1, paratype, G.S.C. No. 10415, Fisher Branch dolomite, from 4 miles south of Narcisse. (Page 73.)

Figure 2. *Neozaphrentis manitobensis* sp. nov. Transverse section near base of corallum, slightly retouched, x2, paratype, G.S.C. No. 11033, East Arm dolomite, from sec. 4, tp. 57, rge. 20, W. Prin. mer., Moose Lake. (Page 73.)

Figure 3. *Neozaphrentis tyrrelli* sp. nov. Transverse section at base of calyx, x2, holotype, G.S.C. No. 10420, Fisher Branch dolomite, from l.s. 9, sec. 31, tp. 25, rge. 2, W. Prin. mer. (Page 74.)

Figure 4. *Neozaphrentis manitobensis* sp. nov. Base of calyx showing fossula, x2, paratype, G.S.C. No. 10489, Cross Lake member, Cedar Lake formation, from island in southeast corner Cross Lake. (Page 73.)

Figure 5. *Neozaphrentis hindi* sp. nov. Side view of corallum, holotype, x1, G.S.C. No. 10421a, Stonewall formation, from Mile 25·5, Flin Flon highway. (Page 76.)

Figure 6. *Neozaphrentis hindi* sp. nov. Transverse section, paratype, x1, G.S.C. No. 10421b, Stonewall formation, from Mile 25·5, Flin Flon highway. (Page 76.)

Figure 7. *Neozaphrentis tyrrelli* sp. nov. Side view of two corallites, x1, paratype, G.S.C. No. 10422, Fisher Branch dolomite, from l.s. 11, sec. 10, tp. 25, rge. 2, W. Prin. mer. (Page 74.)

Figures 8, 9. *Dinophyllum lundarense* sp. nov. Side view and transverse section of holotype corallum, x1, G.S.C. No. 10473, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 87.)

Figure 10. *Dinophyllum lundarense* sp. nov. Natural cross section near base of corallum, paratype, x1, G.S.C. No. 10478, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 87.)

Figure 11. *Dinophyllum lundarense* sp. nov. Latex cast of base of calyx, x1, G.S.C. No. 11053, Cedar Lake formation, from Fort Island, Cedar Lake. (Page 87.)

Figures 12, 15. *Amplexoides* sp. A. Transverse section, x2, and side view, x1, of a corallum, G.S.C. No. 10497, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 79.)

Figure 13. *Neozaphrentis symmetricus* sp. nov. Mould of base of calyx, slightly retouched, holotype, x1, G.S.C. No. 10498, Cross Lake member, Cedar Lake formation, from foot of Cross Lake Rapids. (Page 77.)

Figure 14. *Beatricia regularis* sp. nov. Holotype showing axial column and outline of surrounding cystose zone, x1, G.S.C. No. 10467, Stonewall formation, Stonewall quarry. (Page 53.)

