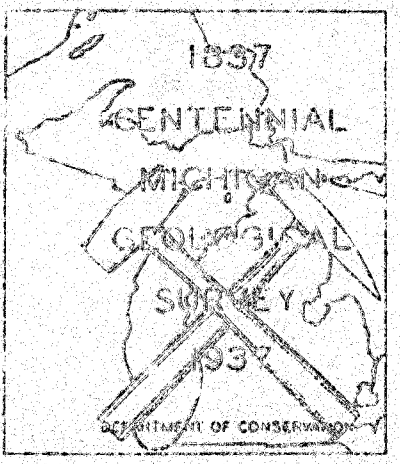
SEVENTH ANNUAL FIELD EXCURSION OF THE MICHIGAN ACADEMY OF SCIENCE, ARTS AND LETTERS SECTION OF GEOLOGY AND MINERALOGY

MAY 29-30, 1937



CELEBRATING THE CENTENNIAL ANNIVERSARY OF THE FOUNDING OF THE MICHIGAN GEOLOGICAL SURVEY

MICHIGAN ACADEMY OF SCIENCE, ARTS AND LETTERS

SECTION OF GEOLOGY AND MINERALOGY

Seventh Annual Field Excursion May 29-30, 1937

Itinerary (Saturday)

Place	Time	Cumulative Mileage
Leave Alpena, Owl Cafe Follow U. S. 23 west	8:00 A.M.	0
1. Cross Lake Nipissing beach at cemetery		2
2. Note sand dunes of Lake Algonquin (both sides of road)		4
3. Cross Algonquin beach		5.5
4. Arrive Huron Portland Cement Co. shale quarry (Antrim shale)	8:20 A.M.	10.00
Leave shale quarry	8:50 A.M.	
5. Highest Algonquin beach		12.00
5. Emerson Esker (length 10 miles)		12.00
Drive on till plain to Lachine		15.00
6. Lachine Kame (turn north)		15.00
7. Arrive at Sink Holes ("4 Holes" sign on road)	9:20 A.M.	22.5
Leave Sink Holes	10:05 A.M.	
8. Arrive Rogers City, quarry of Michigan Limestone & Chemical Company (World's largest limestone quarry).	10:35 A.M.	45.0
Rogers City and Dundee limestones		
Lunch at Rogers City Strand Cafe Brooks Hotel Thompson House)	12:30 P. M.	
Leave Rogers City, Courthouse Square	1:30 P. M.	0
9. Outcrops of Rockport limestone		10.5
Outcrops of Rockport limestone		12.2

	Place	Time	Cumulative Mileage
10.	Arrive Rockport quarry, Bell, Rockport, and Ferron Point formations	3.10 P.M.	
	Leave Rockport quarry	5.00 P.M.	
11.	Outcrops of Genshaw formation		2.2
12.	Arrive Alpena Portland Cement Co. (old shale pit) Genshaw & Ferron Point formations	5.20 P.M.	7.5
	Leave Alpena Portland Cement Company	6.00 P.M.	
13.	Arrive Killians Resort (contact Genshaw formation and Killians Limestone. Also note ice rampart and shingle beach of Lake Algonquin	6.20 P.M.	15.0
	Leave Killians	6.35 P.M.	
	Arrive Alpena	7.00 P.M.	25.0
	Dinner	7.00 P.M.	
	Discussion	8.00 P.M.	

Sunday - May 30

		Time
	Leave Owl Cafe	8.00 A.M.
14.	Arrive quarry of Michigan Alkali Co. Biohermns in Alpena limestone	8.15 A.M.
	Leave Michigan Alkali Quarry	8.45 A.M.
15.	Arrive Thunder Bay Quarries Alpana Limestone, Doch Street Clay, and higher beds of Alpana limestone	9.00 A.M.
	Leave Thunder Bay Quarries	9.45 A.M.
16.	Arrive Four Mile Dam Upper Alpena limestone, Norway Point formation and bioherm	10.00 A.M.
	Leave Four Mile Dam	10.45 A.M.
17.	Arrive Norway Point Dam Norway Point formation	11.15 A.M.
	Leave Norway Point Dam	12.00 noon
18.	Arrive Alpena Cemetery Potter Farm formation	12.30 P.M.
	Leave Alpena Cemetery	1.00 P.M.
	Arrive Alpena Lunch at Owl Cafe	1.15 P.M.
	Leave Alpena	2.15 P.M.
19.	Arrive Partridge Point Partridge Point formation and Squaw Bay limestone	2.45 P.M.
	Leave Partridge Point	4.15 P.M.
20.	Arrive Squaw Bay Antrim Shale outcrop	4.30 P.M.
	Disband - end of excursion	4.45 P.M.

