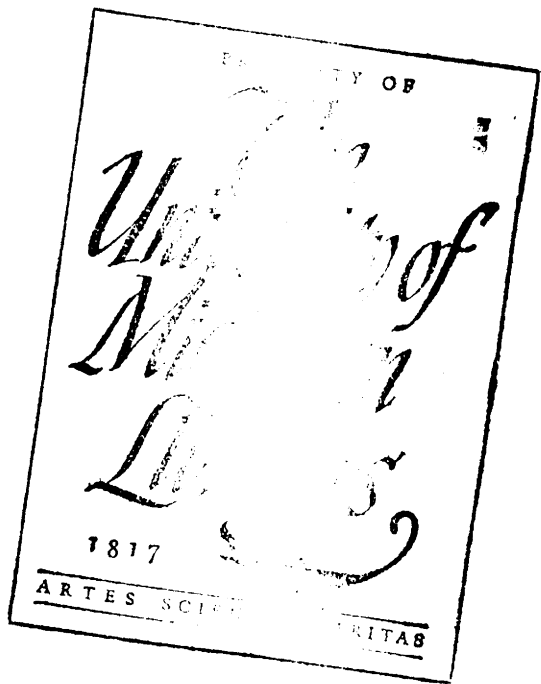
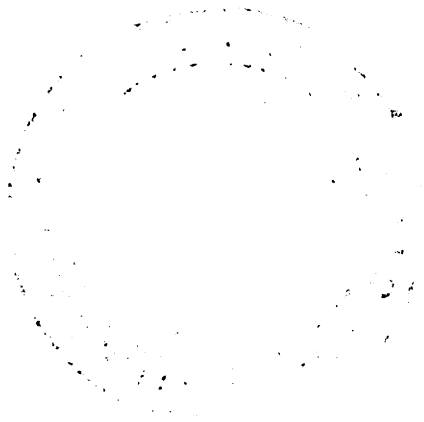


THE DUNDEE AND ROGERS CITY
LIMESTONES OF THE NORTHERN
PART OF THE SOUTHERN PENIN-
SULA OF MICHIGAN

Robert E. Radabaugh



THE DUNDEE AND ROGERS CITY LIMESTONES
OF THE NORTHERN PART
OF THE SOUTHERN PENINSULA OF MICHIGAN

By

Robert E. Radabaugh

A dissertation submitted in partial fulfillment of the requirements for the degree of Master of Science in the University of Michigan.

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PART OF THE SOUTHERN PENINSULA OF MICHIGAN

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INTRODUCTION

Statement of Problem

The purpose of this paper is to describe and delimit the Dundee limestone of the northern part of the Southern Peninsula of Michigan, and to name and describe a new Middle Devonian formation, the Rogers City limestone, which is present in this region. Heretofore, strata measuring approximately two hundred and fifty feet in thickness have been correlated with the Dundee limestone of southeastern Michigan. The occurrence of a fauna in the upper part of these strata, differing from that of the typical Dundee limestone, was first recognized by Dr. G. M. Ehlers at whose suggestion this study was undertaken.

Acknowledgement

For aid in this investigation the writer is greatly indebted to Dr. G. M. Ehlers of the University of Michigan, who has shown an untiring interest in the problem, both in the field and in the laboratory. Mr. J. A. Valentine, manager of the quarry of the Michigan Limestone and Chemical Company at Rogers City, Michigan, kindly permitted the writer to make a study of the strata exposed in the quarry.