PLATE IX

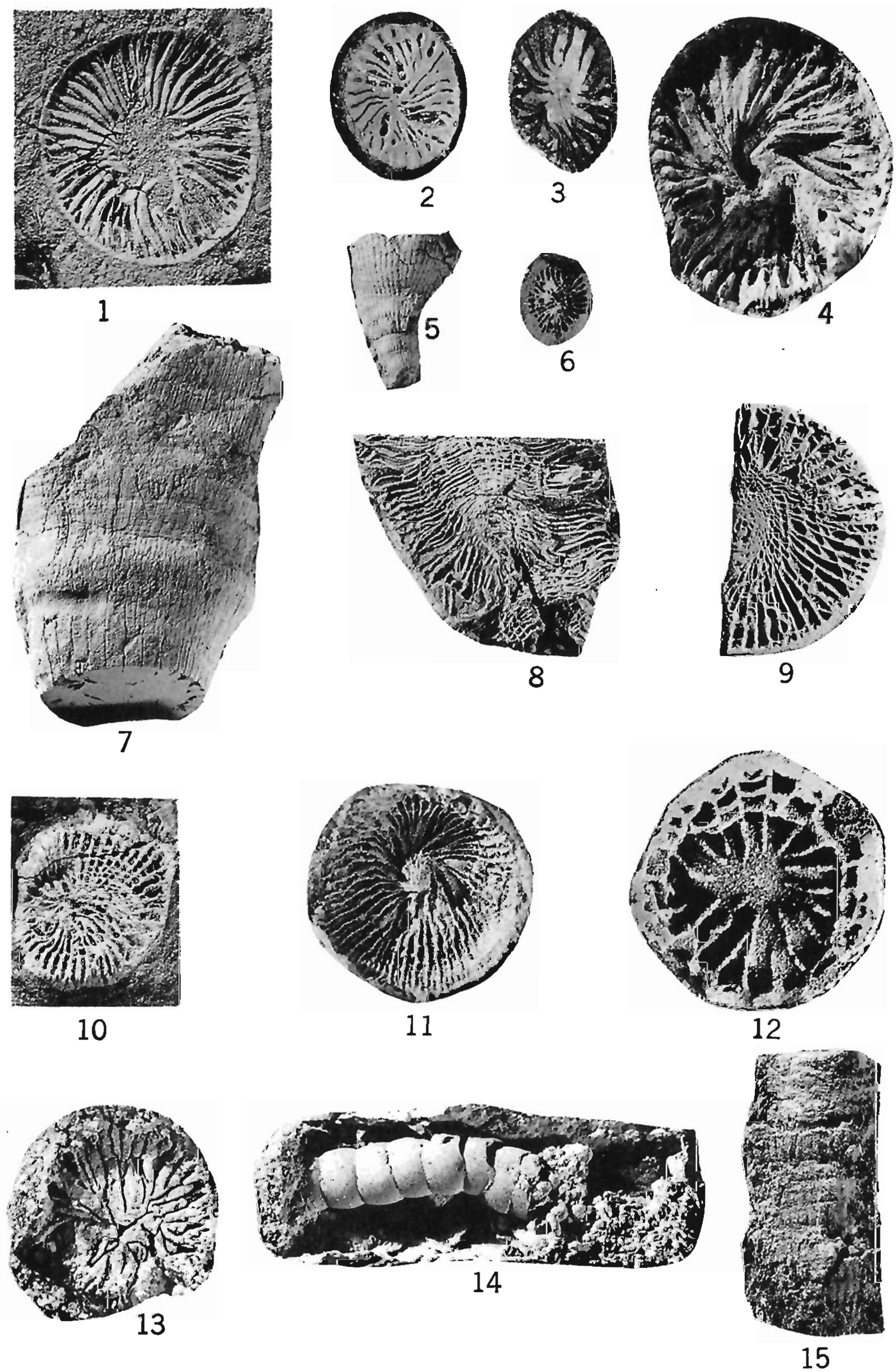


PLATE X

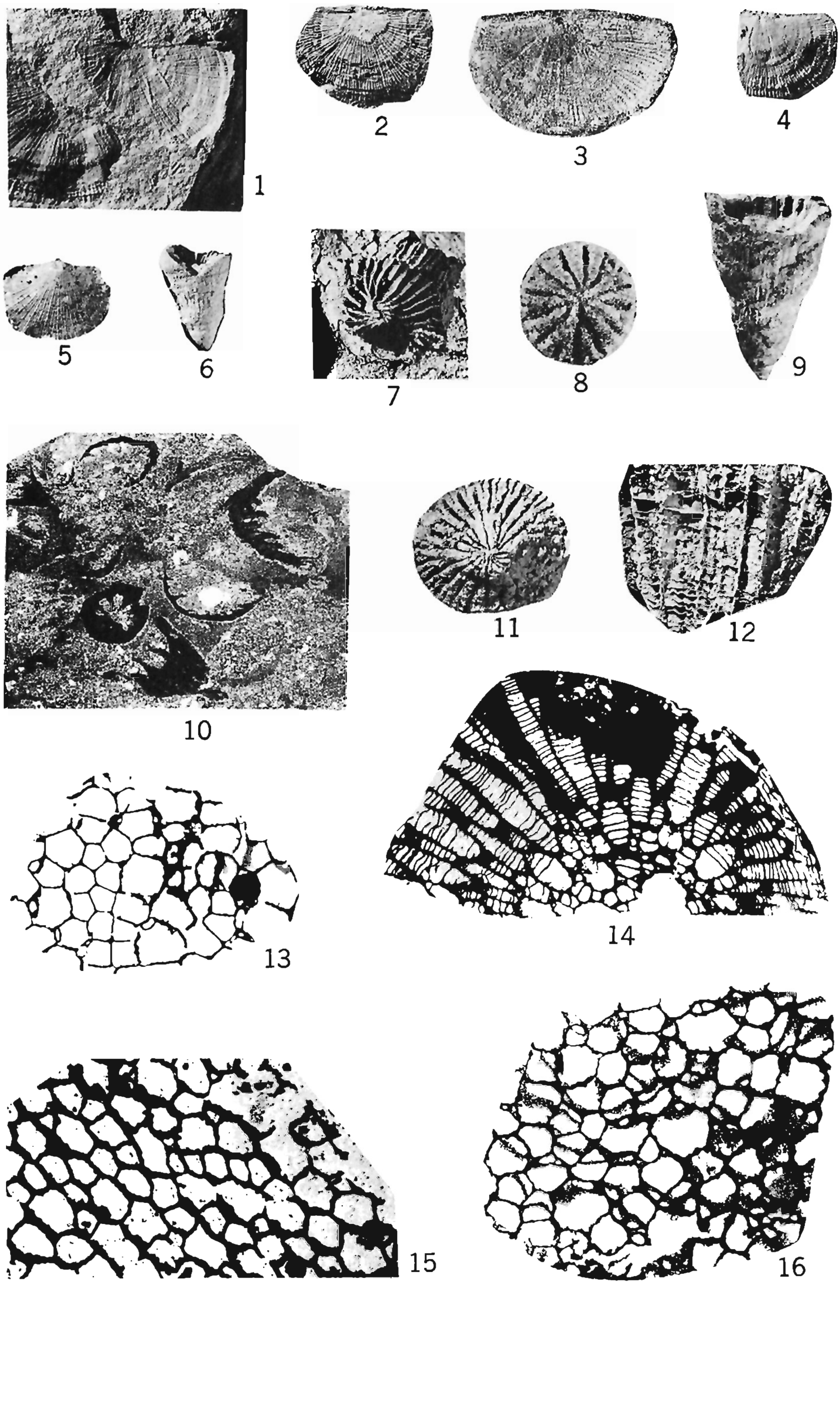


PLATE X

Figure 1. *Öpikina* (?) *stonewallensis* sp. nov. Dorsal interior showing 4 prominent septa, paratype, x2, G.S.C. No. 10441, Stonewall formation, from Stonewall quarry. (Page 96.)

Figure 2. *Öpikina* (?) *stonewallensis* sp. nov. Dorsal exterior, holotype, x1, G.S.C. No. 10448, Stonewall formation, from highway 7, 4·2 miles north of Fisher Branch. (Page 99.)

Figure 3. *Öpikina* (?) *stonewallensis* sp. nov. Dorsal exterior, showing trace of interior septa, paratype, x2, G.S.C. No. 11058, Stonewall formation, 4·2 miles north of Fisher Branch. (Page 99.)

Figure 4. *Öpikina* (?) *stonewallensis* sp. nov. Dorsal exterior with impression of interior septa, paratype, x1, G.S.C. No. 10442, Stonewall formation, from Stonewall quarry. (Page 99.)

Figure 5. *Fardenia elegans* (Prouty). Ventral exterior, x1, G.S.C. No. 10459, Moose Lake dolomite, from west shore, Moose Lake, at latitude 54° 3′. (Page 101.)

Figure 6. *Asthenophyllum occidentale* (Whiteaves). Corallum, x1, G.S.C. No. 10408, Atikameg dolomite, from head of Grand Rapids, south shore. (Page 85.)