ROUTE MAP

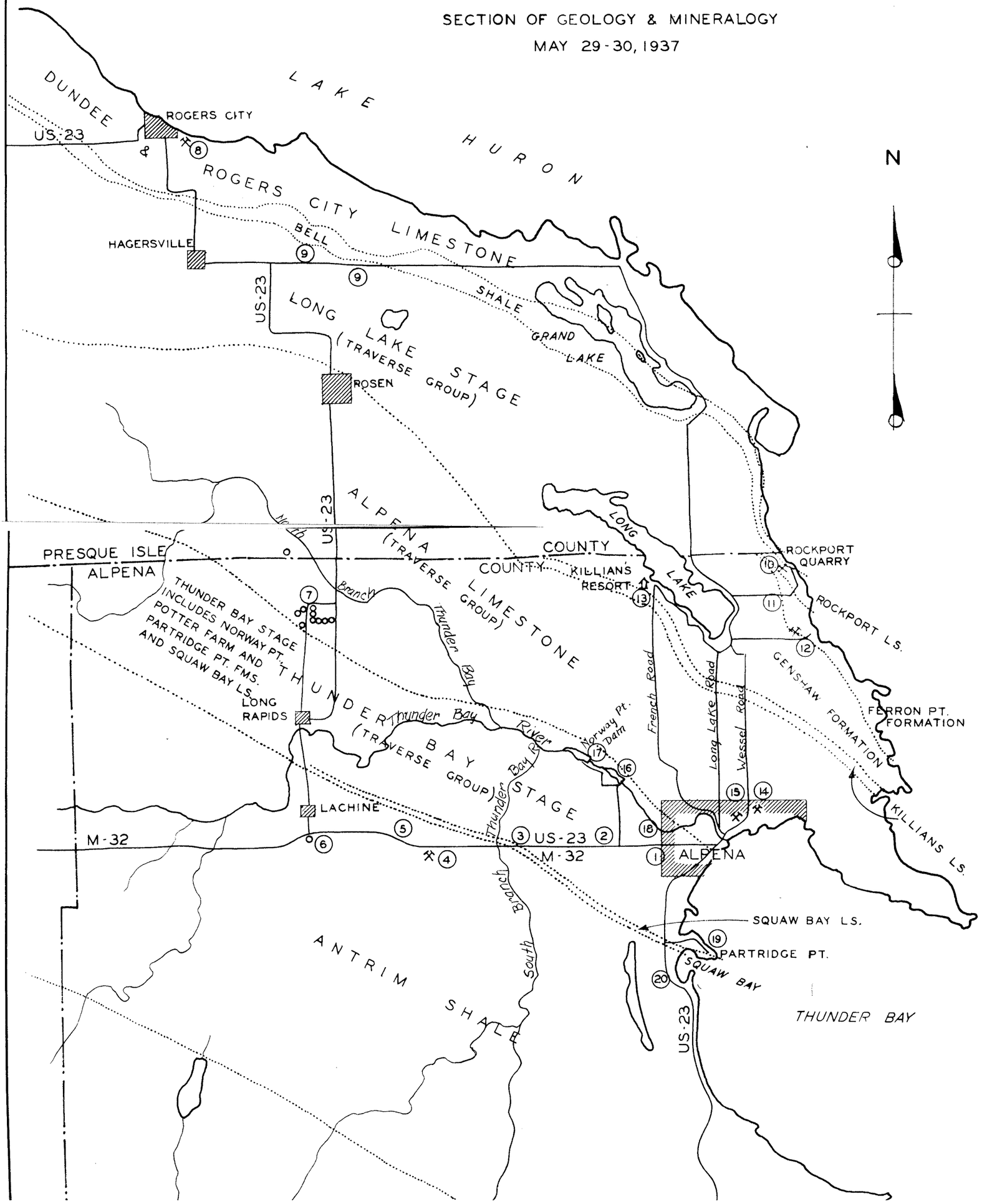
FIELD EXCURSION

OF THE

MICHIGAN ACADEMY OF SCIENCE

SECTION OF GEOLOGY & MINERALOGY

MAY 29-30, 1937



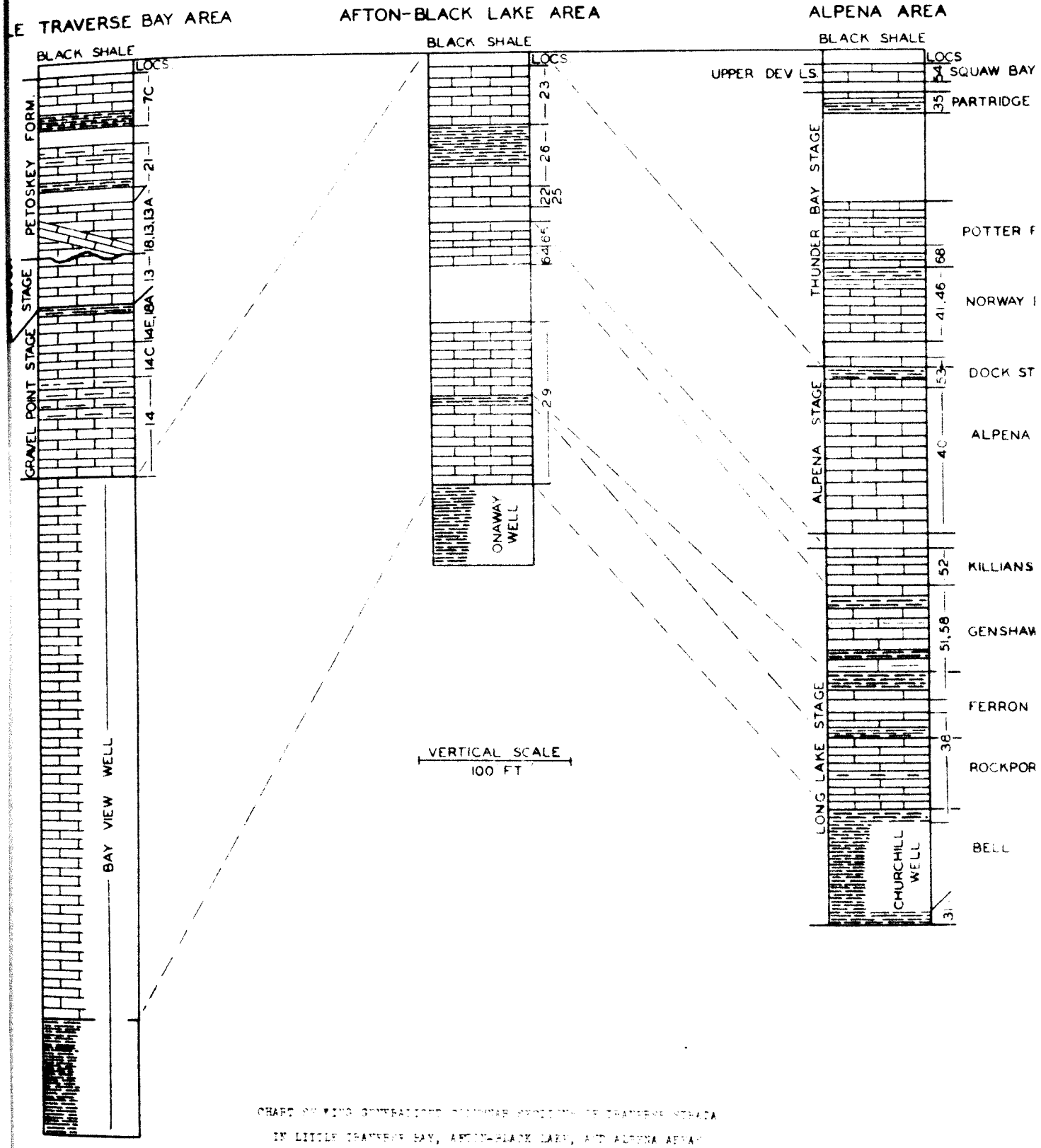
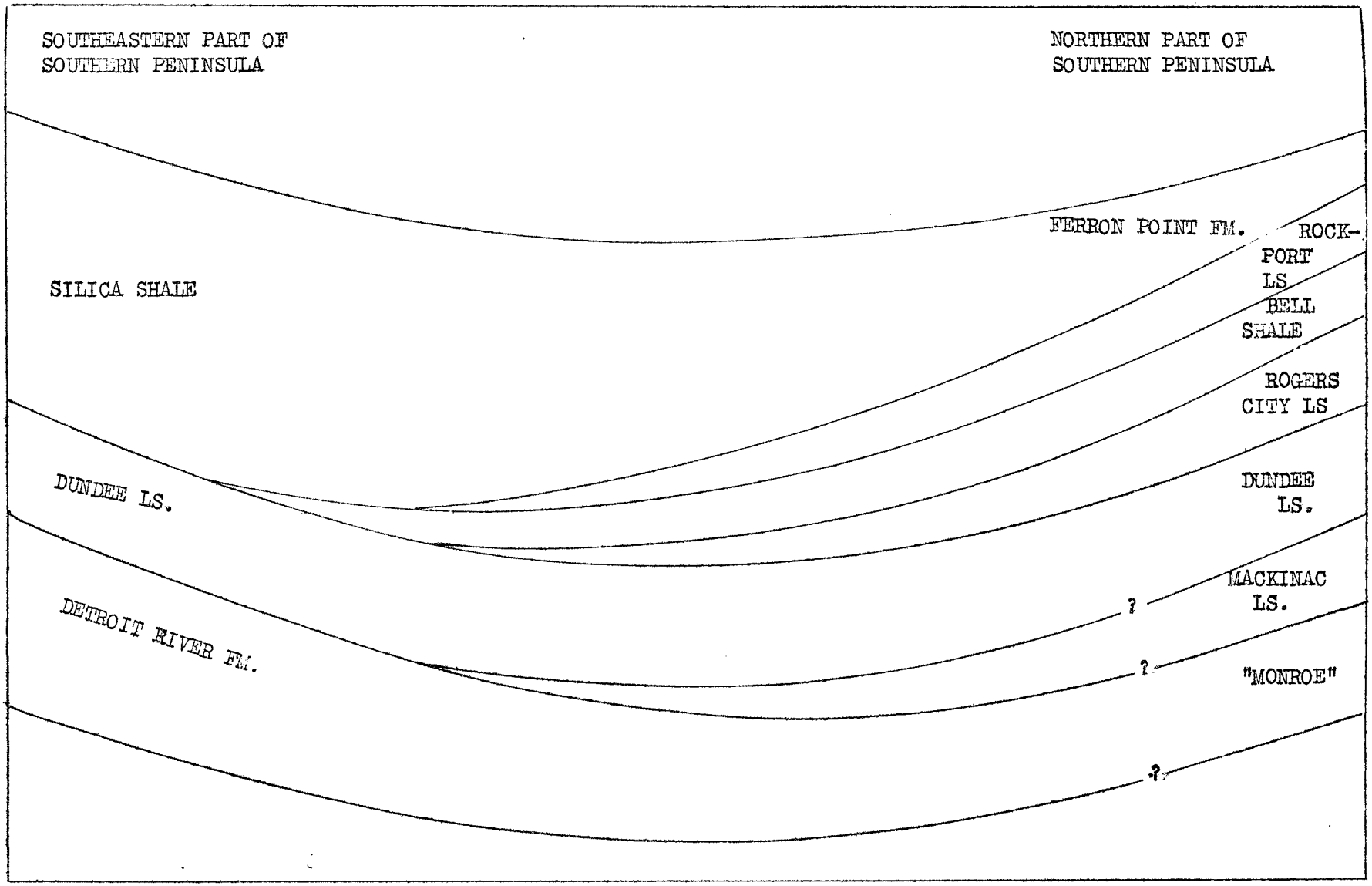


CHART SHOWING CORRELATION OF MIDDLE DEVONIAN STRATA OF TRAVERSE AREA
IN LITTLE TRAVERSE BAY, AFTON-BLACK LAKE, AND ALPENA AREAS



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

ANTRIM SHALE

TYPE LOCALITY: Antrim county. Shore of Grand Traverse Bay about 1½ miles south of Norwood, Michigan, apparently considered as the type locality.