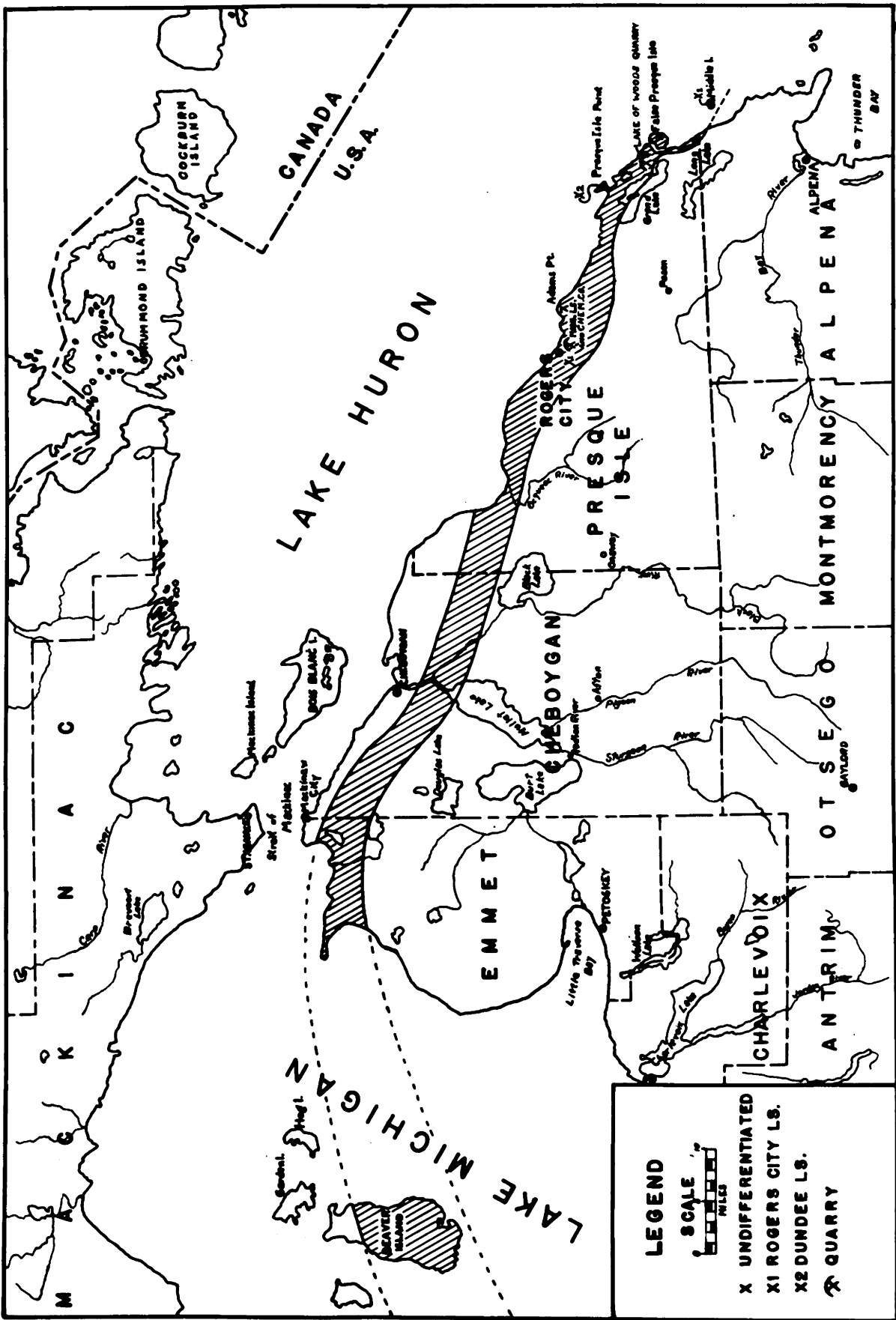
The Museum of Paleontology of the University of Michigan has given full use of its facilities for the work, both in the field and in the laboratory.

DISTRIBUTION AND CLASSIFICATION OF THE
DUNDEE AND ROGERS CITY LIMESTONES

Distribution

The Dundee and Rogers City limestones crop out at the surface or ^{are} covered only by glacial drift in a belt extending from Middle Island in Lake Huron, northwestward along the shore of the Lake through Presque Isle and Cheboygan Counties, and thence westward through the northern part of Emmet County, (see plate 1). The strata of this belt occupy a position along the northern and northeastern margins of the Michigan Basin and dip gently to the south and southwest.

The Dundee limestone crops out on Presque Isle point and in the quarry of the Michigan Limestone and Chemical Company at Rogers City, Presque Isle County, (see plate 1). Outcrops of the Rogers City limestone occur in Presque Isle County in the quarry of the Michigan Limestone and Chemical Company, in the Lake of the Woods quarry of the Kelly Island Lime and Transport Company, on the shore of Lake Huron about a quarter mile north of the southern boundary line of Presque Isle County, and in a ditch along U. S. highway number 23 about three and one-half miles southeast of the center of Rogers City, approximately one-fourth mile east of the Northwest corner of section 29, T. 35 N., R. 5 E., (see plate 1). In Alpena County the Rogers City limestone crops out on Middle Island. So far as known, there are no outcrops of either formation in Cheboygan or Emmet County.