Figure 7. *Asthenophyllum occidentale* (Whiteaves). Calyx, x2, G.S.C. No. 11037, Atikameg dolomite, from head of Grand Rapids, south shore. (Page 85.)

Figure 8. *Asthenophyllum inwoodense* sp. nov. Calicular mould of immature specimen, x4, G.S.C. No. 12867, Atikameg dolomite, from Dunsekikan Island, Lake St. Martin. (Page 83.)

Figure 9. *Asthenophyllum inwoodense* sp. nov. Corallum, holotype, x2, G.S.C. No. 11012, Inwood formation, from Inwood quarry. (Page 83.)

Figure 10. *Asthenophyllum inwoodense* sp. nov. Thin section of several coralla embedded in dolomite, x4, G.S.C. No. 11006, Inwood formation, from Inwood quarry. (Page 83.)

Figure 11. *Asthenophyllum* sp. A. Calicular mould, x2, G.S.C. No. 11039, Cedar Lake formation, from Cross Lake, 3·5 miles north of Demicharge Rapids. (Page 86.)

Figure 12. *Paleofavosites capax* (Billings). Side view of several corallites, slightly retouched, x2, G.S.C. No. 10493, Stonewall formation, from Stonewall quarry. (Page 61.)

Figure 13. *Paleofavosites prolificus* (Billings). Transverse thin section, x3, G.S.C. No. 11009, Stonewall formation, from Stonewall quarry. (Page 60.)

Figure 14. *Favosites niagarensis lundarensis* subsp. nov. Longitudinal thin section, x2, G.S.C. No. 11034, Chemahawin member, Cedar Lake formation, from Lundar quarry. (Page 57.)

Figure 15. *Paleofavosites transiens* sp. nov. Transverse thin section, x3, G.S.C. No. 10487, Cross Lake member, Cedar Lake formation, from east side Cross Lake Rapids. (Page 62.)

Figure 16. *Paleofavosites poulseni* Teichert. Transverse thin section, x4, G.S.C. No. 11023, Stonewall formation, from Mile 19, Flin Flon railway. (Page 62.)

PLATE XI

Figure 1. *Camarotoechia indianensis* (Hall). Latex mould of dorsal exterior, x1, G.S.C. No. 10455, Inwood formation, from Broad Valley quarry. (Page 104.)

Figure 2. *Camarotoechia indianensis* (Hall). Mould of dorsal interior, x1, G.S.C. No. 10454, Fisher Branch dolomite, from Mile 24·5, Churchill branch, Canadian National railway. (Page 104.)

Figure 3. *Hesperorthis davidsoni* (Verneuil). Mould of ventral interior, x1, G.S.C. No. 10437, Cedar Lake formation, from Fort Island, Cedar Lake. (Page 93.)

Figure 4. *Fardenia elegans* (Prouty). Ventral exterior, x1, G.S.C. No. 10459, Moose Lake dolomite, from west shore of Moose Lake, at latitude 54° 3′. (Page 101.)

Figure 5. *Dalmanella* (?) sp. Dorsal interior, x1, G.S.C. No. 10447, Fisher Branch dolomite, from sec. 16, tp. 32, rge. 6, W. Prin. mer. (Page 94.)

Figure 6. *Dalmanella* (?) sp. Ventral exterior, x1, G.S.C. No. 10446, Fisher Branch dolomite, from sec. 8, tp. 25, rge. 2, W. Prin. mer. (Page 94.)

Figure 7. *Camarotoechia winiskensis* Whiteaves. Mould of ventral interior, x1, G.S.C. No. 10436, Cross Lake member, Cedar Lake formation, from south channel, Demicharge Rapids. (Page 104.)

Figure 8. *Brachyprion paskoiacensis* sp. nov. Mould of ventral interior, paratype, x1, G.S.C. No. 10449, Inwood formation, from Grand Rapids, l.s. 5, sec. 16, tp. 48, rge. 13, W. Prin. mer. (Page 97.)

Figures 9-11. *Megamyonia nitens* (Billings). Ventral exteriors, x1, G.S.C. Nos. 10451, 10452, 10453, Stonewall formation, from Stonewall quarry. (Page 101.)

Figure 12. *Fardenia ellipsoides* sp. nov. Dorsal exterior, holotype, x1, G.S.C. No. 10460, Atikameg dolomite, from Dunsekikan Island, Lake St. Martin. (Page 102.)

Figures 13, 14. *Fardenia ellipsoides* sp. nov. Dorsal exteriors, paratypes, x1, G.S.C. Nos. 10461, 10462, Inwood formation, from l.s. 9, sec. 28, tp. 23, rge. 2, W. Prin. mer. (Page 102.)

Figure 15. *Fardenia ellipsoides* sp. nov. Dorsal exterior, paratype, x1, G.S.C. No. 10465, Inwood formation, from 1·7 miles west of Sandridge. (Page 102.)

Figures 16, 17. *Brachyprion paskoiacensis* sp. nov. Side view and ventral exterior, holotype, x1, G.S.C. No. 10440, Inwood formation, from sec. 16, tp. 48, rge. 13, W. Prin. mer. (Page 97.)

Figures 18, 19. *Brachyprion paskoiacensis geniculatus* subsp. nov. Side view and ventral exterior, holotype, x1, G.S.C. No. 10443, Fisher Branch dolomite, from sec. 8, tp. 25, rge. 2, W. Prin. mer. (Page 98.)

Figures 20, 21. *Brachyprion acanthopterus* (Whiteaves). Side view and ventral interior of small form from Chemahawin, x1, G.S.C. No. 10438, Chemahawin member, Cedar Lake formation, from Chemahawin. (Page 96.)

Figures 22, 23. *Brachyprion inflatus* sp. nov. Side view and mould of ventral exterior, holotype, x1, G.S.C. No. 10457, Cross Lake member, Cedar Lake formation, from south shore of Portage Bay, Cross Lake. (Page 97.)