SECTION: Quarry of Huron Portland Cement Co. at Paxton about 9 miles west of Alpena, Michigan.

		Feet	Inches
5	Shale, black, with spherical concretion	6	6
4	Shale, alternating bands of greenish gray and black; few concretions	4	2
3	Shale, black, with greenish mud lumps and pyrite	25	4
2	Shale, greenish-gray, calcareous		2 ±
1	Shale, black (in sump)	18-19	

A record of a well drilled in the floor (Top of interval 2 of above section) of the quarry by the Cement Company is as follows:

4	Shale, black	30-35	
3	"Limey material," cream-colored, effervesces with acid	3 ±	
2	Shale, black	20-21	
1	"Sand," black, yielding fresh water		18

Note: The "sand" mentioned above was encountered in several wells drilled in the vicinity of the quarry. It is possible that this sand is at or near the contact of the Antrim with the underlying Squaw Bay limestone.

CHARACTERISTIC FOSSILS: Several conodonts collected from the shales of this quarry are related to Mississippian species. The shales also contain Callixylon newberryi (Dawson) and Sporangites. Concretions in shale contain Dinichthys.

ROGERS CITY LIMESTONE

(G. M. Ehlers and R. E. Radabaugh MS)

TYPE LOCALITY: Quarry of Michigan Limestone and Chemical Co. at Rogers City, Michigan.

TYPE SECTION:

	Feet	Inches
Traverse group (Bell shale)		
Shale, calcareous, bluish-gray and abundantly fossiliferous	1-10	
Disconformity		
Rogers City limestone		
Limestone, buff-gray to buff, medium grained, fairly thick-bedded and porous, containing Prismatophyllum sp., Favosites sp., a costellate Atrypa, Raphistoma tyrrelli Whiteaves, Omphalocirrus manitobensis Whiteaves and other gastropods	49	
Limestone, gray, finely crystalline, dense and thick-bedded, containing numerous specimens of Gypidula sp. and a few individuals of a costellate Atrypa and Omphalocirrus manibensis Whiteaves	4-6	
Limestone. Lower 2 to 3 feet mottled buff and buff-gray, magnesian and thin-bedded; upper 6 feet less mottled, less magnesian and thicker bedded than underlying beds. Limestone contains numerous specimens of a costellate Atrypa and a few specimens of Gypidula sp. and Omphalocirrus manitobensis Whiteaves	8	6
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	
Dundee limestone		
Limestone, gray, weathering to a buff-gray, composed of numerous shells of brachiopods and a smaller number of other invertebrates. Characteristic fossils are Prismatophyllum sp. Productella spinulocostata Hall, Etheridgina ? spinosa Bassett, Atrypa costata Bassett, A.		

	feet	inches
ehlersi Bassett, Spirifer lucasensis Stauffer and Athyris sp. - identical with a species found in Dundee limestone of southeastern Michigan	6	5
Limestone, gray, weathering buff-gray, with few chert nodules and remains of Prismatophyllum sp., Atrypa costata Bassett and A. ehlersi Bassett and other fossils	2-3	
Limestone, buff-gray to buff, weathering to brown, and thick-bedded, with Diphyphyllum rectiseptatum Rominger, Prismatophyllum sp. - corrallites averaging 8 mm. in diameter, Prismatophyllum sp. - corallites 4 to 5 mm. in diameter, Atrypa costata Bassett and A. ehlersi Bassett	59	
Limestone, buff-gray to gray, mottled, dense and somewhat magnesian in lower part, containing Synaptophyllum ? sp., Atrypa elegans Grabau, A. costata Bassett, Pentamerella sp. cf. P. parva Bassett and numerous specimens of Paracyclas sp.	72	

In the description of this section, the Dundee limestone is shown to have a thickness of 139 to 140 feet, the Rogers City limestone 69½ to 72½ feet and the Bell shale 1 to 10 feet. The maximum thicknesses of these three formations in nearby areas are greater however than those exhibited in the quarry.

Drilling tests made by the Michigan Limestone and Chemical Company show that dolomites and some limestones are present beneath the lowest Dundee strata exposed in the quarry. Further information may show that a part of these dolomites and limestones belong to the Dundee formation and a part to the underlying Mackinac limestone which appears at the surface in the region bordering the Strait of Mackinac.

The maximum thickness of the Rogers City limestone as shown by diamond drill cores a few miles south of the quarry is about 106 feet; that of the Bell shale is about 60 feet.

Ferron Point Formation

(Lower Part)

TYPE LOCALITY: Rockport quarry of Kelly Island Lime and Transport Co., sec. 6, T. 32 N., R. 9E., Alpena Co., Michigan.

