

ITINERARY
OF
Geological Excursion

TO
PUT-IN-BAY

LAKE ERIE

Summer School

Michigan State Normal College

SATURDAY, JULY 15, 1905.

CONDUCTED BY W. H. SHERZER

WHO'S WHO.

1	Miss Bernice Akey	Colon
2	Miss Madge Akey	Colon
3	Miss Bessie Ashley	Eaton, Ind.
4	Miss Elizabeth Baxter	Ypsilanti
5	Mr. J. W. Bolender	Plainwell
6	Miss Maude Blair	Homer
7	Miss Edna Cook	Ypsilanti
8	Mrs. Clarence Coryell	Ypsilanti
9	Miss Emma A. Cutter	Carlisle, Pa.
10	Miss Irene Dewitt	Flint
11	Miss Alice C. Doyle	Grand Rapids
12	Mr. L. W. Fast	parta
13	Miss Zula Griggsby	Logansport, Ind.
14	Miss Mazie Harrison	St. Louis
15	Miss May Hehnstetter	St. Marys, Ohio
16	Miss Celia Higgins	Bellevue
17	Miss Stella Higgins	Bellevue
18	Miss Belle Hoopingarner	Wapakoneta, Ohio
19	Miss Mary Hurst	Muncie, Ind.
20	Miss Bertha Hutson	Ypsilanti
21	Mr. Charles B. Jordan	Morrice
22	Miss Elizabeth Keith	ledo
23	Miss Lillian M. Keyes	Grand Rapids
24	Miss Edjth King	Lansing
25	Mr. Herbert J. Leighton	Bear Lake
26	Miss Edith Matlehner	Wapakoneta, Ohio
27	Miss Margaret McKenzie	Emmet
28	Miss Sarah McKenzie	Yale
29	Miss Mary McKosh	Homer
30	Miss Katherine McNaughton	Middleville
31	Miss Blanche Parkinson	Yale
32	Mr. Max M. Peet	Ypsilanti
33	Miss Maude Pearce	Yale
34	Miss Addie Pease	Burr Oak
35	Miss Mary Richey	Homer
36	Mr. Byron J. Rivett	Homer
37	Mr. Arthur Scott	Ontario, Ind.
38	Miss Gertrude Sherzer	Ypsilanti
39	Master Jerome Sherzer	Ypsilanti
40	Miss Josephine Sherzer	Ypsilanti
41	Miss Clara Smith	Carlisle, Pa.
42	Mr. George Smith	North Adams
43	Mrs. Mary E. Straight	Ypsilanti
44	Miss Frances Streng	Grand Rapids
45	Miss Alice Taft	Weston
46	Miss Grace Utley	White Cloud
47	Miss Clara Ward	Grand Rapids
48	Miss Myrta M. Wilsey	Milwaukee, Wis.
49	Miss Elizabeth Wilson	Ypsilanti
50	Miss Florence Wilson	Ypsilanti
51	Mr. S. R. Wilson	Union City
52	Miss Theo. J. Wilson	Ypsilanti
53	Miss Maud White	Flint
54	Mr. E. J. Wilman	Montague
55	Mr. R. A. Young	Onaway

GUEST OF HONOR

Dr. Edward F. Bigelow New York City

En Route.

Ypsilanti. Summit St. Crest of lower beach of glacial LAKE MAUMEE, elevation about 794 ft. About one mile west lies the upper beach of LAKE MAUMEE (812 ft.) upon the eastern face of the DEFIANCE MORAINE. Descend into the valley of the Huron, banks of which are about 100 ft. above the river and 1½ miles apart. The main gravel terrace upon which Ypsilanti is built is about 60 ft. below Summit St. General elevation 736 ft. This terrace is believed to have been built by the Huron when it emptied into the next lower glacial LAKE WHITTLESEY. When the level of this lake was lowered to form LAKES WARREN and SAGINAW the Huron cut through the gravel terrace to the depth of 40 ft. Notice this younger valley within the older as we cross the river, with its upper terrace and still lower FLOOD PLAIN.