Figure 24. *Brachyprion acanthopterus* (Whiteaves). Mould of dorsal exterior, holotype, x1, G.S.C. No. 5779, Cedar Lake formation, from east side Lake Winnipegosis. (Page 96.)

Figure 25. *Brachyprion acanthopterus* (Whiteaves). Dorsal interior, x1, G.S.C. No. 10439, Cedar Lake formation, east side of bay behind Denbeigh Point, Lake Winnipegosis. (Page 96.)

Figure 26. *Brachyprion robustus* Twenhofel. Mould of ventral interior, x1, G.S.C. No. 10458, Cedar Lake formation, from first corner north of Hilbre. (Page 99.)

PLATE XI

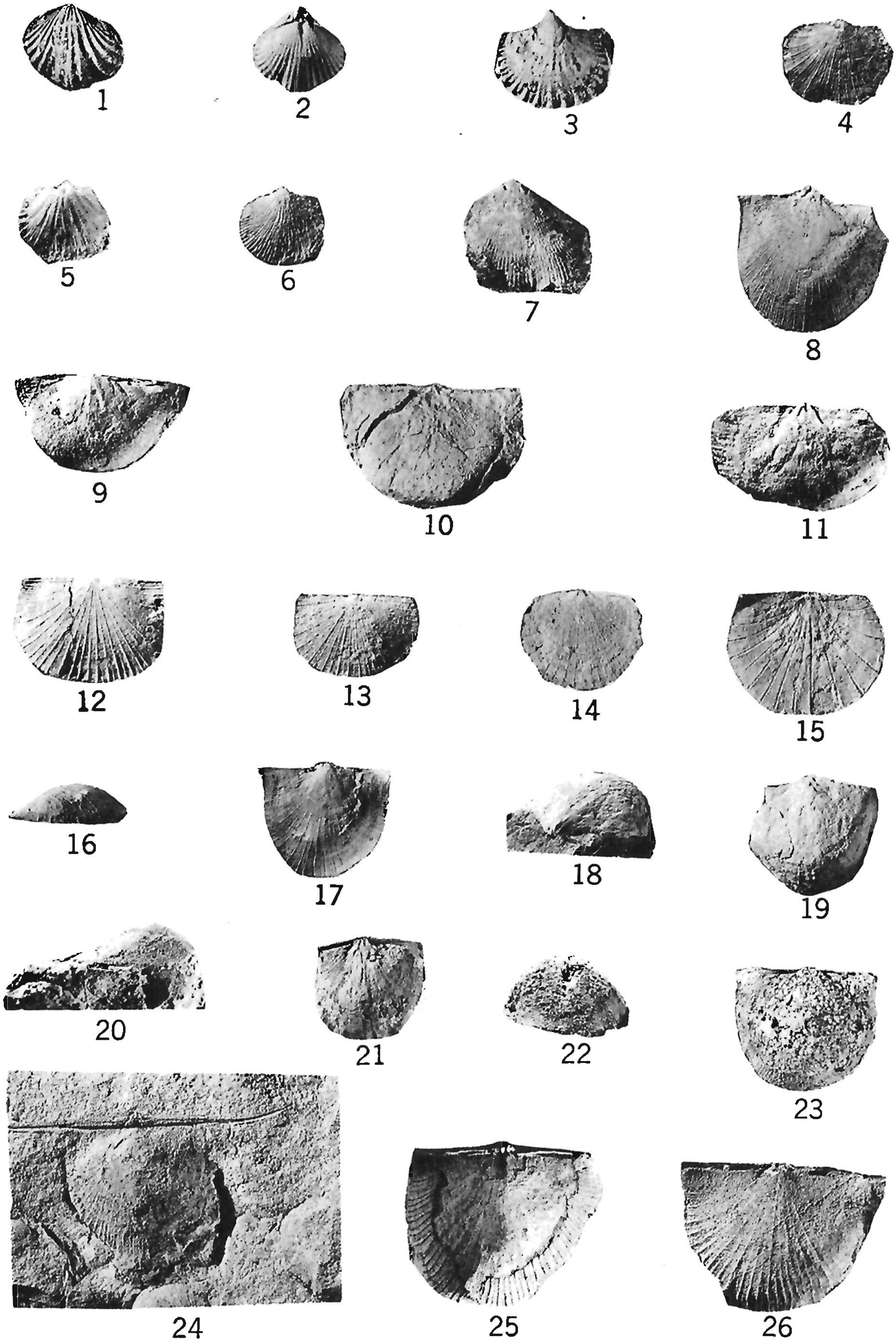


PLATE. XII

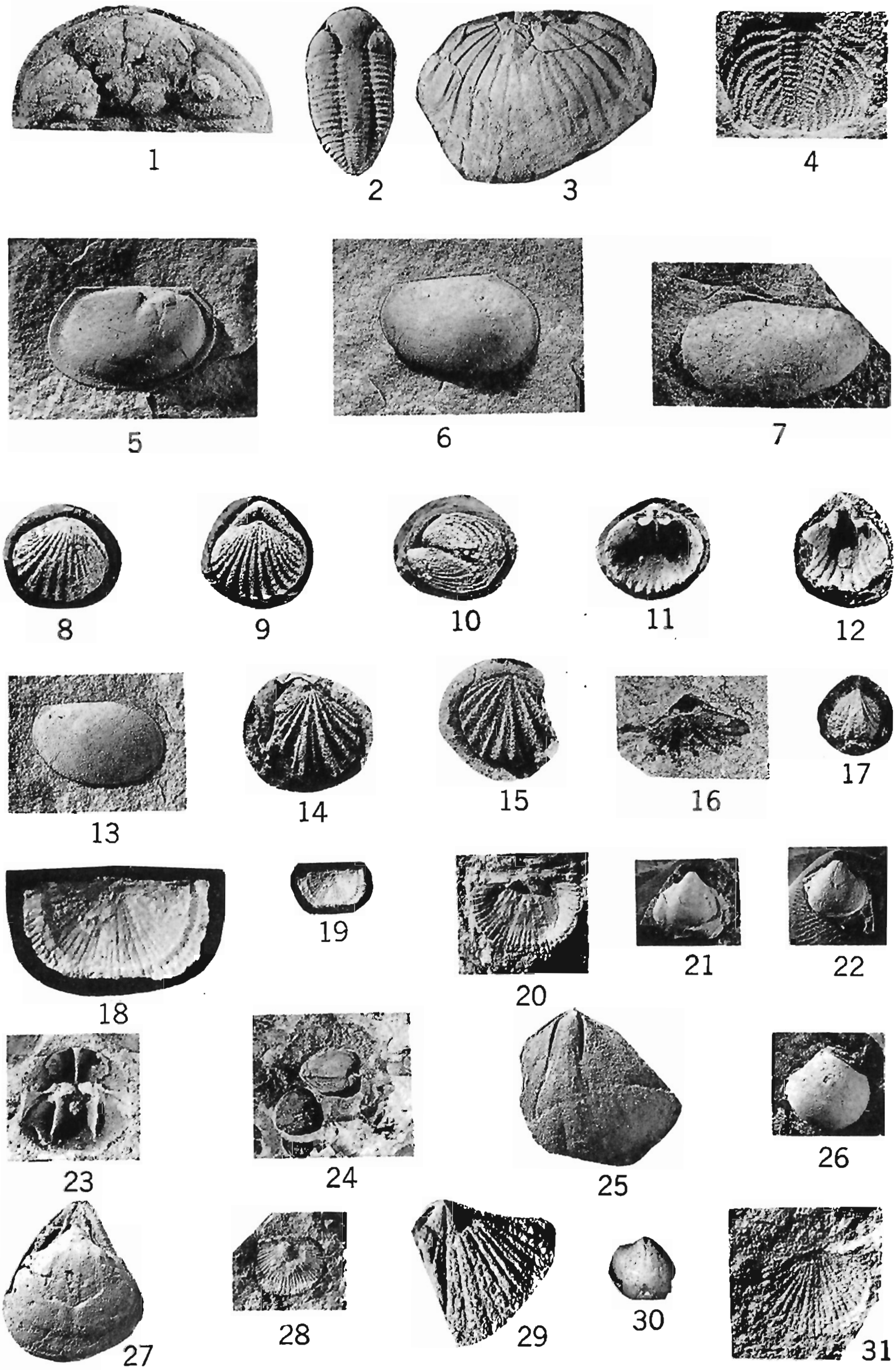

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31

PLATE XII

Figure 1. *Encrinurus hypoleprus* sp nov. Cephalon, paratype, x2, G.S.C. No. 11040, Cedar Lake formation, from east side of bay behind Denbeigh Point, Lake Winnipegosis. (Page 122.)

Figure 2. *Encrinurus hypoleprus* sp. nov. Dorsal shield, holotype, x1, G.S.C. No. 11062, Cross Lake member, Cedar Lake formation, from south bank of Saskatchewan River, N. 40° W. from main discharge of Cross Lake Rapids. (Page 122.)

Figure 3. *Arctinurus* sp. Pygidium, x1, G.S.C. No. 11059, Cedar Lake formation, from west shore of Cross Lake, 3·5 miles northeast Demicharge Rapids. (Page 123.)

Figure 4. *Encrinurus hypoleprus* sp. nov. Pygidium, x2, G.S.C. No. 11050, Cedar Lake formation, from Denbeigh Point, Lake Winnipegosis. (Page 122.)

Figure 5. *Dihogmochilina latimarginata* (Whiteaves). Side view, holotype, x1, G.S.C. No. 6055a, Cedar Lake formation, from Denbeigh (Long) Point, Lake Winnipegosis. (Page 126.)

Figure 6. *Leperditia hisingeri* Schmidt. Side view, x3, G.S.C. No. 8752, Cedar Lake formation, from Denbeigh Point, Lake Winnipegosis. (Page 124.)