TYPE SECTION: measured on the west wall of the quarry.

		Feet	Inches
	Top of section covered		
	Ferron Point formation	2	8
7	Gray, fossiliferous limestone	1	1
6	Gray, calcareous shale; many Prismatophyllum	1	10
5	Gray, massive argillaceous ls.; weathers yellowish	1	10
4	Bluish-gray clay shale	1	8
3	Bluish, argillaceous ls.; Prismatophyllum	9	0
2	Bluish-gray clay shale with limestone lenses		
	Rockport limestone	12	0
1	Buff limestone; specks of crystalline calcite		

Bed 7 of this section may be the equivalent of the basal bed in the Alpena Portland Cement Co. clay pit section (No. 1 of the clay pit section). If a covered interval actually exists at this point in the succession, it is less than 15 feet.

CHARACTERISTIC FOSSILS

Bed 7 Prismatophyllum, many cup corals, crinoid columnals.
" 6 Prismatophyllum, Schizophoria.
" 5 Atrypa cf. reticularis, Prismatophyllum, cup corals, massive bryozoa.
" 4 Spirifer cf. mucronatus, Camarotoechia, fenestellids.
" 3 Prismatophyllum.
" 2 ABUNDANT: Atrypa, Athyris, Cyrtina alpenensis, Stropheodonta cf. demissa, Spirifer cf. mucronatus, large Ceratopora, Pholidostrophia; COMMON: Prismatophyllum, cup corals, dumose Favosites, Aulopora conferta, Hederella, massive and fenestellid bryozoans, Cyrtina cf. hamiltonensis, large Pentamerella, Schizophoria, Stropheodonta cf. erratica; RARE: Chonetes cf. fragilis, Camarotoechia (Bell shale type) Schuchertella, Productella.

Ferron Point Formation

(Upper Part)

TYPE LOCALITY: Abandoned clay pit of the Alpena Portland Cement Co., SE ¼ sec. 18, T. 32N., R. 9E. Alpena County, Michigan.

TYPE SECTION:

		Feet	Inches
	Top of section		
	Genshaw formation	14	0
4	Gray, calcareous shale	0	6
3	Gray, argillaceous limestone		
	Ferron Point Formation		
2	Greenish-gray clay shale with lenses of *Chonetes* coquina	21	0
1	Gray, shaly limestone with brachiopods and corals	3	

CHARACTERISTIC FOSSILS

Bed 2 Hederella sp., Arthroclema sp., Helopora inexspectata McNair ms., Stictoporina granulifera Stewart, Strophodonta cf. demissa, Spirifer mucronatus, Chonetes cf. fragilis, Stewart Cyrtina cf. hamiltonensis, Orthoceras sp., Henicystites devonicus Bassler, Lepidodiscus alpenensis Bassler, Lophonychia cf. cordata Stewart.

Note: Helopora inexspectata, Stictoporina granulifera, chonetes cf. fragilis and Lophonychia cf. cordata are closely related to, or identical with, species found in the Silica shale of Lucas County, Ohio.

Genshaw Formation

TYPE LOCALITY: eastern portion of T. 32 N., R. 8E., Alpena Co., Michigan. The name is taken from the Genshaw School, located in section 13 of this township.

TYPE SECTION: a composite section, beds 1-5 being measured in the Alpena Portland Cement Co. clay pit; beds 5-9 along the Long Lake Road in sections 15 and 22, T. 32 N., R. 8E; beds 9-12 along French Road 0.3 mi. S. of Killians Hotel.

		Feet	Inches
	Top of section		
	Killians limestone		
12	Black carbonaceous limestone		
	Genshaw formation	1	0
11	Dark gray impure limestone	7	0
10	Gray, calcareous shale	9	0
9	Gray, granular to semi-crystalline limestone	8	0
8	Gray, calcareous shale	3	0
7	Gray, granular limestone	5	0
6	Gray, calcareous shale	3	0
5	Gray, massive argillaceous limestone	1	0
4	Gray, Calcareous shale	3	0
3	Gray, massive argillaceous limestone	14	0
2	Gray shale, less calcareous toward the base	0	6
1	Gray, arg. ls.		
	Ferron Pt. shale		
	Greenish-gray, soft, clay shale		

The individual beds of this section preserve their identity over their entire outcrop in Alpena County. The calcareous shales of the section are all very much alike, and can be placed with certainty only by identifying the limestones with which they alternate.

CHARACTERISTIC FOSSILS:

Bed 10 Atrypa - large sp., Spirifer cf. mucronatus, Stropheodonta cf. erratica, Cyrtina alpenensis, Gypidula roningeri, Stropheodonta cf. concava, Productella sp.

9 Atrypa - large sp., Cyrtina alpenensis, Gypidula roningeri many small Atrypa reticularis, Athyris,

8 Aulopora conferta, Prismatophyllum, Favosites sp., Cyathophyllum scyphus, Atrypa - large sp., Gypidula roningeri, Spirifer cf. mucronatus, Spirifer cf. granulosus, Athyris cf. fultonensis, Schizophoria - large sp., Spirifer cf. lucasensis, Cyrtina alpenensis, Stropheodonta sp., Productella sp., Schuchertella sp.

7 Prismatophyllum (large, thin coralla), Pholidostrophia sp., Atrypa - large sp., Schizophoria - large sp., Productella sp., Spirifer cf. granulosus.