Upon the left we look back at the derrick of the Moorman mineral well. Depth 960 ft. It draws a very strong mineral water from the CORNIFEROUS LIMESTONES, seen at the surface at Trenton. If we assume a difference in the level of the surface where it "out-crops" and the mouth of this well of 132 ft. what is the "dip" of this limestone in this distance of about 23 miles? Make a diagram.

Ypsilanti to Dentons. We slowly rise out of the Huron valley and for three miles are in the bed of LAKE MAUMEE. Is it perfectly flat? The front of the great Canadian ice sheet was at Detroit forming the moraine there and the drainage of the lake was by Ft. Wayne, Indiana, into the Wabash River during the first stage. Elevation 812 feet. During the second stage, elevation about 794 ft., the drainage was by Ft. Wayne and also across the "Thumb" at Inlay City into the Grand River and glacial LAKE CHICAGO, at the southern end of Lake Michigan.

The melting of the ice to the northeast uncovered the "Thumb" and LAKE MAUMEE became confluent with and a part of LAKE SAGINAW, which had been forming in the Saginaw valley. In this region two levels are recorded by sand beaches, to be seen presently at Dentons, at levels of 708 ft. and 694 ft. Farther north a middle one can be made out. An advance of the ice presently took place, partially covering the Thumb again, and forcing the lake up to a level of 736 ft., where there was made a beautiful gravel beach, the BELMORE. Notice it as we cross with the house to the north and the barn to the south. The lake is known as WHITTLESEY and it drained across the Thumb by a single outlet at Uby, Huron Co., into the Grand River.

Passing this beach we are in the bed of glacial LAKE WHITTLESEY. Observe the very flat topography due to wave action and compare with that just seen in the bed of LAKE MAUMEE. The

PORT HURON MORAINE was now being formed, owing to the halting of the ice front.

We cross the line from Washtenaw Co. into Wayne and observe a change of clay soil to sand. Just as we enter Dentons (cemetery on right) we pass an obscure sandy beach line, marking the upper of the three successive stages of LAKE SAGINAW, actually older than LAKE WHITTLESEY as just explained. These beaches are very faint as they were wave washed by LAKE WHITTLESEY and nearly obliterated. Just beyond the switch, leaving Dentons, we pass the lower of these beaches to which the term "ARKONA" has been applied.

Dentons to Wayne. The sand extends to the switch and down to a level of about 590 ft., when it gives way to clay which extends eastward for about five miles. The wells through here are charged with salt and artesian flows are numerous. The ice has again withdrawn from the Thumb by melting and allows the waters of our lake to flow around, down the Grand into LAKE CHICAGO, and thence into the Des Plaines, Illinois and Mississippi Rivers. This lake is known as LAKE WARREN, being of greater extent than any of the preceding and apparently standing at FOUR successive levels. At Canton we see the uppermost of the series of beaches formed, a pretty well defined gravel ridge, elevation 680 ft., known as the UPPER FOREST.

Beyond Canton, upon the left, the south branch of the Rouge River appears at intervals as far as Dearborn. Notice the broad valley, the meanders across the flood plain, the deserted "ox bows," and the alluvial cones where tributaries enter the valley. Here and there the river is seen cutting back into the "till" for short distances.

As we approach Wayne the soil becomes sandy, low DUNES of sand appear, heaped up by wind action, indicating that another beach is near. Wayne is located upon the low, broad sand crest, with an elevation of 655 ft. This is the LOWER FOREST BEACH, marking the principal stage of LAKE WARREN. The ice margin has withdrawn much farther to the northeast and the lake is of correspondingly wider extent. Drainage into LAKE CHICAGO and to the Mississippi. This fall in the level of the lake was due apparently to the sudden (?) cutting of the Grand River bed to a lower level.

Wayne to Dearborn. Good views of the Rouge upon the left. Two miles from Wayne we pass the Wayne County House, upon the left. To the south a short distance can be seen the dunes of the GRASSMERE BEACH, (elevation 635 ft.) which collect drinking water for the 1,000 inmates of the County House. These same ridges will be observed upon either side of the track for the next 1½ miles to Inkster. A mile or two below the low SAND DUNES again make their appearance. Entering Dearborn we pass the

large asylum, St. Joseph's Retreat, upon our left. Farther on in the village we see a rectangular building, used by the government for a number of years for storing military supplies. We cross here another sandy beach, the ELKTON (610-615 ft.) produced by LAKE WARREN at its lowest stage. This series of lakes goes by the name of "Warren" because the same outlet persisted throughout.