Figure 7. *Leperditia phaseola* (Hisinger). Side view, x3, G.S.C. No. 8755, East Arm dolomite, from Redrock Rapids. (Page 125.)

Figures 8-10. *Clintonella bailliei* sp. nov. Ventral, dorsal, and side views of holotype, x3, G.S.C. No. 11031, East Arm dolomite, from Mile 5·5, Churchill branch, Canadian National railway. (Page 105.)

Figures 11, 12. *Clintonella bailliei* sp. nov. Dorsal and ventral interiors, two paratypes, x3, G.S.C. Nos. 11014, 11015, East Arm dolomite, from Mile 5·5, Churchill branch, Canadian National railway. (Page 105.)

Figure 13. *Leperditia hisingeri fabulina* Jones. Side view, x3, G.S.C. No. 6052, Fisher Branch dolomite ?, from foot of Grand Rapids, collected by J. B. Tyrrell. (Page 124.)

Figures 14, 15. *Homeospira lowi* (Whiteaves). Latex casts of two dorsal exteriors, x2, G.S.C. Nos. 11019, 11020, Atikameg dolomite, from 1 mile southwest of Atikameg Lake station. (Page 107.)

Figure 16. *Homeospira lowi* (Whiteaves). Interior, looking towards the beak, showing brachiophores, x2, G.S.C. No. 11013, Atikameg dolomite, from narrows of Cross Lake. (Page 107.)

Figure 17. *Homeospira lowi* (Whiteaves). Ventral exterior, x1, G.S.C. No. 10456, Atikameg dolomite, from narrows of Cross Lake. (Page 107.)

Figures 18, 19. *Fardenia transversalis* sp. nov. Dorsal exterior, holotype, x1 and x3, G.S.C. No. 10450, Inwood formation, from l.s. 5, sec. 16, tp. 48, rge. 13, W. Prin. mer., Grand Rapids. (Page 103.)

Figure 20. *Fardenia transversalis* sp. nov. Interior of dorsal valve, paratype, x2, G.S.C. No. 11032, Inwood formation, l.s. 5, sec. 16, tp. 48, rge. 13, W. Prin. mer. (Page 103.)