5 Prismatophyllum (large, thin coralla), Atrypa-large sp., Schizophoria-large sp., Gypidula roningeri, Schuchertella sp.

4 Atrypa - large sp., Spirifer cf. mucronatus, Strophcodonta cf. demissa, Pholidostrophia sp.

3 Prismatophyllum (large thin coralla), Atrypa - large sp., Gypidula romingeri, Productella sp., Pholidostrophia sp.

2 Atrypa - large sp., Gypidula romingeri, Spirifer cf. granulosus, Cyrtina cf. hamiltonensis, Pholidostrophia sp., Schuchertella sp., Pterinea sp., Arthroclema sp.

Killians Limestone

TYPE LOCALITY: exposures along French Road one-half mile south of Killians Hotel, Long Lake, Alpena County, Michigan.

TYPE SECTION:

		Feet	Inches
	Top of section		
	Alpena limestone		
4	Brown, crinoidal, granular limestone	3	0
	Killians limestone		
3	Dark gray to black limestone with black shale layers up to ten inches in thickness	21	0
	Genshaw formation		
2	Gray, impure limestone	1	0
1	Gray, calcareous shale	7	0

CHARACTERISTIC FOSSILS:

Bed 3 Trochiliscus herbertae, Stromatopora - smooth sp., Favosites cf. alpenensis, Favosites-digitate sp., Stropheodonta cf. erratica, Pholidostrophia sp., Dentalium (3-inch), Gomphoceroid, Spirifer cf. mucronatus (also in Genshaw bed 10).

This formation is equivalent to the "black Zone" of the Alpena limestone of Ver Wiebe, and corresponds roughly to beds 3 to 11 inclusive of his section (p. 187). Despite the black shale beds, this formation is more resistant that the underlying Genshaw formation, and usually forms a conspicuous terrace where the drift cover is not too thick.

Norway Point Formation

TYPE LOCALITY: Norway Point Dam (also known as Seven Mile Dam), Thunder Bay River, Alpena County, Michigan.

TYPE SECTION: measured below dam, the lowest beds being exposed along the tailrace on the north side of the river.

		Feet	Inches
	Top of section		
	Potter Farm formation		
11	Gray crinoidal shaly limestone	0	6
	Norway Point formation		
10	Blue clay with a few siltstone lenses	24	0
9	Blue, calcareous, highly fossiliferous shaly limestone	3	0
8	Gray, coarsely crystalline limestone	1	3
7	Gray, calcareous mudstone, irregularly bedded	12	0
6	Gray, massive, finely crystalline limestone	0	6
5	Gray, coarsely crystalline, fossiliferous limestone	1	0
4	Gray, finely crystalline, fossiliferous limestone	3	0
3	Brown, finely crystalline limestone, weathering sandy	1	0
2	Brown limestone, fossiliferous	1	0
1	Brown stylolitic limestone	0	2
	Base of section covered		

The contact with the Potter Farm formation is not visible at the Norway Point Dam, but may be seen along the road on the south side of the Thunder Bay River at several spots between this dam and the Four Mile (Fletcher) Dam.

Beds 1 to 7 of the above section outcrop on a small anticline which possibly is a thinly covered reef of Alpena limestone. Although the exact contact with the Alpena limestone is not visible, at the Four Mile (Fletcher) Dam bed 7 lies directly on a biohermal core of the (Alpena) limestone, beds 1 to 6 being overlapped at this dam.

CHARACTERISTIC FOSSILS

Bed 10 Large fucoids, Chonetes cf. coronatus, Orthonota cf. constricta, Homalonotus sp.

9 Strophcodonta cf. domissa, Spirifer granulosus, Fistulipora spinulifera, Spirifer cf. mucronatus, Cyrtina cf. hamiltonensis, fenestellids, small Atrypa reticularis, Athyris cf. fultonensis, small Pentamerella, Greenops boothi, Chonetes cf. coronatus.

8 Fucoids

5 Chonetes, small Spirifer, Strophcodonta cf. domissa, Pholidostrophia, Cyrtina, crinoid columnals

4 Many small Chonetes, Cyrtina, Spirifer cf. mucronatus, small Favosites.

2 Chonetes, Spirifer 2 sps., Pholidostrophia, Camarotoechia rare.

Potter Farm Formation

TYPE LOCALITY: Potter Farm, east halves of section 18 and 19, and section 20, T. 31 N., R. 8E., Alpena Co., Michigan.

TYPE SECTION: a composite section, beds 1 to 4 being measured in shallow pits along the road on the south side of the Thunder Bay River, between the Four Mile and Norway Point dams, and beds 4 to 12 being measured along the road running south from the Four Mile dam through sections 18 and 19. A similar but less complete section may be observed along the road on the south side of section 20.

		Feet	Inches
	Top of section covered		
	Potter Farm formation		
12	Gray, coral-stromatoporoid limestone	2	0
11	Covered	5	0
10	Gray to bluish limestone with many corals	2	0
9	Covered	8	0
8	Gray, platy limestone	7	0
7	Crinoidal limestone	1	0
6	Gray, lithographic limestone	1	0
5	Covered	3	0
4	Crinoidal limestone; fossils silicify on weathering	1	0
3	Blue, fossiliferous clay; weathers yellow	0	6
2	Gray, crinoidal limestone	0	6
	Norway Point formation		
1	Blue clay shale	1	0
	Base of section covered		

Beds 2 to 5 include the highly fossiliferous layers found in the southeast quarter of section 20. Bed 12 is believed to outcrop also in the shallow abandoned quarry in section 19 just west of the schoolhouse.