LEGEND

SCALE 10 MILES

X UNDIFFERENTIATED
 X1 ROGERS CITY LS.
 X2 DUNDEE LS.
 Q QUARRY

MAP SHOWING DISTRIBUTION OF DUNDEE AND ROGERS CITY LIMESTONES

Previous Classification

The strata included in the formation here designated the Dundee and Rogers City limestones, were first noted by Douglass Houghton (1839, p. 178) along the shore of Lake Huron between Middle Island and Forty-mile Point. C. C. Douglass (1841), pp. 583-584), who assisted Houghton in the study of the geology of Michigan, observed compact, fossiliferous, limestones at intervals along the Lake Huron shore between Middle Island and Forty-mile Point. Alexander Winchell (1861, pp. 61-62) assigned the strata of Crawford's quarry, now a part of the quarry of the Michigan Limestone and Chemical Company, to the Upper Helderberg group. Carl Rominger (1876, pp. 50-53) placed the limestones of Crawford's quarry and of Middle Island in the lower part of the Hamilton group. In 1895 A. C. Lane (1895, pp. 25-26) defined the Dundee limestone "...as extending down from the bluish beds of the Hamilton so long as the formation continues to be limestone, stopping with the appearance of dolomite or of gypsiferous shales." Lane stated that these limestones were nearly equivalent to the Corniferous or Upper Heldeberg. A. W. Grabau (1902, pp. 191-192) was the first to directly apply the term Dundee limestone to the strata of Crawford's quarry and the adjoining region. To date he has been followed by nearly all geologists.

Proposed Classification

In 1922 Dr. G. M. Ehlers, of the Museum of Paleontology of the University of Michigan, had occasion to examine a few gastropods collected from the so-called Dundee limestone of Presque Isle County by the late Dr. H. H. Hinshaw of Alpena, Michigan. Although the exact stratigraphic position of these gastropods was not known, two of the specimens were found to be identical with Raphistoma tyrrelli Whiteaves and Omphalocirrus manitobensis Whiteaves, species which are found in the Middle Devonian strata of Manitoba and the Mackenzie River basin of Canada.

The exact stratigraphic occurrence of this fauna in Michigan was not discovered until the summer of 1926, at which time Dr. Ehlers took part in a preliminary study of the "Dundee" limestone and the Traverse group of rocks for the Michigan Geological Survey. Dr. Ehlers found that the fauna, which is representative of the Middle Devonian of Manitoba and the Mackenzie River basin, is present in the upper part of the so-called Dundee limestone exposed in the quarry of the Michigan Limestone and Chemical Company. This information was transmitted to E. R. Pohl, who (1930a, p. 31 and 1930b, p. 60) noted the presence of "Manitoba beds" with a northern fauna above the Dundee limestone.

During the summer of 1936 the writer, in company with Dr. Ehlers, spent about a month in a field study of the so-called Dundee limestone of Presque Isle County. The results

of this study and the identification of the fossils obtained during the course of the field work indicate that the "Dundee" consists of two distinct and readily recognizable formations. The lower one of these contains numerous species of fossils characteristic of the typical Dundee limestone of southeastern Michigan. Since this formation evidently is a northward continuation of the typical Dundee limestone, the writer suggests the application of the name Dundee to it. The upper formation contains a fauna which is similar to that found in certain Middle Devonian strata of Manitoba and the Mackenzie River basin of Canada. For this formation the name Rogers City limestone is proposed; the name is taken from the town of Rogers City, where the type section of the formation is shown in the quarry of the Michigan Limestone and Chemical Company.

STRATIGRAPHY OF THE DUNDEE LIMESTONE

Lithologic Character

The Dundee limestone is composed of grey to buff, crystalline and porous limestone. The strata in the upper part of the formation are exceptionally pure, averaging approximately 95 per cent calcium carbonate; those of the lower part are mottled and darker in color; more dense, and more magnesian than the overlying strata. The best exposure of the Dundee limestone in the northern part of the Southern Peninsula is exhibited in the quarry of the Michigan Limestone and Chemical Company. The lithologic character and

common fossils of the strata exhibited in the quarry are noted in the following generalized section.