Dearborn to Detroit. Just east we make a halt at the power house and then cross the main trunk of the Rouge. Breadth of valley is 3,000 ft., with banks 20 ft. high. Surface of water is 578 ft. giving a fall of only about 4 ft. from here to its mouth, 6 miles southeast in a straight line.

From the Rouge to Detroit the general surface is exceedingly flat, not varying more than five feet from 600 in the nine miles. The entire township of Springwells consists of a deposit of stratified clay, varying in thickness from a few inches to possibly 50 ft. This deposit was laid down in the depression just west of the Detroit moraine, presently to be seen. Three distinct beds can be recognized and MAY represent the successive deposits in lakes MAUMEE, WHITTLESEY and WARREN. If this supposition is correct how would you expect these clay beds to differ? Notice the numerous brick yards which utilize this clay from the railroad crossing (Pere Marquette) to the city limits.

When well into the city look along the cross streets and note the gentle undulations to be seen. These mark the low, regular ridges of the DETROIT MORAINE which was "water laid," that is, deposited in the waters of LAKE MAUMEE just at the ice front. How deep was the water here at this stage?

The theatre of action now shifts to the state of New York. Water had been accumulating in the basins of the "Finger Lakes" known as LAKE DANA, and finally became confluent with LAKE WARREN. Subsequently the ice withdrew from the Mokawk valley and opened up an outlet into the Hudson. This outlet was so much lower than the Chicago outlet that the bodies of water occupying the basins of Lakes Michigan, Huron and Superior, now confluent, were separated from Lake Erie and formed a large lake known as "LAKE ALGONQUIN." Elevation about 590 ft. This lake drained down the Detroit River at first, in a broader channel than the river now shows. The cutting down of the Mohawk outlet lowered the water in the Ontario basin and a body of water formed there known as LAKE IROQUOIS." This brought the Niagara River into existence and the falls were at Lewiston, beginning the serious task of cutting their gorge.

We leave our special car at First St., where the elevation is 598 ft. and walk S. S. E. towards the river. Between LaFayette and Fort streets we cross a ridge of the Detroit moraine and at about Congress St. are on the ALGONQUIN BANK, from which the descent

to the river is quite rapid. It is evident that this ancient Detroit River was cutting in its bank here. The site of the city of Detroit is due to the high ground of the moraine here, which rises 60 ft. above the river, in a distance of four miles.

Detroit to Lake Erie. The river here has a breadth of 2200 ft., is from 37 to 38 feet deep and has an average velocity of two miles per hour. It is calculated by the U. S. Engineers that there passes the city every second 209,910 cu. ft. of water. The elevation of the river is about 575 ft., giving a fall of but two feet in the 20 miles to Lake Erie. Three miles down the river you see Ft. Wayne upon the right, the site of which was determined by the ALGONQUIN BANK, which is here a gravel and sand ridge. Just beyond you see the derricks of the Solway salt wells upon Brady Is. Remarkable beds of rock salt are found here from 800 to 1600 ft. below the surface; the thickest of which is 240 ft. The beds reach as far south as the Sibley quarry. The salt is dissolved, pumped up as brine and evaporated. Much of it is used in the manufacture of "soda ash" and "alkali." Seven miles down the river we come to Fighting Is., belonging to Canada, low and marshy (on our left). Opposite Wyandotte we reach Grosse Isle (on the right) which carries ridges of an unarmed, water-laid moraine, which runs over into Canada. As we approach Amherstburg (on the left) the channel narrows and becomes shallow. The river here contains numerous glacial boulders washed out from the till. Opposite Amherstburg we have Bois Blanc Is. on our right, below which the river broadens to four miles and is rather shallow except in the channel.