The limestone outcropping on the beach at Stony Point is believed to correspond approximately to bed 10 of the type section. The gastropod limestone in the abandoned quarry south of the Detroit and Mackinac Ry. tracks in the NE. $\frac{1}{4}$ sec 29, T. 31N., R. 8E. probably lies a small distance above bed 12.

CHARACTERISTIC FOSSILS

Bed 12 Favosites alpenensis, Coenostroma monticulifera, Cladopora sp., Stromatopora pustulifera, 3 cup corals, Cylindrophyllum sp., Strophodonta cf. arratica, Athyris-small sp., Conocardium sp., large, low-spired gastropod.

10 Favosites alpenensis, Cylindrophyllum sp., cup corals, stromatoporoids.

8 Chonetes sp., Strophodonta sp., Dwarf brachiopods and gastropods.

7 Small Pentamerella, crinoid columnals.

3 Cylindrophyllum hindshawi, Alveolites sp., Cystiphyllum sp., Favosites sp., 3 cup coral sps., Ceratopora sp., Coenostroma monticulifera, rare Prismatophyllum sp., Strophodonta sp., Atrypa-small sp., Athyris-small sp., Pentamerella-small sp., Cyrtina cf. alpenensis, Terebratuloid.

Partridge Point Formation

TYPE LOCALITY: east shore of Partridge Point, three miles south of Alpena, Michigan.

TYPE SECTION: measured along low bluff on east shore of the point.

		Feet	Inches
Top of section			
	Squaw Bay limestone	3	0
6	Brown dolomitic limestone	3	0
5	Covered Interval		
	Partridge Point formation	2	0
4	Gray, irregularly bedded, fine-grained limestone		
3	Gray shale with limestone lenses, becoming predominantly granular limestone at top	7	6
		3	0
2	Covered interval		
1	Blue argillaceous limestone, weathering to a rusty brown color - to lake level	1	0

CHARACTERISTIC FOSSILS:

Bed 4 Modiomorpha cf. mytiloides, Homalonotus cf. dekayi.

3 Cylindrophyllum sp., Cystiphyllum 2 sps., Cyathophylloids 2 sps., Favosites alpenensis, Favosites sp., Dictyonema sp, fenestellids, Atrypa cf. devonica, Camarotoechia sp., 3 terebratuloids, Spirifer cf. mucronatus, Spirifer (large syringothyroid), Lepadocystis sp., Heteroschisma gracile, Pentremitidea americana, Nucleocrinus melonigracile, N. obovatus, Dolatocrinus triadactylus, Megistocrinus tuberatus, Platyceras-spiny sp., Proetus sp.,

1 Fenestellid bryozoa, reworked crinoid columnals, Coccosteus sp.

Squaw Bay Limestone

TYPE LOCALITY: Squaw Bay shoreline of Partridge Point, center of S. line, sec. 11, T. 30N., R. 8E., Alpena County, Michigan.

TYPE SECTION:

		Feet	Inches
Top of section covered			
	Squaw Bay limestone		
3	Brown limestone and dolomitic limestone	3	0
2	Covered interval	3	0
	Partridge Point formation		
1	Gray, fossiliferous limestone		

CHARACTERISTIC FOSSILS

Bed 3 Tornoceras uniangulare, Koenenites cooperi Miller ms., Bactrites warthini Miller ms., Styliolina sp. These fossils suggest that the Squaw Bay limestone is of Portage and not Traverse (Hamilton) age.

Although only a small thickness of this formation is exposed at the lake edge, these beds are important because of the light they shed on the age of the Traverse and Antrim shales.

In wells drilled by the Alpena Business Men's Association in sec. 2[illegible] of the above mentioned township, 12 feet of rock probably belonging to this formation were encountered. In southeastern Michigan an oil well log contains 31 feet of similar rock at this position interbedded with black shale, which suggests that the lower part, at least, of the Antrim shale may be of Portage age.

BIBLIOGRAPHY

Allen, R. C.., Smith, R. A., Barrett, L.P., Geol. Map of Michigan (1916)

Arnold, C. A. 1931. On Callixylon newberryi (Dawson): Contrib. Mus. Paleon., Univ. of Michigan, vol. 3, pp. 207-232, 7 pls. 9 text figs.

Arnold, C. A. 1934. The so-called branch impressions of Callixylon Newberryi (Dawson) and the conditions of their preservation: Journ. Geol., vol. 42, pp. 71-76.

Bassett, C. F. 1935. Stratigraphy and paleontology of the Dundee limestone of southeastern Michigan: Bull. Geol. Soc. Amer., vol. 46, pp. 425-462, pls. 33-39, 1 fig.

Case, E. C. 1931. Arthrodiran remains from the Devonian of Michigan: Contrib. Mus. Paleon., Univ. of Michigan, vol. 3, pp. 163-182, 5 pls., 13 text figs.

Deiss, C. F. 1932. A description and stratigraphic correlation of the Fenestellidae from the Devonian of Michigan: Contrib. Mus. Paleon., Univ. of Michigan, vol. 3, pp. 233-275, 14 pls.

Eddy, G. E. 1933. A study of the insoluble residues of the lower Traverse, Bell and upper Dundee formations of Michigan: Michigan Acad. Sci., Arts and Letters, vol. 18, pp. 345-361, pls. 31-38, text fig. 14, map 32.