Section of strata exposed in quarry of Michigan
Limestone and Chemical Company at Rogers City,
Presque Isle County, Michigan.

	Thickness	
	Feet	Inches
<u>Traverse group (Bell shale)</u>		
9. Shale, calcareous, bluish grey, abundantly fossiliferous	1-10	
<u>Disconformity</u>		
<u>Rogers City Limestone</u>		
8. Limestone, buff-grey to buff, medium grained, fairly thick bedded and porous, containing <u>Prismatophyllum</u> sp., <u>Favosites</u> sp., a costellate <u>Atrypa</u> , <u>Raphistoma tyrrelli</u> <u>Whiteaves</u> , <u>Omphalocirrus manitobensis</u> <u>Whiteaves</u> and other gastropods	49	0
7. Limestone, gray, finely crystalline, dense and thick bedded, containing numerous specimens of <u>Gypidula</u> sp. and a few costellate <u>Atrypa</u> and <u>Omphalocirrus manitobensis</u> <u>Whiteaves</u>	4-6	0
8. Limestone, lower 2 to 3 feet mottled buff and buff-gray, magnesian and thin bedded; upper 6 feet of a more even buff-gray color, less magnesian and thicker bedded than underlying beds. Upper part contains numerous specimens		

Thickness
Feet Inches

of a costellate Atrypa, and a few specimens of Gypidula sp. and Omphalocirrus manitobensis Whiteaves 8 6

5. Dolomite, with discontinuous, alternating buff and buff-gray bands, fine grained and thin bedded, with molds of Productella sp., Atrypa sp., and other brachiopods, pelecypods, Tentaculites sp., and Proetus sp. 8-9 0

Dundee Limestone

4. Limestone, gray, weathering to a buff-gray, composed of exceedingly numerous shells of brachiopods and a smaller number of other invertebrates making up a coquina-like rock. Characteristic fossils are Prismatophyllum sp., Productella spinulocostata Hall, Etheridgina? spinosa Bassett, Atrypa costata Bassett, A. ehlersi Bassett, Spirifer lucasensis Stauffer, and Athyris sp.--identical with a species found in the Dundee limestone of southeastern Michigan 6 5
3. Limestone, gray, weathering buff-gray, with a few chert nodules and remains of Prismatophyllum sp., Atrypa costata Bassett, and A. ehlersi Bassett, and other fossils 2-3 0
2. Limestone, buff-gray to buff, weathering to brown, and thick-bedded, with Diphyphyllum rectiseptatum Rominger, Prismatophyllum sp.--corallites averaging 8 mm. in diameter, Atrypa costata Bassett, and A. ehlersi Bassett 59 0

Thickness
Feet Inches

- | | | |
|---|----|---|
| 1. Limestone, buff gray to gray, mottled, dense, and somewhat magnesian in lower part, containing <u>Synaptophyllum</u> sp., <u>Atrypa elegans</u> Grabau, <u>Atrypa costata</u> Bassett, <u>Pentamerella</u> sp. cf. <u>P. parva</u> Bassett, and numerous specimens of <u>Paracyclas</u> sp. | 72 | 0 |
|---|----|---|

Thickness

In the description of the section given above, the Dundee limestone is indicated as having a thickness of 139 to 140 feet. This probably does not represent the maximum thickness of the Dundee limestone in this region. Drilling tests made by the Michigan Limestone and Chemical Company in the vicinity of Rogers City show that magnesian limestones and dolomites are present beneath the lowest strata exposed in the quarry. Further study may show that a part of these strata belong to the Dundee limestone and a part to the underlying Mackinac limestone, which appears at the surface in the region bordering the Straits of Mackinac.