Figures 21, 22. *Meristospira dunbari* sp. nov. Ventral exteriors of two paratypes, x2, G.S.C. Nos. 11017, 11018, East Arm dolomite, southeast corner Reader Lake. (Page 109.)

Figure 23. *Meristospira dunbari* sp. nov. Interior of both valves, holotype, x2, G.S.C. No. 10444, East Arm dolomite, from southeast corner Reader Lake. (Page 109.)

Figure 24. *Meristospira dunbari* sp. nov. Side view of cast of interior, x1, G.S.C. No. 10445, East Arm dolomite, from southeast corner Reader Lake. (Page 109.)

Figure 25. *Meristina manitobensis* sp. nov. Mould of ventral interior, holotype, x2, G.S.C. No. 11038, Cedar Lake formation, from sec. 36, tp. 29, rge. 9, W. Prin. mer. (Page 106.)

Figure 26. *Meristina manitobensis* sp. nov. Ventral exterior, paratype, x1 G.S.C. No. 10464, Cedar Lake formation, from l.s. 2, sec. 7, tp. 51, rge. 19, W. Prin. mer. (Page 106.)

Figure 27. *Monomerella laurentina* (Twenhofel). Cast of interior of ventral valve, x1, G.S.C. No. 10435, Inwood formation, from behind shore of Lake Winnipeg, 3 miles north of Grand Rapids. (Page 92.)

Figure 28. *Dolerorthis redrockensis* sp. nov. Ventral exterior, holotype, x1, G.S.C. No. 10434, East Arm dolomite, from Redrock Rapids. (Page 93.)

Figure 29. *Dolerorthis redrockensis* sp. nov. Mould of dorsal interior, x3, G.S.C. No. 11049, East Arm dolomite, from ¾ mile east of Orok. (Page 93.)

Figure 30. *Meristina manitobensis* sp. nov. Mould of dorsal interior, x1, G.S.C. No. 10463, Cedar Lake dolomite, from west shore of Cross Lake, north of Cranberry Bay. (Page 106.)

Figure 31. *Dolerorthis redrockensis* sp. nov. Ventral exterior, paratype, x2, G.S.C. No. 11035, East Arm dolomite, from Redrock Rapids. (Page 93.)

PLATE XIII

Figure 1. *Kochoceras* cf. *productum* Troedesson. Plasticene cast of siphuncle, x1, G.S.C. No. 11055, Stonewall formation, from Stonewall quarry. (Page 110.)

Figure 2. *Elrodoceras exile* sp. nov. Side view of paratype, x2, G.S.C. No. 11016, Cedar Lake formation, east side of bay behind Denbeigh Point, Lake Winnipegosis. (Page 111.)

Figure 3. *Sactoceras marginale* sp. nov. Longitudinal section, holotype, x2, G.S.C. No. 10479, East Arm dolomite, from northeast bay of Big Island, Moose Lake. (Page 112.)

Figure 4. *Bickmorites insignis* (Whiteaves). Side view of holotype, x1, G.S.C. No. 2781, Stonewall formation, Stonewall quarry. (Page 121.)