Still another episode occurred in the history of the lakes which may best be mentioned here. When the ice had withdrawn from the bed of Lake Nipissing and the valleys of the Ottawa and Mattawa rivers in Ontario, a lower outlet than the Detroit River was established to the east. The level of the waters of Lake Algonquin was lowered so that the three upper lakes became separate and assumed approximately their present form. They are distinguished as the "LAKES NIPISSING." Only the water from Lake Erie passed over Niagara and into the streams emptying into the Detroit River and the western end of Lake Erie cut deep channels at their present mouths. The uplift of the land supposed to be still in progress raised the Nipissing outlet so as to throw the drainage back again into the Detroit and the streams are all "drowned" at their mouths. The present system of Great Lakes was established when the St. Lawrence valley became free of ice and LAKE IROQUOIS passed into Lake Ontario. This varying amount of water passing over Niagara has left its record in the gorge.

Lake Erie. The mean elevation of this lake is 573 ft. The distance from the mouth of the Detroit River to Put-in-Bay Is. is

about 32 miles, S. S. E., and the depth of the water averages from 30 to 36 ft. This portion of the bed of the lake is believed (by the writer) to have been gouged out by the first (Illinoian) of the four great advances of the ice from the Labrador peninsula, moving southwest. Notice on the map that the islands are arranged in lines having a general southwest and northeast direction. We may account for their presence by assuming that they represent masses of harder rock which were able to resist the ice erosion. The general direction of the rock strata beneath the water ["strike'"] happens to coincide here with the direction of ice movement, so that the the softer beds were gouged out, forming great troughs. These troughs are parallel with those on the mainland at the western end of the lake. How much above the water level here is the Training School ground at Ypsilanti?

Put-in-Bay Is. The limestone strata exposed at various points about the island are of the magnesian variety [dolomite]. They are commonly known as the "Waterlime" layers of the Lower Helderberg, which is a division of the Upper Silurian. They UNDERLIE and are consequently OLDER geologically than the limestone seen at Sibley quarry. They are similar in physical properties, composition, fossils and mineral deposits to the principal beds in Monroe Co., at the west end of the lake. As the result of our visit we wish to determine now just what these characteristics are, the thickness and position of the strata, to discover any signs of disturbance, evidences of glaciation with the direction of ice movement, the effect of the weather upon the rock, the dissolving power of running water and the action of the waves of the lake, in both DESTRUCTIVE and CONSTRUCTIVE work. Let us look for evidences of the mechanical breaking up of the dolomite by frost and by plants and its conversion into soil. Can we find any surface streams of water upon the island? Any springs? What is the water supply of the island?

According to Prof. E. H. Kraus the folding of the rocks of the region was due to expansion caused by the conversion of the mineral anhydrite into gypsum. The caverns he believes to be due to the partial collapse of these folded strata. Crystal Cave is a great geode formerly filled with water from which the massive crystals of celestite were deposited on all sides. The submerged stalactites seen in one of the caverns is evidence that the level of Lake Erie was at the time of their formation lower than at present. (Nipissing stage of upper lakes?)

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PREDECESSORS OF GREAT LAKES.

Name of Lake	Beach	Elevation	Outlet	Location on Electric Ry.
Maumee, 1st stage	Van Wert	812 ft.	Ft. Wayne & Wabash R.	1 mi. west of Ypsilanti
Maumee, 2nd stage	Leipsic	794	Ft. Wayne and Imlay City	Water Tower
Saginaw	Arkona	708 to 694	Grand River	Dentons
Whittlesey	Belmore	736	Ubly, Mich.	Wiards
Warren 4 Stages	Upper Forest	680	Grand River Around Thumb	Canton
	Lower Forest	655		Wayne
	Grassmere	635		Inkster
	Elkton	610		Dearborn
Algonquin	Algonquin	590	Mohawk River	Detroit

(Lowering of Mokawk bed brought Lake Iroquois into existence, over the present site of Ontario and gave birth to Niagara River and Falls.)

Lakes Nipissing	Nipissing	580	Ottawa and Mattawa R.	Detroit
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(Detroit River out of commission and only waters of L. Erie going over Niagara Falls, cutting the narrow part of the gorge.)

The elevation of land in Ontario shifted the outlet from the Ottawa to the Detroit River and raised the level of the water in it and Lake Erie.

The withdrawal of the ice from the St. Lawrence valley opened up the present outlet and gave rise to the present system of lakes.