PLATE 2

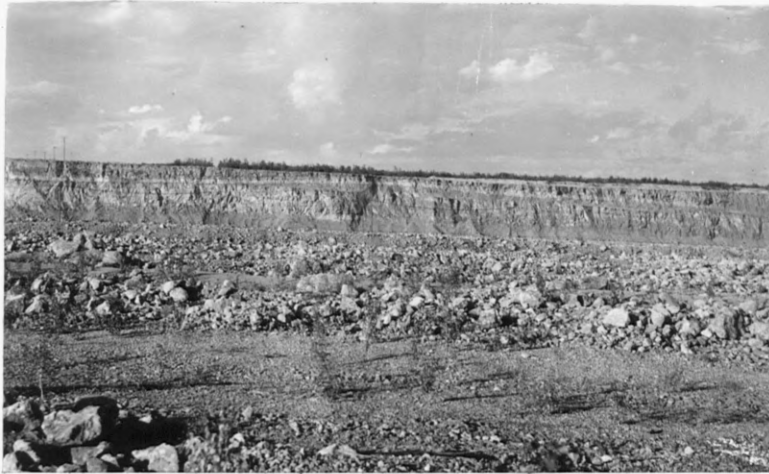


FIGURE 1. VIEW OF SOUTHWEST WALL OF MICHIGAN LIMESTONE AND CHEMICAL COMPANY QUARRY AT ROGERS CITY. Contact of Dundee and Rogers City limestones occurs at bottom of light band near top of quarry wall.



FIGURE 2. DUNDEE LIMESTONE STRATA EXPOSED IN MICHIGAN LIMESTONE AND CHEMICAL COMPANY QUARRY. Contact of intervals 1 and 2 (see section pages 10-11) shown by dark line about two-thirds the distance above quarry floor.

Formational Boundaries

The Dundee limestone of the northern part of the Southern Peninsula occupies a stratigraphic position between the underlying Mackinac limestone and the overlying Rogers City limestone.

The contact of the Dundee limestone with the underlying Mackinac limestone, although not seen, is believed to be a disconformable one. This is suggested by the fact that the faunas of the Mackinac and Dundee limestones are very distinct, indicating a probable interruption in deposition. Additional evidence for the presence of a disconformity is shown in southeastern Michigan where the Dundee rests on the eroded surface of the Detroit River formation (Bassett, 1935, p. 346; Grabau and Sherzer, 1910, p. 54; and Newcombe, 1933, p. 44).

The contact of the Dundee limestone with the Rogers City limestone probably is a conformable one; further observations, however, are necessary to determine its exact character.

Correlation

The Dundee limestone of the northern part of the Southern Peninsula is the northward extension of the typical Dundee limestone of southeastern Michigan. In the Dundee limestone of the northern part of the Southern Peninsula are found a number of species of fossils that are identical with