PLATE XIII

1

2

3

4

Plate XIV

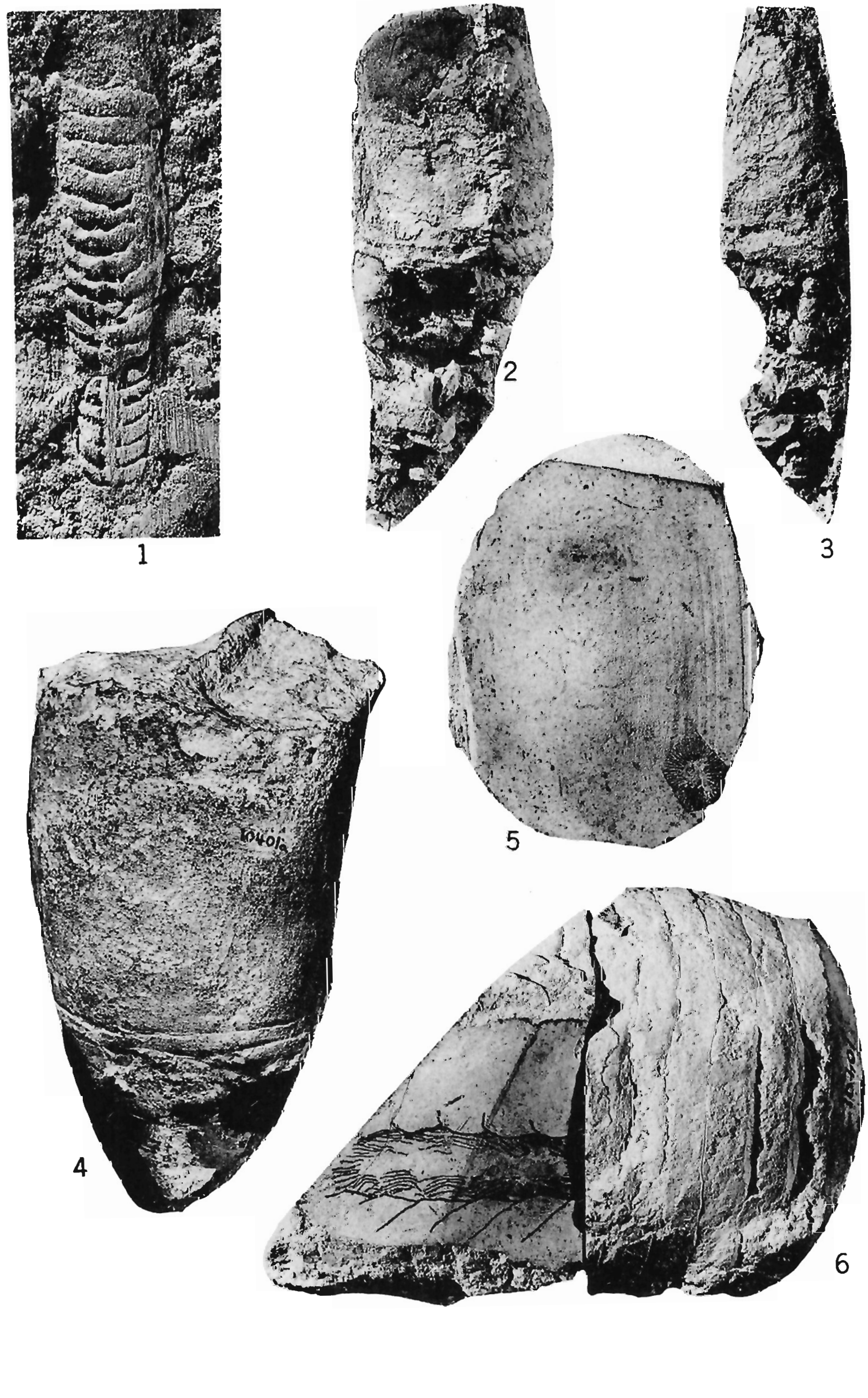


PLATE XIV

Figure 1. *Elrodoceras exile* sp. nov. Side view, lower part of specimen, sectioned to show siphuncle, holotype, x2, G.S.C. No. 10428, East Arm dolomite, from centre sec. 9, tp. 57, rge. 20, W. Prin. mer., Moose Lake. (Page 111.)

Figure 2. *Amphicyrtoceras* cf. *reedsi* Foerste. Side view of conch, slightly restored with clay, siphuncle on right, x1, G.S.C. No. 10427, Inwood formation, from sec. 18, tp. 26, rge. 3, W. Prin. mer. (Page 117.)

Figure 3. *Amphicyrtoceras* cf. *reedsi* Foerste. Ventral view of specimen of Figure 2, showing siphuncle.

Figure 4. *Blakeoceras robustum* sp. nov. Side view of conch, x¾, G.S.C. No. 10433, Inwood formation, from Grand Rapids. (Page 116.)

Figure 5. *Blakeoceras robustum* sp. nov. View of sectioned adoral end of holotype, showing siphuncle, slightly retouched, x1, G.S.C. No. 10484, Inwood formation, from Grand Rapids. (Page 116.)

Figure 6. *Blakeoceras robustum* sp. nov. Side view of holotype, partly sectioned to show siphuncle, retouched, x1, G.S.C. No. 10484, Inwood formation, Grand Rapids. (Page 116.)

PLATE XV

Figure 1. *Megadiscosorus remotus* (Foord). Side view of siphuncle, x1, G.S.C. No. 10426, East Arm dolomite, from Mile 5·5, Churchill branch, Canadian National railway. (Page 112.)

Figures 2, 3. *Ephippiorthoceras minutum* sp. nov. Side and dorsal view of holotype conch, x1, G.S.C. No. 10431, Stonewall formation, from Stonewall quarry. (Page 113.)

Figure 4. *Phragmoceras parvum* Hall and Whitfield. Side view of conch, x1, G.S.C. No. 10425, Cedar Lake formation, from Anchor Point, Saskatchewan River. (Page 119.)

Figures 5, 7. *Phragmoceras nelsoni* sp. nov. Oral and side view of holotype, x1, G.S.C. No. 10424, Inwood formation, Grand Rapids. (Page 120.)

Figure 6. *Cyrtorizoceras* sp. Side view of living chamber and one camera, x1, G.S.C. No. 10430, Atikameg dolomite, from Mile 18, Churchill branch, Canadian National railway. (Page 115.)

Figure 8. *Oocerina canadensis* sp. nov. Side view of phragmocone, holotype, x1, G.S.C. No. 10423, Inwood formation, from Inwood quarry. (Page 115.)

Figure 9. *Kochoceras* cf. *productum* Troedesson. Mould of exterior of siphuncle with part of the siphuncle in place, x1, G.S.C. No. 11055, Stonewall formation, from Stonewall quarry. (Page 110.)

Figure 10. *Kochoceras* cf. *productum* Troedesson. Adapical view of specimen of Figure 9 showing ventral depression of conch and siphuncle, x1.

Figure 11. *Lowoceras imbricatum* sp. nov. Siphuncle and impression of exterior, holotype, x1, G.S.C. No. 10429, Inwood formation, from Grand Rapids. (Page 118.)