Ehlers, G. M. 1925. Two new crinoids from the Devonian of Michigan: Contrib. Mus. Paleon., Univ. of Michigan, vol. 2, pp. 99-104, 1 pl.

Ehlers, G. M. and Hussey, R. C. 1921. A new gastropod and a new cephalopod from the Devonian of Michigan: Papers of the Michigan Acad. Sci., Arts and Letters, vol. 1, pp. 248-251, pl. 37, figs. 1-4, pl. 38.

Ehlers, G. M. and Virginia Kline. 1934. Revision of Alexander Winchell's types of brachiopods from the Middle Devonian Traverse group of rocks of Michigan: Contrib. Mus. Paleon., Univ. of Michigan, vol 4, pp. 143-176, 4 pls.

Ehlers, G. M.and Leighly, J. B. 1922. Lipsanocystis traversensis, a new cystid from the Devonian of Michigan: Papers of the Michigan Acad. Sci., Arts and Letters, vol. 2, pp 155-158, pl. 10, figs. 1-5, text figures 4-6.

Ehlers, G. M. and T. E. White. 1932. Cylindrophyllum panicum (Winchell) and Cylindrophyllum hindshawi sp. nov., Tetracoralla from the Traverse group of Michigan: Contrib. Mus. Paleon., Univ. of Michigan, vol. 4, pp. 93-100, 5 pls.

Fenton, C. L. and Fenton, Mildred Adams. 1930. Studies on the genus Atrypa: The American Midland Naturalist, vol. 12, no. 1, pp. 1-18, 2 pls.

Foerste, A. F. 1927. Devonian Cephalopods from Alpena in Michigan: Contrib. Mus. Paleon., Univ, of Michigan, pp. 189-208, 5 pls.

Foerste, A. F. 1930. The color patterns of fossil cephalopods and brachiopods, with notes on gastropods and pelecypods: Contrib. Mus. Paleon., Univ. of Michigan, vol. 3, pp. 109-149, 5 pls.

Foerste, A. F. 1930. Additional notes on Nephriticerina: Contrib. Mus. Paleon., Univ. of Michigan, vol. 3, pp. 151-154, 1 pl. and 1 fig.

Grabau, A. W. 1902. Stratigraphy of the Traverse group of Michigan: Michigan Geol. Surv., Ann. Rep't for 1901, pp. 161-210.

Imlay, R. W. 1932. Gypidula petoskeyensis sp. nov., a new brachiopod from the Traverse group of Michigan: Contrib. Mus. Paleon., Univ. of Michigan, vol 4, pp. 101-104, 1 pl.

Leverett, Frank., Taylor, F. B. Pleistocene of Indiana and Michigan and the History of the Great Lakes. U.S. Geol. Survey Monograph LIII.

Leverett, Frank. 1917. Surface geology and agricultural conditions of Michigan: Michigan Geol. and Biol. Surv., pub. 25, geol. ser. 21, 223 pp. Note - map showing surficial geology accompanies this publication.

Leverett, Frank. Map of surface formations of southern peninsula of Michigan.

Newcomb, R. B. 1932. Oil and gas fields of Michigan: Dep't of Conservation, Geol. Surv. Division, Pub. 38, Geol. Ser. 32, 293 pp.

Pohl, E. R. 1930. The Middle Devonian Traverse group of rocks in Michigan, a summary of existing knowledge: Proc. U. S. Nat. Mus., vol. 76, art. 14, pp. 1-34, 2 pls.

Poindexter, O. Floyd. 1936. Sinkholes in the Indian Lake region, Schoolcraft County, and other Michigan sinks: Michigan Acad. Sci., Arts and Letters, vol. 21, pp. 439-444, pls. 51-53, maps 35-36.

Smith, R. A. 1916. Limestones of Michigan: Michigan Geol. and Biol. Survey pub. 21, geol. ser. 17, pp. 103-311, 8 pls., 15 text-figures.

Springer, Frank. 1921. The fossil crinoid genus Dolatocrinus and its allies: U. S. Nat. Mus., Bull. 115, 78 pp., 16 pls.

Van Pelt, Herberta L. 1933. Some ostracods from the Bell shale, Middle Devonian, of Michigan: Jour. Paleon., vol. 7, pp. 325-342, pl. 39.

VerWiebe, W. A. 1927. The stratigraphy of Alpena County, Michigan: Michigan Acad. Sci., Arts and Letters, vol. 7, pp. 181-192, map 6. (Includes maps of glacial and areal geology)

Warthin, A. S. 1934. Common ostracoda of the Traverse group: Contrib. Mus. Paleon., Univ. of Michigan, vol. 4, pp. 205-226, 1 pl.

Warthin, A. S. and Cooper, G. Arthur. 1935. Hamilton correlations in Ontario and Michigan: Proc. Geol. Soc. Amer. for 1934, pp. 362-363.

Warthin, A. S., and Cooper, G. Arthur. 1935. New formation names in the Michigan Devonian: Jour. Washington Acad. Sciences, vol. 25, pp. 524-526.

Wildermuth, R., Moon, J. W., Schoenmann, L. R. and Veatch, J. O. 1929. Soil Survey of Alpena County, Michigan: U. S. Dep't Agric., Bur. Chem. and Soils, ser. 1924, no. 28, 30 pp., 1 map. Note. Paper contains excellent base map of Alpena County on which colors for soils are placed.