PLATE 3

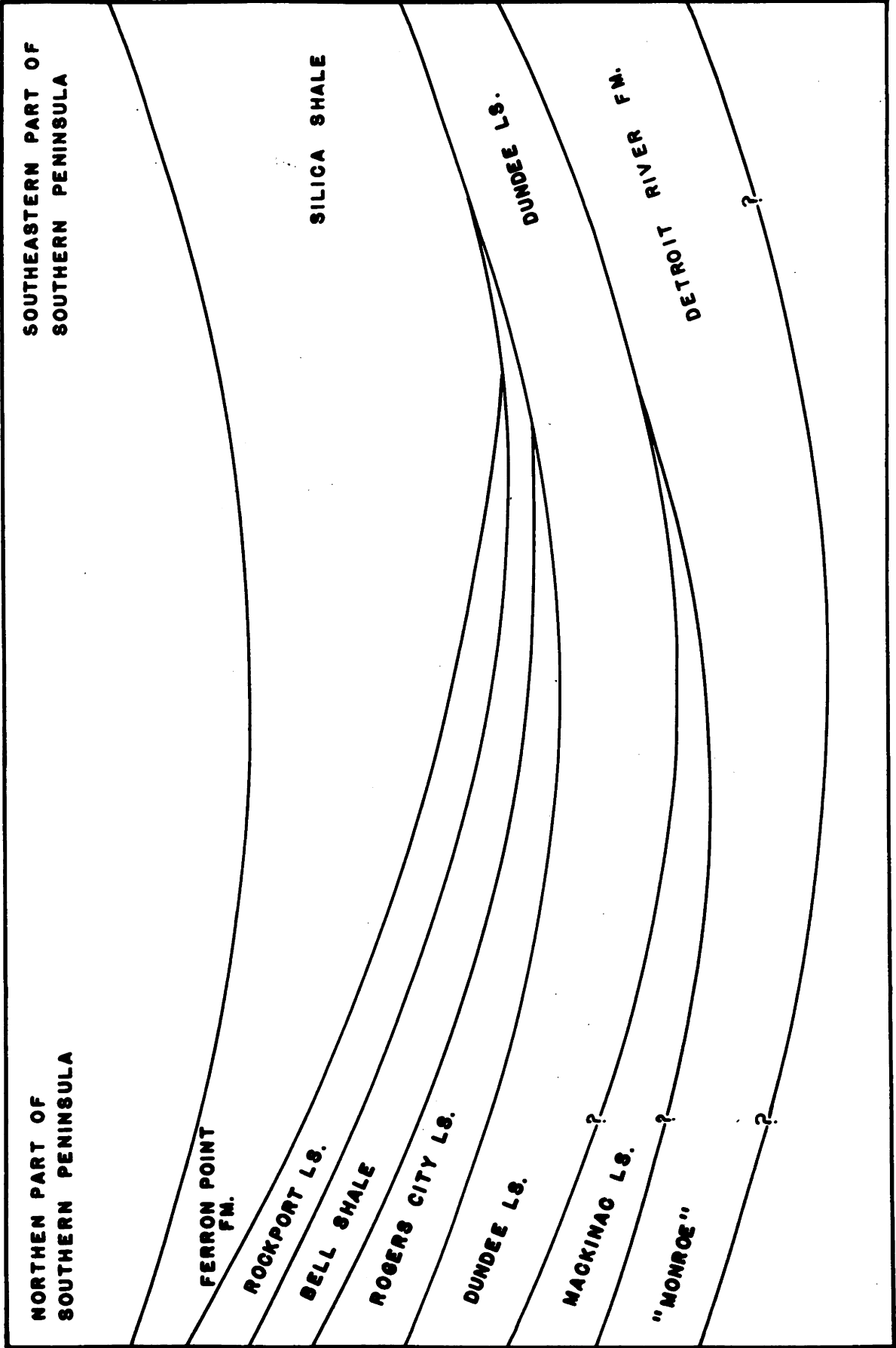


DIAGRAM SHOWING STRATIGRAPHIC RELATIONSHIPS OF DUNDEE AND ROGERS CITY LIMESTONES TO UNDERLYING AND OVERLYING FORMATIONS OF THE SOUTHERN PENINSULA OF MICHIGAN

forms found in both the Dundee limestone of southeastern Michigan (see Table I) and the so-called Columbus limestone (Dundee) of northwestern Ohio. However, there are certain species present in the northern Dundee that are not found in this formation in southeastern Michigan.

The stratigraphic position of the fauna of the Dundee limestone, as noted by Grabau (1913, p. 363), is intermediate between that of the typical Onondaga and that of the typical Hamilton of New York.

In southeastern Michigan the Dundee limestone is underlain by the Detroit River formation and in the northern part of the Southern Peninsula by the Mackinac limestone, which in turn is underlain by the "Monroe" formation. The Mackinac limestone pinches out before it reaches southeastern Michigan. Part or all of the "Monroe" formation probably is equivalent in age to the Detroit River strata.

In southeastern Michigan the Dundee limestone is overlain by the Silica shale and in the northern part of the Southern Peninsula by the Rogers City limestone. The Rogers City limestone is overlain by the strata of the Traverse group. The Rogers City limestone and the Bell shale and Rockport limestone of the Traverse group wedge out to the southward. The Ferron Point formation, which overlies the Rockport limestone, is in part correlated with the Silica shale of southeastern Michigan and northwestern Ohio. (See plate 3).

TABLE I

TABLE SHOWING DISTRIBUTION OF DUNDEE LIMESTONE SPECIES

Genera and Species	Intervals	
	Mich. Is. and Chem. Company Quarry	Sibley Quarry*
BRACHIOPODA		
Athyris sp.	4	21
Atrypa costata Bassett	1, 2, 3, 4	25
Atrypa ehlersi Bassett	2, 3, 4	17
Atrypa elegans Grabau	1	24
Chonetes sp.	2, 3, 4	
Cryptonella sp.	1	
Cystina sp.	3, 4	
Etheridgina? spinosa Bassett	4	17, 20, 21
Gypidula sp. 1	2	
Gypidula sp. 2	2	
Pentamerella sp. cf P. parva Bassett	1	21
Pentamerella sp. 1	1	
Pentamerella sp. 2	1	
Productella spinulicostata Hall	4	20, 21, 22
Spirifer lucasensis Stauffer	4	17, 22, 25
Spirifer sp. 1	3, 4	
Spirifer sp. 2	3, 4	
Stropheodonta sp. cf S. inaequis- trata Conrad	4	
Stropheodonta sp. aff. S. concava Hall	4	
PELECYPODA		
Paracyclas sp. cf P. elliptica Hall	1, 2, 3, 4	17, 20

*Intervals for Sibley Quarry as reported by Bassett, 1935, pp. 440-441.