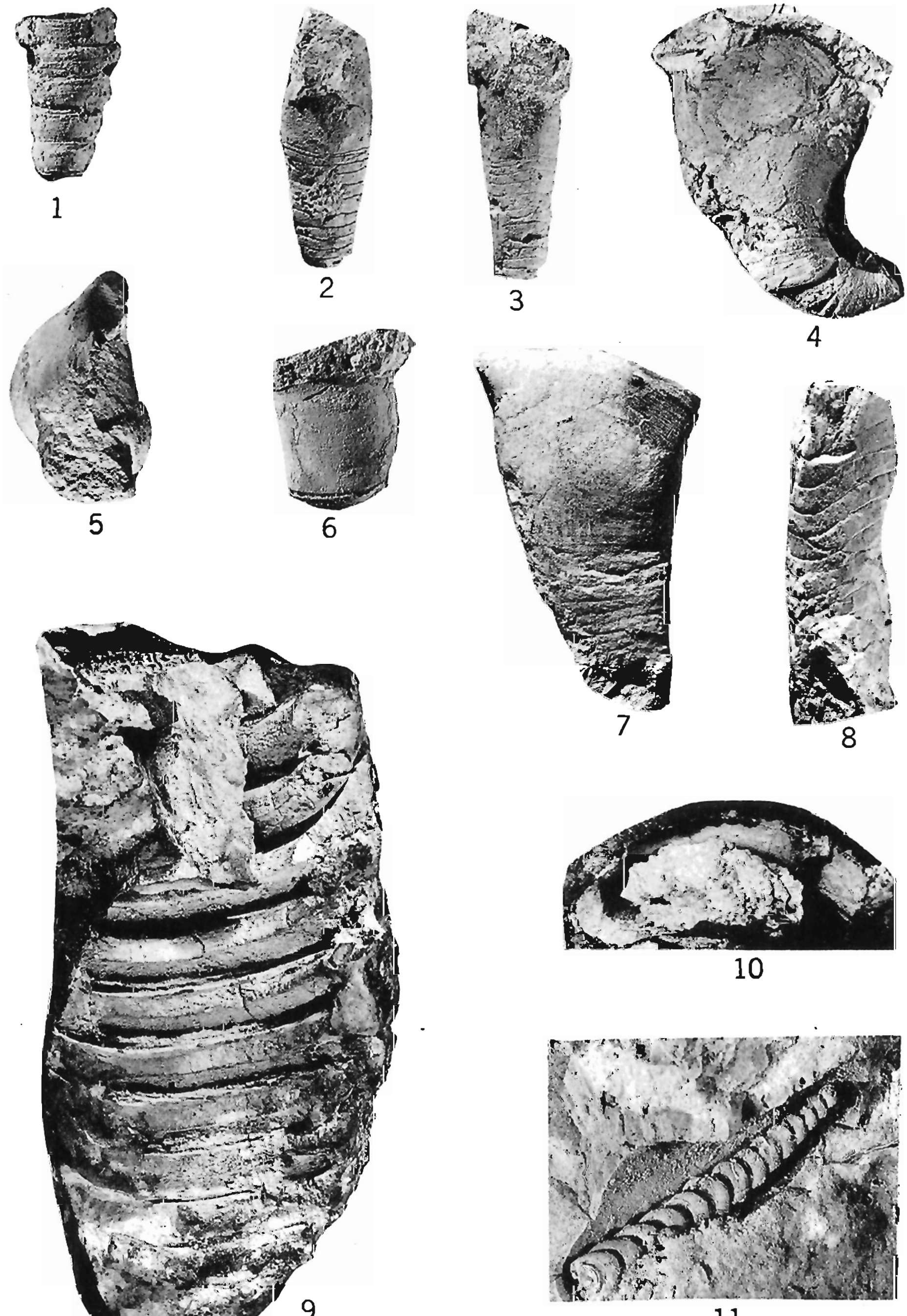
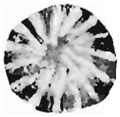

1
2
3
4
5
6
7
8
9
10
11

Plate XVI


1

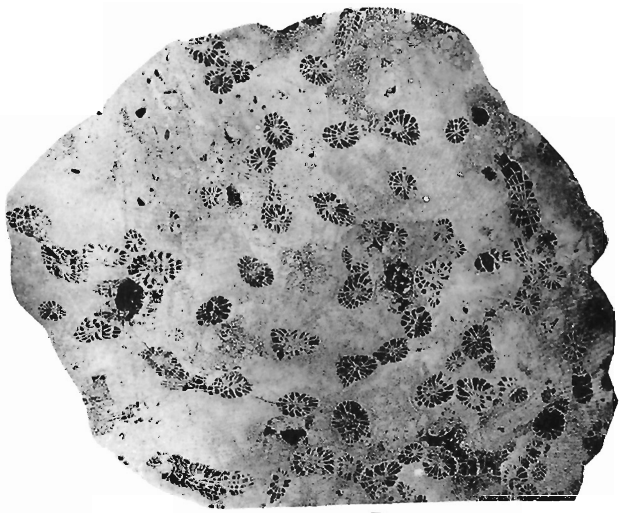

2

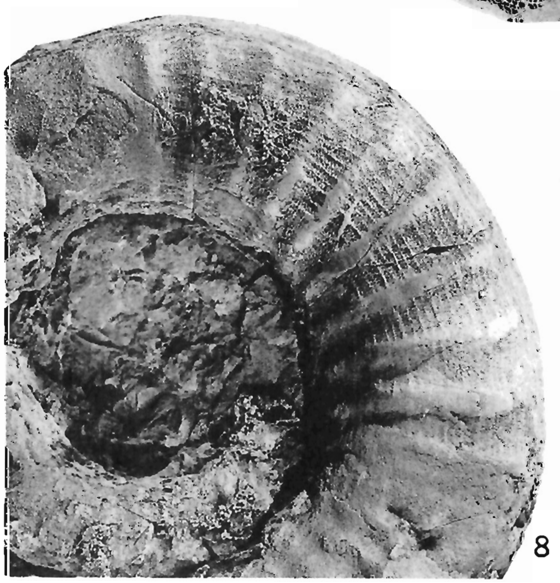

3


4


5


6


7


8


9

PLATE XVI

Figures 1-3. *Pycnactis canadensis* sp. nov. Three transverse polished sections of holotype, near base of corallum, about half-way up it, and near base of calyx, x4, G.S.C. No. 11054, Moose Lake dolomite, from East Arm, Moose Lake, north of the Narrows. (Page 88.)

Figure 4. *Asthenophyllum occidentale* (Whiteaves). Transverse thin section showing fossula, x4, G.S.C. No. 11001, Atikameg dolomite, head of Grand Rapids. (Page 85.)

Figures 5, 6. *Mandaloceras parvulum* (Whiteaves). Top and side views of living chamber, x1, G.S.C. No. 5706c, Inwood formation, from Grand Rapids. (Page 117.)

Figure 7. *Palaeophyllum pasense* sp. nov. Top view of holotype corallum, x1, G.S.C. No. 10403, Stonewall formation, from the side road at Mile 25, Flin Flon highway. (Page 89.)

Figure 8. *Bickmorites insignis* (Whiteaves). Part of the paratype showing fine ornament, x1, G.S.C. No. 2780, Stonewall formation, from Stonewall quarry. (Page 121.)

Figure 9. *Acidaspis perarmata* Whiteaves. Top view of dorsal shield, holotype, x1, G.S.C. No. 5813, Cedar Lake dolomite, east shore Lake Winnipegosis. (Page 123.)

INDEX TO FOSSILS

Numbers in **bold face** type indicate pages where species are described

55176—12