The exact stratigraphic position of the Dundee limestone with reference to the standard Devonian section of North America in New York State has not been definitely determined. Most geologists have regarded it as the equivalent of the Onondaga of the New York section. The Dundee limestone of northern Michigan is underlain by limestone breccias and overlying calcareous strata collectively known as the Mackinac limestone, which are exposed in the region bordering the Straits of Mackinac. These strata, as noted by Rominger (1873, pp. 25-26) and Grabau (1907, pp. 718-19) contain fossils which suggest that they are equivalent to the Onondaga and Schoharie beds of New York. Warthin and Cooper (1935, pp. 362-363) have correlated the upper Wanakah shale of the Ludlowville group of New York with the lower Thunder Bay beds of the Traverse group of Michigan, and the Centerfield limestone, which is basal Ludlowville, with the Dock street clay and the upper Alpena limestone of the Traverse group. They state that, "no strata of Moscow age were recognized***at Alpena, and part or all of the Marcellus is absent from Michigan." Thus the Dundee limestone is seen to occupy a stratigraphic position in the standard New York Devonian section between the Ulsterian and Erian series which contain respectively the Onondaga limestone and the Hamilton group, the correlatives the Mackinac limestone and the Traverse group. Whether the Dundee limestone should be assigned to the Ulsterian or Erian series or to a distinct series can only be determined by further study.

STRATIGRAPHY OF THE ROGERS CITY LIMESTONE

Lithologic Character

The type and most complete section of the Rogers City limestone is found in the quarry of the Michigan Limestone and Chemical Company. The lithologic character and common fossils of the strata of the Rogers City limestone exhibited in this quarry are noted in the generalized section on preceding pages (9-11).

The characteristics of the strata of the Rogers City limestone exhibited in the Lake of the Woods quarry, about 25 miles to the southeast of Rogers City, in Presque Isle County, are given in the following section.

Section of strata exposed in Lake of the Woods
quarry of the Kelly Island Lime and Transport
Company, Presque Isle County, Michigan

	Thickness	
	Feet	Inches
<u>Rogers City limestone.</u>		
2. Limestone, buff-gray to buff, coarse grained, and fairly thick-bedded, containing a costellate <u>Atrypa</u> sp., <u>Raphistoma tyrrelli</u> Whiteaves, <u>Omphalocirrus manitobensis</u> Whiteaves, and other gastropods	32	0
1. Limestone, gray, finely crystalline, dense, and massive, containing numerous specimens of <u>Gypidula</u> sp., and a few costellate <u>Atrypa</u> , and <u>Omphalocirrus manitobensis</u> Whiteaves	4	0

From the preceding sections the Rogers City limestone is seen to consist mainly of buff-gray to buff, crystalline, and porous limestones. A bed of mottled, fine-grained, and thin-bedded dolomite, 8 to 9 feet in thickness, occurs at the bottom of the formation. About 16 feet above the base of the formation is a bed of gray, dense limestone 4 to 6 feet in thickness. Above this stratum the remainder of the formation is fairly uniform in character.

Thickness

There are 69 to 72 feet of Rogers City limestone exposed in the quarry of the Michigan Limestone and Chemical Company. Numerous diamond drill cores taken in the vicinity of the quarry show that the thickness of the Rogers City limestone varies considerably. A maximum thickness of 106 feet was measured several miles south of the quarry.

Formational Boundaries

The Rogers City limestone, where typically exhibited in the quarry of the Michigan Limestone and Chemical Company, occupies a position between the Dundee limestone, and the Bell shale of the Traverse group.

The contact of the Rogers City limestone with the underlying Dundee limestone apparently is conformable; it occurs at the base of a conspicuous 8 to 9 foot bed of dolomite. (See plate 5, figures 1 and 2). Further field work and paleontologic study, however, may show that the dolomite



FIGURE 1. VIEW OF PART OF NORTHERN FACE OF MICHIGAN LIMESTONE AND CHEMICAL COMPANY QUARRY AT ROGERS CITY, SHOWING IN DETAIL THE CONTACT OF THE DUNDEE AND ROGERS CITY LIMESTONES AND THE THIN BEDDING OF THE DOLOMITE JUST ABOVE THIS CONTACT.



FIGURE 2. VIEW OF PART OF SOUTHERN FACE OF MICHIGAN LIMESTONE AND CHEMICAL COMPANY QUARRY AT ROGERS CITY, SHOWING CONTACT OF THE DUNDEE AND ROGERS CITY LIMESTONES. Light band just above contact represents the conspicuous dolomite described as interval 5 of quarry section (p. 10).

should be included with the underlying Dundee limestone and that a disconformity exists between the Dundee and Rogers City limestones.

The contact of the Rogers City limestone with the overlying Bell shale is disconformable. The effects of the erosion of the Rogers City limestone prior to the deposition of the Bell shale are well known. In the quarry of the Michigan Limestone and Chemical Company, about two miles south of the crusher plant, the Bell shale occupies a broad shallow depression eroded in the Rogers City limestone. Beneath the bottom of the depression the Rogers City limestone is only about 60 feet in thickness, which, when compared with the maximum known thickness of 106 feet, indicates a removal of at least 46 feet of strata at this locality. The surface of the limestone in this depression, after the Bell shale has been stripped away, shows anastomosing solution channels one to two inches in width and about one inch in depth, which were formed by sub-areal weathering prior to the deposition of the Bell shale. (See plate 5, figure 1).

In the quarries of the Michigan Limestone and Chemical Company, and the Kelly Island Lime and Transport Company at the Lake of the Woods, so-called pockets of Bell shale are encountered within the Rogers City limestone. Some of these pockets are small caverns formed by the solution of the limestone prior to the deposition of the shale and subsequently filled with it (see plate 5, figure 2); others are crevices formed by the enlargement of joints in the limestone.

PLATE 5



FIGURE 1. VIEW SHOWING UPPER SURFACE OF A BLOCK OF ROGERS CITY LIMESTONE WITH ANASTOMOSING CHANNELS FORMED BY SOLUTION PRIOR TO THE DEPOSITION OF THE BELL SHALE.



FIGURE 2. VIEW SHOWING A MASS OF BELL SHALE IN A SMALL CAVERN (OUTLINED IN INK) WITHIN THE ROGERS CITY LIMESTONE OF THE MICHIGAN LIMESTONE AND CHEMICAL COMPANY QUARRY.

and later filled with the shale. Workmen in the quarry report that in some instances the walls of the small caverns are coated with travertine, which obviously was deposited prior to the deposition of the Bell shale.

Correlation

The Rogers City limestone does not correlate with any of the formations found in southeastern Michigan. It consists of strata deposited during an invasion of a northern sea, which in all probability did not reach southern Michigan, (see plate 3).

The Rogers City limestone like the underlying Dundee limestone occupies a general stratigraphic position between the Onondaga limestone and the Hamilton group in the standard Devonian section of New York.

The Rogers City limestone is related to certain Devonian strata of northwestern Manitoba. These strata, according to E. M. Kindle (1914, pp. 248, 251-257) consist of the Elm Point limestone at the base, the Winnipegosan dolomite in the middle, and the Manitoban limestone at the top. J. B. Tyrrell (1892, pp. 205E-209E) has listed the fauna of these formations. A large number of the gastropods and a few of the species of other invertebrates listed by Tyrrell as occurring in the Winnipegosan dolomite have been found in the Rogers City limestone. Stringocephalus burtini DeFrance, which is characteristic of the Winnipegosan dolomite and

certain Middle Devonian strata of Europe, has not been found in the Rogers City limestone. The apparent absence of Stringocephalus in the Rogers City limestone seems unusual because the limestone contains many gastropod genera associated with this brachiopod in Manitoba and Europe. Certain genera and species of gastropods found in the Rogers City limestone have been reported from both the Stringocephalus-bearing Winnipegosan dolomite and the overlying Manitoban limestone. Because these gastropods are not restricted to either the Manitoban limestone or the Winnipegosan dolomite, it is impossible at this time to state whether the Rogers City limestone should be correlated with one or both of these formations. It is hoped that a further study of these formations and their faunas will make it possible in the near future for the writer to show the exact stratigraphic and faunal relationship of the Rogers City limestone to the Devonian strata of Manitoba.

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